PRINCIPAL TECHNOLOGY LEADERSHIP PRACTICES, TEACHER ICT COMPETENCY, AND TEACHER ACCEPTANCE OF SCHOOL MANAGEMENT SYSTEM (SMS) IN NEGERI SEMBILAN SECONDARY SCHOOLS

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ABSTRACT

This study aims to investigate teachers' perception on the level of principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of School Management System (SMS) in Negeri Sembilan secondary schools. This is a non-experimental quantitative research using survey technique through the administration of a questionnaire that comprised of four sections (teacher demographic variables, principal technology leadership practices, teacher acceptance and use of SMS, and teacher ICT competency) to collect data. The selection of samples for this study was conducted in several stages using probability sampling procedure that involved proportional stratified random sampling, simple random sampling, and systematic random sampling. From a total of 450 questionnaires distributed to the respondents, 417 valid questionnaires were returned representing a valid response rate of 92.7%. The findings showed that teachers among secondary schools in Negeri Sembilan perceived that their principals as demonstrating a high level of technology leadership practices, and teachers rated themselves to have a high level of ICT competency, and acceptance and use of SMS. Furthermore, data indicated that there were statistically significant positive and moderately strong relationships that exist between principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS. In addition, the multiple regression analysis showed that digital citizenship and visionary leadership are the two principal technology leadership practices dimensions that are statistically significant predictors of teacher acceptance and use of SMS, while digital citizenship and systemic improvement being the two principal technology leadership practices dimensions that are statistically significant predictors of teacher ICT competency. Smart pedagogy, professional growth and leadership, and digital citizenship and responsibility are the three teacher ICT competency dimensions that are statistically significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools. The mediation analysis using SEM showed a partial positive mediating effect of teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS. The moderating effect test revealed that teacher demographic variables (gender, age, educational level, teaching experience and experience in using computer) were not statistically significant moderators to the relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Finally, a new model comprising principal technology leadership practices, teacher ICT competency and teacher acceptance and use of SMS have been derived from the findings of this present study. This study has highlighted that two important human factors, individual (teacher ICT competency) and contextual (principal technology leadership), in predicting teacher acceptance and use of SMS. Besides, several invaluable implications and contributions for academics and practitioners are revealed in this study. This study has contributed significantly to the general body of knowledge in education and particularly educational technology integration. It concludes by presenting a model comprising principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS that suggests for more researches in the related field in the Malaysian educational setting.

ABSTRAK

Kajian ini bertujuan untuk mengkaji persepsi guru terhadap tahap amalan kepimpinan teknologi pengetua, kompetensi ICT guru, dan penerimaan serta penggunaan Sistem Pengurusan Sekolah (SMS) di kalangan guru di sekolah menengah Negeri Sembilan. Kajian ini merupakan kajian kuantitatif bukan eksperimen yang menggunakan kaedah tinjauan melalui pentadbiran soal selidik yang terdiri daripada empat bahagian (demografi guru, amalan kepimpinan teknologi pengetua, penerimaan serta penggunaan SMS di kalangan guru, dan kompetensi ICT guru) untuk pengumpulan data. Pemilihan sampel kajian ini telah dijalankan dalam beberapa peringkat mengikut prosedur persampelan kebarangkalian yang melibatkan persampelan rawak berstrata, persampelan rawak mudah, dan persampelan rawak sistematik. Daripada 450 soal selidik yang diedarkan kepada responden, sebanyak 417 soal selidik yang sah telah berjaya dikumpul dan dianalisis. Ini mewakili kadar tindak balas yang sah adalah sebanyak 92.7%. Dapatan kajian menunjukkan bahawa guru-guru di sekolah menengah Negeri Sembilan melihat pengetua mereka menunjukkan amalan kepimpinan teknologi pada tahap yang tinggi dan guru-guru ini menilai diri mereka mempunyai kompetensi ICT, dan penerimaan serta penggunaan SMS pada tahap yang tinggi. Tambahan pula, data menunjukkan terdapat hubungan positif yang signifikan secara statistik dan sederhana kuat di antara amalan kepimpinan teknologi pengetua, kompetensi ICT guru, dan penerimaan serta penggunaan SMS di kalangan guru. Di samping itu, analisis regresi berganda menunjukkan bahawa kewarganegaraan digital dan kepimpinan bervisi adalah antara dua dimensi amalan kepimpinan teknologi pengetua yang merupakan peramal signifikan secara statistik terhadap penerimaan serta penggunaan SMS di kalangan guru sementara kewarganegaraan digital dan penambahbaikkan sistemik adalah antara dua dimensi amalan kepimpinan teknologi

pengetua yang merupakan peramal signifikan secara statistik terhadap kompetensi ICT guru. Pedagogi pintar, perkembangan profesional dan kepimpinan, dan kewarganegaraan digital dan tanggungjawab adalah antara tiga dimensi kompetensi ICT guru yang merupakan peramal signifikan secara statistik terhadap penerimaan serta penggunaan SMS di kalangan guru di sekolah menengah Negeri Sembilan. Analisis pengantaraan menggunakan SEM menunjukkan bahawa terdapat kesan pengantara positif dan separa kompetensi ICT guru terhadap hubungan antara amalan kepimpinan teknologi pengetua, dan penerimaan serta penggunaan SMS di kalangan guru. Seterusnya, ujian kesan penyederhanaan mendedahkan bahawa pembolehubah demografi guru (jantina, umur, tahap pendidikan, pengalaman mengajar, dan pengalaman menggunakan computer) bukan merupakan penyederhaan (moderator) terhadap hubungan antara amalan kepimpinan teknologi pengetua, dan penerimaan serta penggunaan SMS di kalangan guru di menengah sekolah Negeri Sembilan. Akhir sekali, model baru yang merangkumi amalan kepimpinan teknologi pengetua, kompetensi ICT guru, dan penerimaan serta penggunaan SMS di kalangan guru telah dibangunkan berdasarkan hasil kajian ini. Kajian ini juga menekankan bahawa dua faktor manusia penting, individu (kompetensi guru ICT) dan kontekstual (kepimpinan teknologi pengetua), dalam meramalkan penerimaan serta penggunaan SMS di kalangan guru. Selain itu, dapatan kajian ini menunjukkan beberapa implikasi yang tidak ternilai dan sumbangan kepada ahli akademik dan pengamal. Kajian ini secara umumnya, telah menyumbang kepada badan ilmu pengetahuan dalam pendidikan dan khususnya integrasi teknologi pendidikan. Kajian ini disimpulkan dengan model amalan kepimpinan teknologi pengetua, kompetensi ICT guru, dan penerimaan serta penggunaan SMS di kalangan guru yang membuka ruang untuk penyelidikan lanjut dalam suasana pendidikan di Malaysia.

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AGFI	Adjusted Goodness of Fit
AMOS	Analysis of Moment Structures
ANOVA	Analysis of Variance
AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
Chisq	Discrepency Chi Square
Chisq/df	Chi Square/ Degree of Freedom
CIS	Computerized Information System
C.R.	Critical Ratio
CR	Composite Reliability
α	Cronbach Alpha
DOI	Diffusion of Innovation Theory
ECT	Expectation Confirmation Theory
EE	Effort Expectancy
EFL	English as a Foreign Language
EPC	Expected Parameter Change
EPRD	Educational Planning and Research Division
FC	Facilitating Condition
GFI	Goodness of Fit Index
GIS	Geographic Information Systems
HM	Hedonic Motivation
IAB	Institute Aminuddin Baki
ICT	Information and Communication Technology

IFI	Incremental Fit Index
ISTE	International Society For Technology In Education
IT	Information Technology
ITE	Institute of Education
M	Mean
MI	Modification Indices
MOE	Ministry of Education
MSC	Multimedia Super Corridor
NETS.A	National Educational Technology Standards for Administrators
NETS.T	National Educational Technology Standards for Teachers
NFI	Normed Fit Index
NPQEL	National Professional Qualification for Educational Leaders
OCI	Organizational Climate Index
p	Probability
PE	Performance Expectancy
PTLP	Principal Technology Leadership Practices
PTLA	Principals' Technology Leadership Assessment
RFI	Relative Fit Index
RMSEA	Root Mean Square of Error Approximation
S.D.	Standard Deviation
S.E.	Standard Error
SEM	Structural Equation Modelling
SCT	Social Cognitive Theory
SMS	School Management System
SPSS	Statistical Package for Social Sciences

TAGLIT	Taking A Good Look at Instructional Technology
TAM	Technology Acceptance Model
TAM2	Extended Technology Acceptance Model
TAU	Teacher Acceptance and Use
TIC	Teacher ICT Competency
TLI	Tucker Lewis Index
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
TSSA	Technology Standard for School Administrators
TTU	Teachers Technology Use
UTAUT	Unified Theory of Acceptance and Use of Technology
UTAUT	Extended Unified Theory of Acceptance and Use of Technology
VLE	Virtual Learning Environment

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CHAPTER 1: INTRODUCTION

1.1 Introduction

Globalization and the information and communication technology (ICT) advancement have created a new knowledge-driven economy era. In conjunction with this, many nations have viewed ICT as the critical enabler of these knowledge-based societies. Governments worldwide have acknowledged the positive impact of technological advancement on the countries' economic and social development. Hence, in order to develop their nation's human capital, many governments started to allocate huge fund on ICT to address the demands of this digital and information age (Ministry of Education Malaysia, 2010) by employing lots of initiatives to accelerate the potential for interacting these new technologies with the educated population through the technology-rich environment to attain this knowledge-based society.

Avci Yucel and Gulbahar (2013) noticed that the progress of web-based technology together with the exponential growth of internet accessibility has caused the widespread usage of web-based or internet applications across many different disciplines. Furthermore, the increasing availability of mobile and wireless technologies make these kinds of web-based or internet applications even more pervasive and ubiquitous (Avci Yucel & Gulbahar, 2013). Technology has permeated almost every aspect of our daily life. At the same time, globalization has increased worldwide competition force which is called as the new global economic force and it has caused not only many different types of reform development models elsewhere but also has brought some visibility competitiveness in people's workplace (Haughey, 2006).

Adeyemi and Olaleye (2010) noted that the prominent role of ICT could be seen in advancing knowledge and is a necessary skill for effective functioning in the modern world. Hence, in this rapidly changing global economy, the educated workforce is vital to remain competitive because the state of the education system today is the best predictor of Malaysia's competitiveness tomorrow (Ministry of Education Malaysia, 2013b). Thus, educational attainment has been seen as one of the indicators to compare the countries' economic potential (Haughey, 2006).

Schools are expected to prepare people for their employment in this rapidly changing workplace. Hence, principals and teachers are required to deliver their curriculum effectively through the usage of ICT to make sure the success of their students (Bush, 2011). Besides, it was commonly acknowledged that a developing nation needs to be supported by the future generations who should be equipped with the 21st century skills. Thus, ICT is said to be indispensable in education. Furthermore, the education reform based on the "Twenty-First Century Skills" framework (Trilling & Fadel, 2009) also emphasize that technology literacy as one of the essential skill to be successful in work and life for the e-generation.

According to Dede (2010), the twenty-first century seems to be very different if compared with the twentieth century in terms of skills and competencies people need to carry out their work and for their citizenship and self-actualization. In response of these, each society's educational system has to transform their pedagogical objectives and ways of curricula and assessments delivery for their students to help them to attain the excellent outcomes for a successful lifestyle reflected upon their effective contribution in workplace and citizenship. Hence, the greater move towards the use of technology is very much needed in order to engage this techno-savvy generation into their instructional process (Lewis, Fretwell, Ryan, & Parham, 2013).

Since education is a valuable social commodity that can transform human capital to another stage of development (Hussein, 2013), it plays the most important role in any country that pursues economic progress and national development. Human capital is the most valuable asset that can sustain a nation's future survival. Education is said to be the best predictor in determining a nation's future because the success of its people depends significantly on their knowledge, skills, and competencies. Thus, it is not surprising that nations that have achieved higher educational levels will be able to enjoy greater economic prosperity (Ministry of Education Malaysia, 2012a).

According to Colin and Donald (2003), educational institutions have to face the ramifications of globalization, especially the explosion in digital communications and the paradigm shift from the supply-driven to the demand-driven market. At the same time, worldwide educators are confronted with the demand for greater accessibility, flexibility, cost-effectiveness, quality and relevance, and lifelong provision. Although the course of changes in education is unpredictable, the economic landscape of communication and technology will be radically different, and this change will have revolutionary implications for education (Colin & Donald, 2003). This is because the use of ICT could improve education quality and make education accessible for everybody by expanding the learning opportunities (Adeyemi & Olaleye, 2010). In other words, globalization and educational technology have altered and changed the landscape of how people learn and what learners already know, so it is critical for the school leaders to understand this new educational terrain (Papa, 2011).

In Malaysian context, education is clearly acknowledged as the engineering tool for the nation's future citizenry. In order to enhance and improve the overall quality of education, principals have to balance between fulfilling students' and teachers' need, as well as aligning to the needs of the future citizenry as defined by the nation to face the challenges of the rapidly changing environment dominated by the revolution of the ICT (Rahimah, 2004). Thus, the school must be more responsive to community requirements and expectations of changes (Simpson, Payne, & Condie, 2005).

According to S. L. Wong, Mas Nida, Abu Daud, and Othman (2011), the advancement of technology has significantly changed the educational landscape. Hence, in order to accelerate the entry into this information age, Malaysian government has launched Multimedia Super Corridor (MSC) in 1996. MSC was designed as the major national initiative which acts as a catalyst to the ICT development in Malaysia. The aim of this project was to evolve Malaysia into a fully develop country with ICT advancement in order to achieve the country's ambitions according to vision 2020. Smart School, one of the MSC's seven flagships aimed to integrate ICT into school curricula and management to equip the future generation to become more competitive in this globalized world (Hamsha, 2011). The initiatives include upgrading the infrastructure for Information Technology (IT); introducing new IT applications; introducing easier and more effective access to information; and managing and training IT personnel.

Based on the Smart School Initiative Architecture Review (Ministry of Education Malaysia, 2010), Malaysia is now progressively marching away from the Smart School initiative to a more pervasive and substantial 'ICT in Education' concept in order to cope with the dynamic force of change comes from the internal demands and external environment that cause a huge impact on the coming wave of ICT in education. The concept of 'ICT in Education' has a wider impression and it operates in a grander scheme if compare with the 'Smart School' initiative. The wider impression includes merging multi-level efforts from all stakeholders, which includes the Ministry of Education (MOE), schools, and educational institutions. Besides, it also includes the Practice Community which consists of alumni, practitioners, experienced teachers, parents, and students who always make constructive criticism on user requirements and areas of improvement to solidify the method of integrating ICT in education (Ministry of Education Malaysia, 2010). The "*Policy on ICT in Education*" included four major pillars of delivery, namely Infrastructure, Digital Learning Resources, Budget, and Human Capital. Underneath these four pillars of delivery, there are eight key focus areas which included Competency and Professional Development; Structure (Roles and Responsibilities of Stakeholders); Maintenance and Support; Technology and Infrastructure; Community Participation; Budget and Total Cost of Ownership; Education Management System; and Teaching and Learning.

Furthermore, MSC Malaysia would support the development of this policy by identifying the niche areas in e-solutions and software, shared services, creative multimedia, outsourcing and as well as e-business in 10th Malaysian Plan 2011–2015 (The Economic Planning Unit of Prime Minister's Department, 2010) based on the "*Policy on ICT in Education*" (Ministry of Education Malaysia, 2010). At the same time, Malaysian government has put its effort to promote the ICT usage in all industries in conjunction with the development of the ICT sector. Thus, education and training will always be the priority requirements of human resources in this sector.

Besides, The Interim Strategic Plan 2011-2020 (Ministry of Education Malaysia, 2012b) also strongly emphasized the ICT usage in the teaching and learning process as well as in the field of administration and management of schools and educational institutions as a prerequisite for Malaysia to become a developed nation and achieve the 10th Malaysian Plan 2011-2015 objectives.

In order to achieve the objectives mentioned, a comprehensive review of the education reform has been introduced by MOE in October 2011 to develop a new education vision namely National Education Blueprint (Ministry of Education Malaysia, 2012a). It aims to raise the international education standards, the aspiration of preparing better Malaysian students for the competitiveness of the 21st century, and to increase parental and public expectations of the education system. The Blueprint provides a student's aspirations and vision of education plan that Malaysia both needs and deserves, and 11 strategic or operational shifts that would be required to achieve that vision have been suggested. Among these 11 strategic shifts, shift seven is related to the leverage of ICT to upgrade the quality of learning in Malaysia which provides the virtual-learning environment and internet access via 1-BestariNet for all 10,000 Malaysian schools (Ministry of Education Malaysia, 2013b).

Moreover, the main objective of new National Education Policy effort from Educational Policy Planning and Research Division (2012) for Educational System Reform is to improve the conditions and quality of the educational system and to fix a system of education that is "*flexible*" to current development. Clause 29 & 30 in the policy clearly reflected on the needs of the educational system in Malaysia to the use of ICT in Teaching and Learning, and Educational Management. Thus, it can be concluded that ICT usage in education system serves two purposes; first to enhance

Teaching and Learning process (instructional), and second to improve the efficiency, effectiveness, and productivity of school management (Picciano, 2011). Besides, many studies (Bosker, Branderhorst, & Visscher, 2007; Demir, 2006; Levin & Datnow, 2012; Madiha Shah, 2014; Makewa, Meremo, Role, & Role, 2013; Prokopiadou, 2012; Unachukwu & Nwankwo, 2012; Wan Mustama, Ahmad Rafee, Mazlan, & Elhammi, 2004) have shown that the integration of ICT in Educational Management and Leadership contributed to educational institutions excellence as well as to improve the competency and performance of the education managers and leaders.

The significance of effective management and leadership for the successful operation of the school is well acknowledged in the twenty-first century (Bush, 2011). Leadership involves coordinating and balancing the conflicting interest of all members and stakeholders. There is an increasing demand on the principal to be a community builder, budget analyst, public relations expert, special programs administrator, facility manager, assessment expert, and educational visionaries (S. Davis, Darling-Hammond, LaPointe, & Meyerson, 2005). However, decision-making is the heart of educational management (Demir, 2006). In the decision-making process, if a leader is confronted with the situation of poor or insufficient information provided for any important decision-making processes, the leader needs to act on intuitions and assumptions based on their past experience as well that based on feedback from subordinates. This can be quite difficult for leader especially if they have to confront with the situation where the subsequent decision turns out to be wrongly founded. Thus, intuition and gut feeling on the part of leader will often figure in the many decisions the leader will need to make, sometimes having to rely on chance and good fortune to pull through difficult situations. Since, School Management System (SMS) has an important contribution to school management (Demir, 2006), a reliable SMS needs to be set up to help the school leader in the data-driven decision-making process. In order to increase school effectiveness, online SMS has become a critical tool for effective technology leadership (e-leadership) and data-driven decision-making in recent years (Blau & Presser, 2013).

Furthermore, Murray (2013) realized that school system nowadays has to access much more data than ever before but school community mostly the principals and teachers are incompetence in dealing with those data usage. He mentioned that many professions have routinely used data as a basis for assessing improvement by making a quality decision. He also viewed that maintaining and appropriating data usage can enhance and improve the teaching and learning processes. However, he found that school leaders and teachers seldom rely on data to help students in their learning process or for school improvement. This may be due to the potential and benefits of the data usage have not been discovered yet.

According to Hussein (2013), the data-based Management Information System is a fundamental element of any system-wide transformation process because information is a vitally critical variable that no planning, evaluation, research and monitoring exercise can achieve their goals without it. However, he found that various Malaysian educational agencies either at the federal, state or district level routinely collecting some amount of information of any types and in many ways. There appears to be a problem of lack of coordination among the different data-collection agencies. As a consequence, not only that there is a very frequent repetition of tasks required of the person supplying the information but there is also the problem of overlaps and duplication. Thus, teachers, principals, and related personnel at school levels have to supply the exactly same detailed information over and over again from agency to agency and from year to year. This practice has tended to create duplication in data collection, raising issues of questionable data reliability and extra burden on schools. Thus, he views that a more comprehensive, detailed and related information system that can digest, assimilate, interpret and use with full effectiveness is considered necessary to overcome this weakness. Besides, the information system should highlight the integration of management, administration, and operations that will be required in terms of the principal alliances and the channels of communications across divisions and unit, states, districts, and schools. His suggestion is in line with one of the eight key focus areas covered under ICT in Education Policy (Ministry of Education Malaysia, 2010) which was to have a central Educational Management System.

Following this, a new School Management System (SMS) was launched by the Education Technology Division, Ministry of Education in 2013. SMS is a simplified and resourcefully integrated system which can accomplish many management tasks. The main objective of this system is to create only one information management application for all schools to reduce teachers' burden and to create a centralized database that could be reached and utilized by multiple users or all agencies under the MOE. This system automates two key function areas which are: (i) school management and educational administration; and (ii) teaching and learning (Ministry of Education Malaysia, 2013a).

According to Haslina, Bahbibi, and Norhisham (2014), SMS is a type of Information Management System that is pivotal for the effective and efficient running of Malaysian schools. SMS was introduced by the MOE to help teachers and administrators to manage school-related information and centralize administrative tasks. It was developed from Smart Schools Management Modules. Six of the modules from 22 Smart School management modules have been chosen to be implemented in public secondary day schools all over the country. The six management modules involved in SMS are Administration, School Information, Employee, Student, School Calendar and School Facilities.

As mentioned in the Malaysian Education Blueprint 2013-2025 (Ministry of Education Malaysia, 2012a), the quality and effectiveness of education management need to be improved. Thus, SMS is one of the initiative components which is managed by the Performance Delivery Unit of MOE where The Education data Integration aimed to transform ministry delivery capabilities and capacity based on Shift Eight in Education Blueprint 2013-2025. The expansion of SMS involved 10,000 Malaysian schools and its introduction was hoped to bring a great change to school management in Malaysia (Haslina et al., 2014). School administrators and teachers used SMS to manage schools' information, whereas, at the same time parents, MOE staffs, and even students can access relevant information from SMS. Based on a MOE circular with the reference number KP(BPSH-SPKD) 201/005/02/Jld.6 (25) dated 24 December 2014 (Appendix A), all public secondary day schools in Malaysia are required to use SMS mandatory starting from 1st of January 2015.

According to Madiha Shah (2014), the online information system usage in educational management has increased rapidly due to its effectiveness and efficiency. He further clarified that the main purpose and usage of SMS were to improve the efficiency of school activities in term of keeping students and teachers personal data. Furthermore, he found that the overall literature review highlighted the positive impact of SMS on school management and administration which includes more efficient administration, better time management, higher utilization of school resources, reduction in workload, better accessibility to information, and improvement in the quality of reports.

Beside, Munro (2008) stated that school communities have realized the importance and efficiency of using ICT in certain aspects of instruction and to change some of the work processes in their central offices. One of the most important recent advents of ICT usage has been in the way of schools' central office is that data are organized, gathered, delivered and used in a more proper way. For example, a new data system has been used in large districts to track the students' outcomes, as well as the allocation of resources, on a real-time basis, and to make the data available throughout the schools. Thus, it is clear that technology includes all scientific techniques and processes for improving work and to be an effective user of technology, it is important for the school leaders and teachers to understand how technological advances could affect the effectiveness of school management.

1.2 Statement of the Problem

Recently, Malaysian education system received numerous criticism and public scrutiny from parents as well as employers. They voiced their concern and expectation regarding whether our education system is able and adequate to prepare Malaysian students for the upcoming challenges of the 21st century (Ministry of Education Malaysia, 2012a). Furthermore, Malaysia Government has invested substantially in education since independence until today. But, the gap between the high levels of expenditure on educational technology and the expected return in school improvement is still a global education agenda with great debate (Leong, 2010; H. Y. Lu, 2013; Wahdain & Ahmad, 2014).

Moreover, the MOE has spent an extensive amount of money on ICT over the past two decades in education technology field such as smart school, which is considered as one of the most capitals intensive investments Malaysian Education System has undertaken. Besides, continuous efforts are being employed to enhance teachers' ICT skill in Malaysian schools (Sathiamoorthy, Leong, & Mohd Jamil, 2011), but the ICT usage in schools still does not meet the expected requirement both in terms of quality and quantity (Fong, Ch'ng, & Por, 2013). This indicates that the investment and policies in getting teachers to embed with the use of ICT have not been found to be helpful by teachers (Haydn & Barton, 2008).

L.-L. Chen (2004) noted that despite the proliferation of computer equipment has been provided in the school, there still exist a group of teachers who are unfamiliar with the usage of ICT. This was further supported by Wachira and Keengwe (2011) who stated that despite the promise of educational technologies, the survey of teachers consistently showing declines in the educational technologies usage. Based on a MOE's study finding in 2010, only one-third of students perceives their teachers to be using ICT regularly in their teaching process and about 80% of teachers are found to spend less than one hour a week using ICT even though ICT has tremendous potential to accelerate the learning process. However, this potential has not yet been achieved (Ministry of Education Malaysia, 2012a).

Recently, based on the Feedback on The Auditor General's Report 2013, Series 3 (Ministry of Finance, 2014) the level of Virtual Learning Environment (VLE) usage among Malaysian teachers is very low which is in the range of 0.57% to 4.69%. This VLE project is one of the huge capital investments in educational technology made by the Malaysian MOE. The issue of low and slow uptake of technology amongst teachers brings us to one very pertinent question: What can be done to ensure that teachers do and want to accept and use technology in carrying out their routine duties as teachers?

In order to create a new computer-literate user community, principals and teachers need to be as concerned about technology implementations being successful as the people developing the systems or integrating those systems. In other words, "*governments have the constitutional power to impose their will but successful ICT implementation requires commitment from those who are willing to implement these changes. If leaders and the teachers believe that the technology initiative is inappropriate for their usage, they are unlikely to implement it with enthusiasm*" (Bush, 2011, p. 5). Hence, a paradigm shift is needed to maximize the potential of ICT and its application is very much expected in the minds of school principals, teachers and the relevant authority that is in charge of preparing the principals and the teachers to keep abreast of the ICT fast and rapid development (Sathiamoorthy et al., 2011).

Even though ICT usage has been proven able to improve the effectiveness and productivity of many organization, but the human factor is identified as the most important determinants of the success or failure of the ICT implementation (Wahdain & Ahmad, 2014). Thus, human capital acceptance and use is one of the vital elements to ensure that all the initiatives and programs can be implemented by the right method at the right time with the right cost (Ministry of Education Malaysia, 2010).

Although information system has played a significant role in education management, resistance to it usage by public school teachers worldwide remains high (Hu, Clark, & Ma, 2003). Liew (2007) assumed that one of the main factors that might hinder the implementation of the ICT programs could be teachers' resistance to the acceptance and use of this new technologies in school and this will cause the huge investment into the developmental of SMS may be wasted.

So, in order to properly and effectively implement SMS into our public school system, teachers need to have positive attitudes and confidence toward the usage of this SMS that will motivate them to integrate it into their routine works. In other words, teachers' attitudes and beliefs about the usage of SMS will significantly influence their acceptance and use of SMS into their routine works. Obviously, teachers' attitudes are strong predictors of their future actual usage behaviors or decisions regarding the acceptance and use of SMS into their works (L.-L. Chen, 2004).

According to Haslina et al. (2014), SMS is a newly introduced system to help teachers and administrators to manage information and centralize administrative tasks and not much research on its use could be found in Malaysia yet. Thus, it is important to study teacher's level of acceptance and use of SMS to ensure efficient and effective managing of schools in Negeri Sembilan.

Besides, Liew (2007) found that most teachers may not be in favor of the ICT program because they lack competency in dealing with ICT. Is this the main cause of low level of ICT usage among teachers? According to Hamsha (2011), adopting ICT competency standards and adequate training will help school leaders and teachers to incorporate ICT effectively in education. Besides, it is also commonly acknowledged that ICT is expanding rapidly, if teachers are not ready with adequate and latest knowledge and skills, they would not be able to keep pace with the ever-changing technology and inevitably will be left behind and hampered from mastering new ICT competencies (Mas Nida, Wong, & Ayub, 2011). So, in order to prepare teachers to use technology effectively, there is a need to investigate what the current level of teacher ICT competency is. In other words, how teachers perceived their own ICT competency to be.

Teachers have been acknowledged as the catalyst to achieve the promise of educational technology, overlooked in the implementation process was that attaining to this promise depended fundamentally on principals. Principals play the most critical role in making policymakers' visions for data integration and usage a reality at the national, district and school levels. However, most of the previous studies have not pointed out how principals function as the key agents in influencing other users in data integration and usage (Levin & Datnow, 2012). Although there is a widespread acquiescence that leadership has important effects on teachers' ICT acceptance and use, but to date, a relatively little empirical study has explored this phenomenon in detail (Neufeld, Dong, & Higgins, 2007). In other words, what principals do to facilitate the computer technology integration process is a crucial variable (Brockmeier, Sermon, & Hope, 2005).

Although the principal is the key to leading the application of ICT in schools, according to Rossafri and Balakrishnan (2007), most of the principals were at low level of skills and knowledge related to ICT and they become uncomfortable to be leaders in technology field, or they may be unsure about the effectiveness of technology leadership in school improvement. Besides, not many school principals are aware that the MOE has made a huge investment in reducing the digital gaps in the education system today. This, in turn, causes them least responsible as technology leaders which are probably one of the contributing factors to the failure of the technology implementation in education. Are the school principals providing sufficient technology leadership to enhance teacher ICT competency for ICT applications? Is the biggest barrier for technology implementation lies on principal technology leadership? The main question that arises here is whether school principals demonstrate sufficient technology leadership practices.

According to Sathiamoorthy et al. (2011), when principals recognize their role in technology leadership, they can easily provide at least 30% change and enhancement towards teachers' ICT skill. At the same time, if the principal becomes more aware of the various dimensions of technology leadership practices, they can contribute more to their teacher's ICT skill development and application. In another word, only when school principals are prepared for their emerging role as technology leaders, teachers will be positively influenced and supported to accept technology integration.

Many previous studies showed that the application of ICT have a significant impact on teaching and learning process but there is little empirical research on the information system usage in a broader range of school management which helps teachers and administrators to manage information of schools and centralize administrative tasks in the Malaysian context. Although some of the secondary schools do use school management systems, however, these systems tend to be used primarily for the clerical purposes only but not to be used for supporting higher order of managerial activities (Bosker et al., 2007). Besides, the issue of principals' role as technology leaders is beginning to raise some concerns in Malaysia. However, many principals in the country do not fully conscious of their role as technology leaders and practically doing nothing about it (Sathiamoorthy, Sailesh, & Zuraidah, 2012). Wilmore and Betz (2000) also found that there are limited empirical studies on the principal's role and the implementation of ICT in schools have been reported. Malaysia, being a developing country, is also lagging behind the developed ones in terms of the number of research on this issue (Sathiamoorthy et al., 2011).

There are few local studies about technology leadership that have been carried out recently. According to a study conducted by Moktar (2011) on principal technology leadership roles toward the teacher ICT competency in a religious secondary school in Kuching District, Sarawak, his results indicated that there is a significant positive relationship between principal technology leadership and the teacher ICT competency. Besides, Leong (2010) and Mohd Jamil (2011) studies showed that there is a significant positive relationship between principal technology leadership and teacher ICT application. Nevertheless, there is another study conducted by Ting (2007) to investigate the level of ICT usage among teachers in four secondary schools in the district of Sarikei, Sarawak, found that there was moderate and significant positive correlation between principal support and teacher ICT competency with the level of ICT usage among teachers. According to these findings, the researcher found that teacher ICT competency could be a mediator in the relationship between principal technology leadership practices and teacher acceptance and use of SMS.

Thus, based on the problems stated and the findings of the above few local studies about principal technology leadership practices, the researcher aims to investigate principal technology leadership practices and its relationship with teacher ICT competency, and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. More specifically, the researcher frames the conceptual framework of this study to investigate whether principal technology leadership practices have a direct relationship with teacher acceptance and use of SMS or it is mediated by teacher ICT competency.

1.3 Purpose and Objectives of the Study

This study aims to investigate teachers' perception on the level of principal technology leadership practices, teacher ICT competency, and teacher acceptance use of SMS in Negeri Sembilan secondary schools. The objectives of this study are as follows:

1) To analyze the level of:
   (i) teacher acceptance and use of SMS,
   (ii) principal technology leadership practices, and
   (iii) teacher ICT competency in Negeri Sembilan secondary schools.
2) To examine the relationship between:
   (i) principal technology leadership practices and teacher acceptance and use of SMS,
   (ii) principal technology leadership practices and teacher ICT competency, and
   (iii) teacher ICT competency and teacher acceptance and use of SMS in Negeri Sembilan secondary schools.
3) To analyze which of the principal technology leadership practices dimensions are the significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

4) To analyze which of the principal technology leadership practices dimensions are the significant predictors of teacher ICT competency in Negeri Sembilan secondary schools.

5) To analyze which of the teacher ICT competency dimensions are the significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

6) To assess the mediating effect of the teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

7) To assess the moderating effect of teacher demographic variables on the relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

8) To evaluate if the proposed model involving principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS fit with the data collected from Negeri Sembilan secondary school teachers.

1.4 Research Questions

This study seeks to answer the research objectives as outlined in section 1.3. The research questions of this study are as follows:

RQ1 What are the levels of teacher acceptance and use of SMS in Negeri Sembilan secondary schools?

RQ2 What are the levels of principal technology leadership practices in Negeri Sembilan secondary schools?

RQ3 What are the levels of teacher ICT competency in Negeri Sembilan secondary schools?

RQ4 Is there a significant relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools?

RQ5 Is there a significant relationship between principal technology leadership practices and teacher ICT competency in Negeri Sembilan secondary schools?

RQ6 Is there a significant relationship between teacher ICT competency and teacher acceptance and use of SMS in Negeri Sembilan secondary schools?

RQ7 Which of the principal technology leadership practices dimensions are the significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools?

RQ8 Which of the principal technology leadership practices dimensions are the significant predictors of teacher ICT competency in Negeri Sembilan secondary schools?

RQ9 Which of the teacher ICT competency dimensions are the significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools?

RQ10 Is teacher ICT competency a mediator for the relationship between principal technology leadership practices and teacher acceptance and use of SMS?

RQ11 Do teacher demographic variables moderate the relationship between principal technology leadership practices and teacher acceptance and use of SMS?

RQ12 Does the proposed model of principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS fit with the data collected from Negeri Sembilan secondary school teachers?

1.5 Significance of the Study

As research on principal technology leadership is limited in Malaysia, this study could be used as the reference or guideline for other researchers to get an initial overview of the current principal technology leadership practices in Malaysian context and the relationship between principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Next, this study hopes to promote interest in other researchers to pursue further studies and obtain more meaningful results in understanding why people accept or reject an educational innovation. This is to develop and extend knowledge in the field of education technology especially to better explain, predict, and increase user acceptance and use of educational technology innovation like SMS in this study.

If the result of this study indicated that the principal technology leadership practices are the crucial element which direct influencing teacher acceptance and use of SMS, this study can be used as leadership training guidelines for Institute Aminuddin Baki (IAB) to promote principal technology leadership practices according to the dimensions of principal technology leadership practices which have higher impact on teacher acceptance and use of SMS. Besides, the training is expected to raise awareness among school leaders that they play an important role as technology leaders in various dimensions for the success of the effective implementation of SMS. This, in turn, will encourage teachers to effectively use SMS to carry out their routine work.

As SMS is newly introduced system, and not much research on its use could be found yet, therefore, this study provides empirical evidence for the policy makers about the effective use of SMS as an outcome measurement for educational investment in the implementation of SMS, based on the level of teacher acceptance and use of SMS. The output measures could become part of the post-adoption measurement for the system implemented and an effective evaluation of the contribution and performance of the current education management system. There was a need to explore the feasibility of an inclusion of output variables that would yield more direct information and patterns of inadequacies, gaps, and deficiencies, and requirements based on the differences and variations identified. Moreover, individual technology acceptance and use need to be researched extensively in lieu of the fact that technology usage advancement is the only way to move toward the knowledge-based society. Besides, this study also provides educational software designers and developers with a description of teacher acceptance and use profiles. This information could be served as recommendations about more effective ways to support information systems acceptance and use in education.

This study used The Extended Unified Theory of Acceptance and Use of Technology (UTAUT2) Model (Venkatesh, Thong, & Xu, 2012) as its primary theoretical understanding on the teacher acceptance and use of SMS in secondary schools. However, to the researcher's knowledge after a thorough search of all the available databases, local and foreign journals, no study pertaining to teacher acceptance and use of SMS had been carried out in Malaysia using the UTAUT2 model as the foundation to measure the level of teacher acceptance and use of SMS in secondary schools. Hence, this study would contribute to the existing literature by examining different variables that might have been neglected previously. Consequently, this would contribute to the body of knowledge pertaining to the UTAUT2 among teachers in Negeri Sembilan secondary schools.

This study also provides direct and current information about teacher ICT competency and teacher acceptance and use of SMS. This vital information allows State Education Department, District Education Department or school administrators to plan and deliver interventions needed to assist individuals or groups of teachers in implementing the change. Besides, understanding teachers' needs, both before and during the implementation process of an innovation could help concerned authorities to provide the necessary professional development opportunities to support them in the process of innovation adoption and meet the targets for increasing the human capital for school improvement. At the same time, this study also provides information for Institute of Education (ITE) to manage and conduct suitable training programs for pre-service teachers to assist them in developing the 21st century skills needed in order to sufficiently integrate ICT in teaching process to improve student outcomes. Besides, teachers also need to be inculcated with the culture of integrating ICT in education as part of the daily teaching and learning processes.

In the information system field, many well-known models and theories have been developed in the context of U.S. more than a decade ago. However, Malaysia being a developing country has not developed any model for information system acceptance and use in our education system yet. Hence, this study aims to develop a new information system acceptance and use model which integrated teachers' information system acceptance and use (UTAUT2 Model) with two new determinants that could have an effect on teacher acceptance and use of SMS based on literature reviews. These two determinants are principal technology leadership practices and teacher ICT competency. Hopefully, this newly developed model can be used as a guideline for the successful educational technology implementation in Malaysia.

1.6 Definitions of Terms

In this section, all the variables used in this study are conceptually and operationally defined in the next few paragraphs to give a clear understanding to the reader about what researcher intended to study.

1.6.1 Teacher acceptance and use of School Management System (SMS)

The researcher aims to identify teacher acceptance and use of SMS in Negeri Sembilan secondary schools based on The Extended Unified Theory of Acceptance and Use of Technology (UTAUT2) Model (Venkatesh et al., 2012), which have six dimensions: (i) Performance Expectancy; (ii) Effort Expectancy; (iii) Social Influence; (iv) Facilitating Condition; (v) Hedonic Motivation; and (iv) Habit. In this study, the level of teacher acceptance and use of SMS are measured according to teachers' self-rated based on these six dimensions. Each of these six dimensions is operationally defined as follow:

1. Performance Expectancy

   Performance expectancy is defined as "*the degree to which using a technology will provide benefits to an individual in performing certain activities*" (Venkatesh, Morris, Davis, & Davis, 2003). In this study, performance expectancy is defined as the degree to which teachers believe that using the SMS will help them to attain gains in job performance.

2. Effort Expectancy

Effort expectancy is "*the degree of ease associated with individuals' use of technology*" (Venkatesh et al., 2003). In this study, effort expectancy is defined as the degree of ease associated with teachers' use of the SMS.

3. Social Influence

Social influence is the extent to which an individual perceive that the important people (e.g., family and friends) believe that they should use a particular technology (Venkatesh et al., 2003). In this study, social influence is defined as the degree to which teacher perceives that important others believe he or she should use the SMS.

4. Facilitating Condition

Facilitating conditions refer to individual's perceptions of the resources and support available to perform a behavior (Venkatesh et al., 2003). In this study facilitating condition is defined as the degree to which a teacher believes that an organizational and technical infrastructure exists to support the use of the SMS.

5. Hedonic Motivation

Hedonic motivation is defined as the fun or pleasure derived from using a technology, and it has been shown to play an important role in determining technology acceptance and use (S. A. Brown & Venkatesh, 2005; Venkatesh et al., 2012). In this study hedonic motivation is defined as the enjoyment and pleasure derived resultant from using SMS.

6. Habit

Habit refers to a repeated behavioral pattern that occurs automatically under unconscious awareness and it is considered to be a perceptual construct that reflects the results of prior experiences (Venkatesh et al., 2012). Habit has been defined as "*the extent to which people tend to perform behaviors automatically because of learning processes*" (Limayem, Hirt, & Cheung, 2007, p. 705) while S. S. Kim and Malhotra (2005) relating habit with automaticity. Although conceptualized rather similarly, habit has been operationalized in two distinct ways: first, habit is viewed as prior routinized behavior (S. S. Kim & Malhotra, 2005); and second, habit is measured as the extent to which an individual beliefs the behavior to be automatic (Limayem et al., 2007). Since teachers' usage of SMS is mandatory in this study, habit is defined as the teacher's automatic behaviors because of the prior routinized behavior and learning processes.

1.6.2 Principal Technology Leadership Practices

The ISTE Standards•A (Appendix B) is a standard used for evaluating the skills and knowledge that school administrators and leaders need to support digital age learning, implement technology and transform the instruction landscape. The five composite dimensions of ISTE Standards for Administrators (ISTE Standards•A) as prescribed by The International Society for Technology in Education, ISTE (2009) are: (i) Visionary leadership; (ii) Digital age learning culture; (iii) Excellence in professional practice;

(iv) Systemic improvement; and (v) Digital citizenship. In this study, the five principal technology leadership dimensions are measured based on teachers' perception of their principal technology leadership practices at the school level. Each of these five dimensions is operationally defined as follow:

1. Visionary leadership

   This dimension is defined as whether teacher perceives that their principal is able to inspire and lead the development and implementation of a shared vision for comprehensive integration of information technology to promote excellence and support transformation throughout the school.

2. Digital age learning culture

   This dimension is defined as whether teacher perceives that their principal is able to create, promote, and sustain a dynamic, digital-age learning culture that provides a rigorous, relevant, and engaging education for all students.

3. Excellence in professional practice

   The third dimension is defined as whether teacher perceives that their principal is able to promote an environment of professional learning and innovation that empower educators to enhance student learning through the infusion of contemporary technologies and digital resources.

4. Systemic improvement

This dimension is defined as whether teacher perceives that their principal is able to provide digital age leadership and management to continuously improve the school through the effective use of information technology resources.

5. Digital citizenship

This dimension is defined as whether teacher perceives that their principal is able to model and facilitate understanding of social, ethical and legal issues, and responsibilities related to an evolving digital culture among community members.

1.6.3 Teacher ICT competency

Baartman, Bastiaens, Kirschner, and van der Vleuten (2007) stated that competency refers to knowledge, attitudes, and skills that belong to someone for doing their jobs and solve problems efficiently and effectively. Hence, competence is defined as the ability to perform the activities within an occupation or function to the standards expected. Competence is generally defined as the ability, the knowledge, attitudes, and skills to do the job effectively and efficiently (Mustamin & Yasin, 2012). According to Hoo (2007), the term "*ICT competence*" is taken as a reference term for different types of knowledge, skills, and competencies that are needed for teachers to work with ICT in the educational setting. These can be the competencies that sought to be developed by a teacher in the use of ICT (in education administration, preparation and to reach pedagogical purpose), the mastering of ICT tools and knowledge about ICT and its wider societal impact.

In this study, teacher ICT competency was measured according to ISTE Standards for Teachers (ISTE Standards•T) as prescribed by ISTE (2008). ISTE Standards•T (Appendix C) is a standard for evaluating the skills and knowledge which educators need to teach, work and learn in an increasing connected global and digital society. These standards consist five dimensions which are: (i) Smart Pedagogy; (ii) Digital age learning experiences and assessments; (iii) Digital age work and learning; (iv) Digital citizenship and responsibility; and (v) Professional growth and leadership. In this study, the level of teacher ICT competency is measured according to teachers' self-rated on these five dimensions. Each of the five dimensions is operationally defined as follow:

1. Smart Pedagogy

   Smart pedagogy refers to teachers' ability to use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in virtual environments.

2. Digital Age Learning Experiences and Assessments

   Digital age learning experiences and assessments refer to teachers' ability to design, develop, and evaluate authentic learning experiences and assessments incorporating contemporary tools and resources to maximize content learning in context.

3. Digital Age Work and Learning

Digital age work and learning refer to teachers' ability to exhibit knowledge, skills, and work processes representative of an innovative professional in a global and digital society.

4. Digital citizenship and Responsibility

   Digital citizenship and responsibility refers to teachers' ability to understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practices.

5. Professional Growth and Leadership

   Professional growth and leadership refers to teachers' ability to continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources.

1.6.4 Teacher demographic Variable

Teacher demographic variable in this study is defined as the non-manipulative personalized information about the teacher's characteristics which are believed to influence teacher acceptance and use of SMS. "*Non-manipulative factors are factors that cannot be influenced directly by the school, like age, teaching experience, (educational) computer experience of the teacher or governmental policy and the* *availability of external support for schools*" (Drent & Meelissen, 2008, p. 189). In this study, the researcher aims to investigate the moderating effect of five teacher demographic variables which included gender, age, teaching experience, educational level, and experience in using computer, on the relationship between principal technology leadership practices and teacher acceptance and use of SMS.

1.7 Limitations of the Study

The study of principal technology leadership practices is according to the five specified dimensions of Standard•A (2009) and teachers ICT competency also based on the five dimensions of Standard•T (2008) which are recommended by the ISTE. The instrument used in this study was adapted from various sources by referring to the ISTE standard as the guideline so that most of the important elements in the standard are taken into consideration in the adaptation process. Besides, this is the first time an attempt is made to examine the relationship between the principal technology leadership practices with teacher acceptance and use of SMS and teacher ICT competency defined in the Malaysian context. Hence, the instrumentation bias is one of the limitations of this study.

Furthermore, in this study, the researcher aims to investigate individual's level of acceptance and use of SMS, but not the organizational level of acceptance and use as researcher believed that the respond of individual user that will direct effect the successful implementation of any system in use. Since teachers are the end-users of the SMS, their perception about the system will determine their acceptance and use of the SMS.

Due to time and cost constraints faced by the researcher, the researcher cannot use diversifies research methods. The researcher intends to use the questionnaire as the only research instrument in a comprehensive review of data without involving observations and interviews. Hence, feedback received from the respondents is dependent on the sincerity and honesty of the respondents in answering the questionnaire and this will affect the research findings. In addition, the findings of this study should not be generalized to all Malaysian secondary school teachers, as the respondents of this study only involved teachers in a particular state in Malaysia. This population was selected for the study because it was the accessible population to the researcher due to the time constraint and limited financial resources.

1.8 Organization of Thesis

This study was organized according to the traditional dissertation organization which composed of five chapters. The first chapter provided an introduction, statement of problem, purpose, and objectives of the study. Then, the research questions which form the focus of this thesis were outlined. Next, the significance of the study was discussed followed by the definitions of terms. Finally, the limitations of the study were identified.

Chapter Two was structured into six sections. The first section was an introduction followed by the second section, theories and theoretical concepts relevant to the study. The third section reviewed the research literature in the areas of teacher acceptance and use of SMS, principal technology leadership practices, and teacher ICT competency. The fourth section discussed on the relationship between teacher acceptance and use of

SMS, principal technology leadership practices, and teacher ICT competency. Through these comprehensive reviewed of literature, the gaps that exist in the literature have been identified. Then, the fifth section presented the conceptual framework of the current study with a focus on the relationship among teacher acceptance and use of SMS, principal technology leadership practices, and teacher ICT competency respectively based on the underpinned theories presented in the early section. Finally, a summary of the chapter was presented in the last section based on the proposed relationships derived from the literature reviews.

Chapter Three offers a detailed description of the methodology used in the study. It started with an introduction and the research design employed in the study, followed by a description of the population, sample size, and sampling procedure. The next section discussed on the research instrument and questionnaire design. Subsequently, the reliability and validity of the developed instrument were presented. Then, the chapter illustrated on the data collection procedure. Following these, the data analysis section is described in four parts, which included descriptive statistics, Pearson Product Moment Correlation, Multiple Regression Analysis and Structural Equation Modelling in answering the proposed research questions.

Chapter Four compiles and reports on the results of data analysis. The preliminary data analysis in term of the response rate; an overview of the respondent demographic variables (gender, age, teaching experience, educational level, and experience in using computer); normality test for the data collected; and validation of the developed instrument, measurement models and structural model through Confirmatory Factor Analysis (CFA) are presented. This is then followed by presenting the statistical analysis results based on the proposed research questions. The results are presented in the form of descriptive statistics followed by inferential statistics for each of the research questions proposed in this study.

Chapter Five presents a summary of the entire study. It also provides a discussion of the results of the study in the light of relevant literature by interpreting the results drawn from data analysis of the twelve research questions proposed. The next section explores the implications of the study, both theoretically and practically, in the fields of teacher acceptance and use of SMS, principal technology leadership practices, and teacher ICT competency, in particular, the relationship between these three variables. Eventually, recommendations for further research are addressed before conclusions are made.

1.9 Summary

The foundations of this research have been laid in this chapter. It provided a background of the study that ICT has played an important role in schools around the world. More and more teachers and administrators use ICT in some aspect of their daily activities. There is a tremendous need for leadership in the use of ICT to ensure that it makes a valuable and lasting contribution to education.

This chapter also outlines the problem statements on the issue that the Government of Malaysia has invested substantial amount of money in education since independence. But, the gap between the high levels of expenditure on educational technology and the expected return in school improvement is still a global education agenda with great debate. Besides, continuous efforts are being taken to improve teachers' ICT skills in all schools in the Malaysian context, but the ICT usage in schools still does not meet the expected requirement both in terms of quantity and quality. The researcher thinks that this may be due to principals do not practice their role as technology leader or it may be due to teachers' factors in terms of lack ICT competency or resistance to the acceptance and use of SMS.

Thus, the researcher aims to investigate whether there are relationships between principal technology leadership practices with teacher ICT competency and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. More specifically, the researcher aims to investigate whether principal technology leadership practices have a direct relationship with teacher acceptance and use of SMS or it is mediated by the teacher ICT competency.

Eight research objectives focus on the problem statements were formed. Next, twelve research questions were formulated based on the research objectives, which will direct this research to solve the problems stated earlier. This chapter also defines the significance of this study to the policy makers, MOE, State and District Department officers, teacher training colleges, principals and teachers about their role in ensuring the success of the implementation of SMS. Besides, all the variables used in this study are conceptually and operationally defined to give a clear understanding to the reader about what researcher aims to study. Finally, the chapter ends with the limitation of this study in term of the variables measured, instrument and methodology used.

In the following section, Chapter two with the title Literature Review, all the related current published research findings and reports from local or international journals together with the unpublished local and international master and doctoral thesis and dissertation from various perspectives of the exogenous, endogenous, mediating and moderating variables are examined in greater details. The various theories and models which are relevant to this study are explained in details. The detailed conceptual framework of this study is presented at the end of Chapter two.

CHAPTER 2: REVIEW OF LITERATURE

2.1 Introduction

This chapter presents the review of related empirical studies in the literature pertaining to the variables used in this study, in addition to the development of the conceptual framework that supports the study. This study investigates teacher acceptance and use of SMS as the endogenous (dependent) variable in relation to principal technology leadership practices as the exogenous (independent) variable and teacher ICT competency as mediating variable with teacher demographic variables as the moderating variable.

The concept of principal technology leadership practices is discussed in terms of the five dimensions of ISTE Standards•A (2009) and teacher acceptance and use of SMS is measured based on the six dimensions of UTAUT2 Model (Venkatesh et al., 2012). Teacher ICT competency, the mediator, based on five dimensions of ISTE Standards•T (2008) is also examined while moderating effects of the five categories of teacher demographic variables: gender, age, teaching experience, educational level, and experience in using computer are investigated as well.

In order to provide a good representation of the related empirical studies and the formulation of the conceptual framework for the study in this literature review, sources comprising research publications, master's dissertations and doctoral thesis from both local and international contexts, professional books, scholarly or academic journals and relevant databases are utilized.

The flow of this chapter starts with relevant theories and models related to organizational behavior, leadership, and technology acceptance and use. Next, the current studies on teacher acceptance and use of technology, principal technology leadership practices, and teacher ICT competency are identified and discussed in detail. Similarly, the contemporary studies related to the relationship between principal technology leadership practices with teacher acceptance and use of SMS and teacher ICT competency are also presented. Besides, the effects of teacher demographic variables on the relationship between principal technology leadership practices and teacher acceptance and use of SMS are assessed. Finally, all the findings are compared, contrasted, and reviewed critically. The convergence of these empirical studies, the theoretical framework, and the relevant theories that are reviewed leads to the chapter conclusion with an overview of the conceptual framework proposed for this study and a summary of this chapter.

2.2 Theories and Theoretical Concept Relevant to the Study

This section begins with a discussion of organizational behavior theory knowing that school is a social organization. Then the exercises of influence underpinning various leadership theories are discussed in detail to give an overview of the theoretical framework that explained on the relationships that exist between variables used in this study. Finally, theories and models related to technology acceptance and use are presented.

2.2.1 Organizational Behavior Theory

Schools are the social organizations that follow Organizational Behavior Theory (Owens & Valesky, 2007). Just like any organization, the school has structure, power, values, and logic, which are highly interacting with one another to exert a strong influence on the methods in which individuals within the organization perceive, respond, and interpret to the world. The humans' behavior at work in an educational organization such as school either individually or as a group, is not only a reflection of their idiosyncratic personalities but is influenced by the social expectations and norm of the school's culture (Owens, 2001). "*This interplay between individuals and their work environment is powerful in giving rise to the organizational behavior*" (p. 3) of people in the school organization. In another word, "*organizational behavior is a discipline that seeks to describe, understand, and predict human behavior in the environment of formal organizations*" (Owens & Valesky, 2007, p. 102) like schools.

Robbin and Judge (2013) claimed that the influence of people on one another is a social psychology concept which has made a significant contribution in the area of understanding, measuring, and changing attitudes, building trust, communication patterns, the ways in which group activities can satisfied individual needs and group decision-making process. Because of the nature of the human relationship and interaction, there will be a leader and followers existing in a group in all types of situations in which people seek to achieve some common goals, through their mutual actions. Hence, leadership as a group function which involves dynamic interaction process with followers (Owens & Valesky, 2007).

According to Sociotechnical System Theory (Owens & Valesky, 2007), the purpose of existence of an organization is to achieve some goals or set of goals. In another word, it seeks to accomplish a certain *task*. Rationally, the organization is equipped, structured and staffed appropriately to accomplish its mission. In order to achieve an assigned task, an organization has its *structure*. It is the structure that gives an organization system, order and many of its distinctive characteristics. At the same time, the structure establishes a pattern of collegiality and authority. Thus, structure dictates the patterns of communication networks that are the basic to information flow and, therefore, to decision making. Besides, the structure also determines the system of workflow that is, presumably, focused on achieving the organization's tasks. Furthermore, the organization must have *technological resources* which do not only include such typical hardware items only but may also include program inventions to solve problems that stand in the way of organizational task achievement. Finally, the organization must have *people* that contribute to the task achievement of the organization.

These four internal organization factors–*task, structure, technology and people* are highly interactive (Figure 2.1), each tending to mold and shape one another. "*As in any system, the interdependence of the variable factors means that a significant change in one will result in some adaptation on the part of other factors*" (p. 144). "*The important in determining the nature and interrelationship of these internal organizational arrangements in a school district or school is the response of the organization to change occurring in the larger system in which it exists*" (Owens & Valesky, 2007, p. 144).

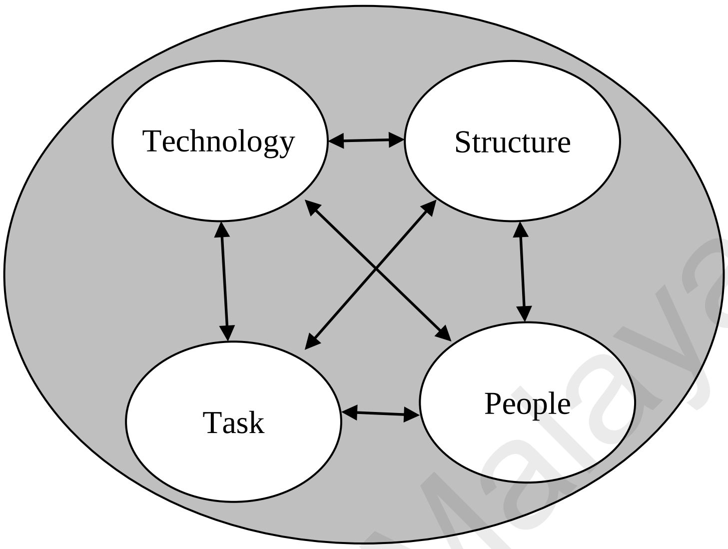


Figure 2.1: Interacting subsystems in the complex organization [Adapted from Harold J. Leavitt, "Applied Organizational Change in Industry: Structural, Technological and Humanistic Approaches," in *Handbook of Organizations,* ed. James G. March. 1965 by Rand McNally & Company, Chicago, Figure 1, p.1145 in Owens and Valesky (2007, p. 144)]

Thus, in coordinating the school's internal processes, it is necessary to deal with the dynamic interaction of these four subsystems: *task, structur*e, *technology, and people*. However, if a significant change is proposed to introduce through one of the primary target variables, it is clearly acknowledged that the other variables will be affected soon. The development in ICT has been the driving force for many of the changes in the 21st century organizations (Gurr, 2004). So, "*change efforts that are basically technological in nature result in some compensatory or retaliatory behavior on the part of people and in some structural adjustments*" (p. 145) within the school (Owens & Valesky, 2007).

Figure 2.2 is the schematic diagram that illustrates the key external and internal relationships of a school system. Few illustrative examples of the many things that are normally included in the structure, technology, people, and task subsystems are provided. In terms of the dynamics of internal organizational functioning, the belief, knowledge, and value possessed by individuals in the human subsystem are as important as the facts that the individuals are present. "*It should be obvious that the human subsystem is the only one that has non-rational (that is, affective) capability*" (Owens & Valesky, 2007, p. 145).

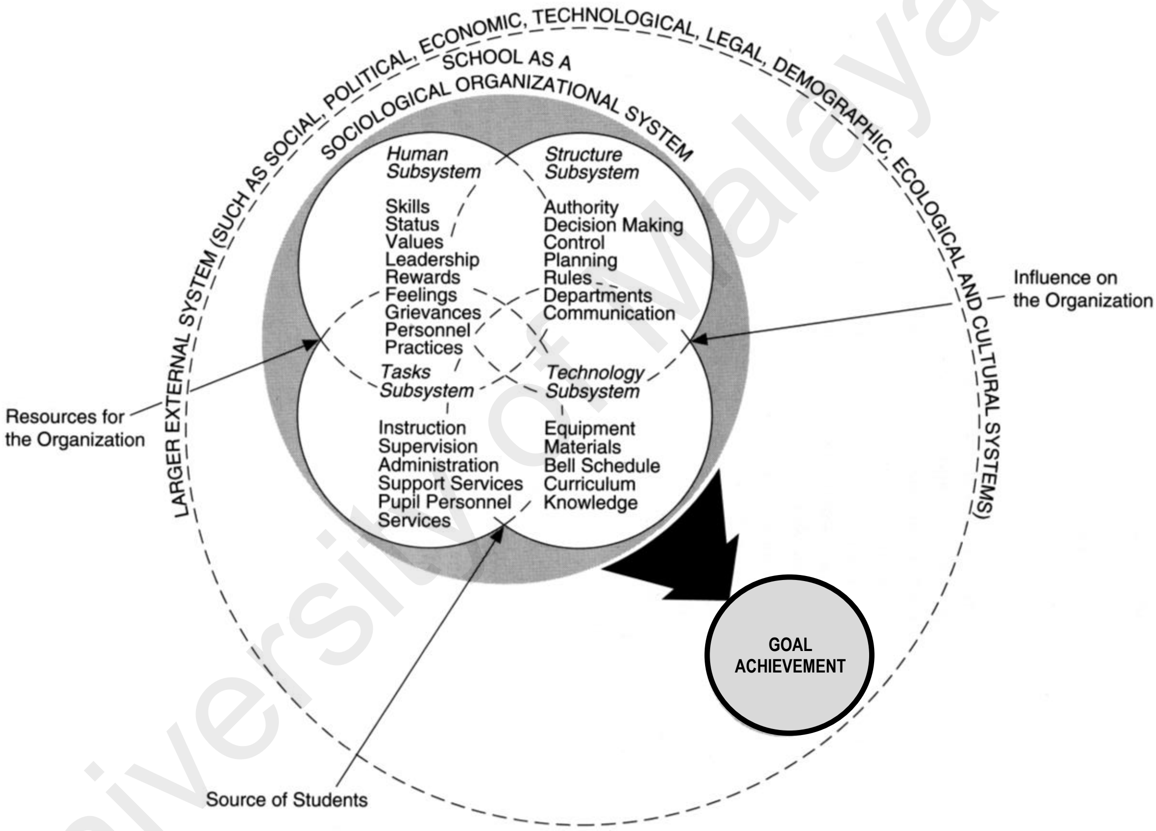


Figure 2.2: Four primary organizational subsystems characterize the internal arrangements of school systems and schools. [Adapted from Robert G. Owens and Carl R. Steinhoff, *Administering Change in Schools*. Englewood Cliffs, NJ: Prentice Hall, 1976, p.143 in Owens and Valesky (2007, p. 146)]

Since human subsystem involves affective dimension, the researcher believes that the human subsystem is the most important factor that will bring changes and success to the other subsystems in an organization. According to J. O. Kotter and Cohen (2002), change is so hard to happen in any organizations because successful transformation requires more than just the operations and structure change of an organization, but the central of the matter is always about human behavior change, and behavior change happens in a highly successful situation mostly by speaking to people's feeling. Thus, this study focuses on the human subsystem in Negeri Sembilan secondary schools that involves principals and teachers. More specifically, this study investigates the influence of principal technology leadership practices on teacher ICT competency (skill and knowledge to carry out the task) and teacher acceptance and use (feeling) of School Management System (technology subsystem) to help teachers and administrators to manage information and centralize administrative tasks (task subsystem) for better decision-making process (structure subsystem). However, according to Fullan (2011), "*leadership is difficult because people are sometimes unmanageable and complicated*" (p. xiii). Moreover, leaders are facing challenges on how to optimally integrate information technology systems and human in their organizations to fully leverage information technology advancement (DasGupta, 2011). Thus, in the next section, various but related leadership theories are presented to explain on how leadership practices influence their followers.

2.2.2 Leadership Theories

Leadership is one of the fascinating topics in organizational behavior. At the same time, this concept has produced literally hundreds of definitions and no one can satisfy all. No matter how much they seem to differ, these leadership definitions generally agree on two things: (i) leadership is a group function and (ii) leaders intentionally seek to influence the behavior of other people (Bass & Bass, 2008). According to

Northouse (2013), "*leadership is a complex process having multiple dimensions*" (p. 1). "*Despite the multitude ways leadership has been conceptualized, he identified the following components as the core to the phenomenon of leadership: (i) leadership is a process, (ii) leadership involves influence, (iii) leadership occurs within a group context, and (iv) leadership involves goal attainment*" (p. 5). Based on these components, he defined "*leadership as a process whereby an individual influences a group of individuals to achieve a common goal*" (Northouse, 2013, p. 5).

Yukl (2013), argued that "*researchers usually define leadership according to their individual perspectives and the aspects of the phenomenon of most interest them*" (p. 2). According to him, "*most definitions of leadership reflect the assumption that it involves a process whereby intentional influence is exerted over other people to guide, structure, and facilitate activities and relationships in group or organization*" (p. 2). Hence, he defined "*leadership as a process of influencing others to understand and agree about what needs to be done and how to do it and the process of facilitating individual and collective efforts to accomplish shared objectives*" (p. 7). Robbin and Judge (2013), also defined "*leadership as the ability to influence a group of people towards the achievement of a vision or a set of goals*" (p. 402).

According to Owens and Valesky (2007), "*what distinguishes leaders from other authority figures is the unique relationship between leaders and followers. Leaders related to followers in ways that:*

(i) motivate them to unite with others in sharing a vision of where the organization should be going and how to get it there;

(ii) arouse their personal commitment to the effort to bring the vision of a better future into being;

(iii) *organize the working environment so that the envisioned goals become central values in the organization;*

(iv) *facilitate the work that followers need to do to achieve the vision*" (p. 277).

Furthermore, Bush (2011) mentioned that leadership dimension embraces concepts of vision, values, and transformational leadership. Thus, he identified three dimensions as the basis for developing a working definition of leadership, which are:

(i) "*Leadership as influence*

A central element in many definitions of leadership is that there is a process of influence" (p. 5).

(ii) "*Leadership and value*

Leaders are expected to ground their actions in clear personal and professional values" (p. 6).

(iii) "*Leadership and vision*

Vision has been regarded as an essential component of effective leadership" (p. 7).

Based on these definitions, researcher drives towards the essence that leadership concept is dealing with the exercise of influence on others through social interaction (Bass & Bass, 2008; Bush, 2011; Northouse, 2013; Owens & Valesky, 2007; Robbin & Judge, 2013; Yukl, 2013). In another word, a leader may be considered as individual "*who exercise positive influence acts upon others*" or "*who exercise more important influence acts than any other members of the group or organization*" (Bass & Bass, 2008, p. 18).

"*The attractions of leadership as a subject of research and the many different conceptions of leadership have created a vast and bewildering literature*" (Yukl, 2013, p. 10), Attempts to organize the literature according to major perspectives or approaches show an only partial success. One of the useful classifications of leadership research and theory was based on the types of variable that are emphasized the most in the study. Figure 2.3 depicts the causal relationship among the primary types of leadership variables in literature. Yukl (2013) asserted that the leader characteristics [illegible] phasi[illegible] often [illegible] nal [illegible] earch [illegible] the effective leadership over the past half-century. However, there is a paradigm shift in the recent research focus wh[illegible] ased on successful leaders' personal attributes to the focus on interactions/ relationships between the leader's skills, traits, and behaviors with followers attitudes and behavior in the situation where both the leaders and followers exists (J. Ho, 2006).

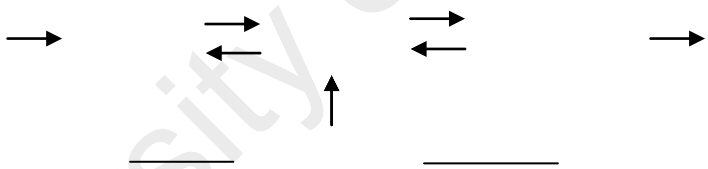


Figure 2.3: Causal relationship among the primary types of leadership variables (Yukl, 2013, p. 11)

There appears to be simultaneous that leadership involves exerting some form of influence on others in an attempt to impact their values, actions, and beliefs, so as to achieve the desired organizational outcomes (J. Ho, 2006). Based on this causal relationship, the researcher would expect that principal technology leadership practices should have an influence on teachers' attitude and behavior. Furthermore, this will enhance teacher acceptance and use of SMS as performance outcomes.

Besides, another classification of leadership theories is in terms of the "level of the conceptualization" or type of constructs used to describe leaders and their influence on followers (Yukl, 2013). "*Leadership can be described as (1) an intra-individual process, (2) a dyadic process, (3) a group process, or (4) an organizational process*" (p. 14). The levels can be viewed as a hierarchy, as depicted in Figure 2.4. What level is emphasized will depend on the primary research question, the type of criterion variables used to evaluate leadership effectiveness, and the type of mediating processes used to explain leadership influence. Typical research questions for each level are listed in Table 2.1.

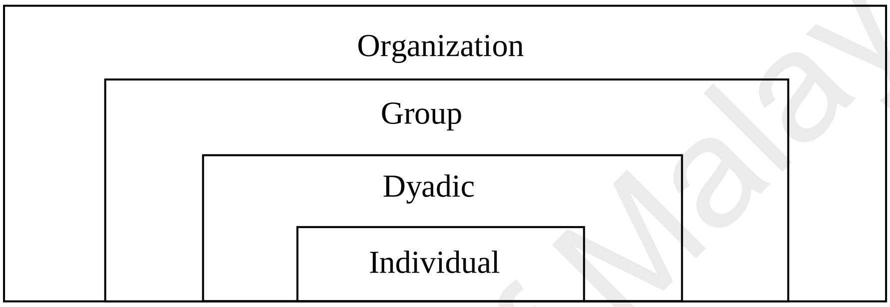


Figure 2.4: Levels of conceptualization for leadership processes (Yukl, 2013, p. 14)

Table 2.1: Research Questions at Different Levels of Conceptualization (Yukl, 2013, p. 15)

Intra-Individual Theories • How leaders manage their own time • How leaders make decisions • How leaders' skills and behaviors are related • How leaders can use self-development techniques • How leaders respond to feedback and learn from experiences • How leaders' value and trait influencing their leadership behaviors • How leaders are influenced by role constraints and expectations
Dyadic Theories • How leaders facilitate their subordinate's work • How leaders influence their subordinate • How leaders influence the loyalty and trust of their subordinate • How leaders interpret subordinate's information • *How leaders develop a subordinate's skills and confidence* • How leaders use influence tactics with their subordinate or peer • *How leader influences subordinate motivation and task commitment* • How leaders develop cooperative exchange relationship with their subordinate
Group-Level Theories • How shared leadership is practiced in the team or group • How leader coordinates and organizes the activities of group members • How leader influences collective efficacy and optimism for the group • How leader influences innovation and collective learning in the group • How different leader-member relations affect each other and team performance

• How leader influences member’s collective identification within the team or unit • How leader influences cooperation and resolve conflict in the team or unit • How unit leaders obtain support and resources from the other organization units
Organizational-Level Theories • How to select leaders at each level • How organizational culture is influenced by leaders • How top executives influence members at other levels • How to resolved leaders’ conflicts in an organization • How leaders influence change and innovation in an organization • How leaders influence the cost and the efficiency of internal operations • How leaders influence human capital and human relations in the organization • How leaders make decisions about external initiatives and competitive strategy

According to Yukl (2013), “*the dyadic approach focuses on the relationship between a leader and another individual who is usually a subordinate or another type of follower*” (p. 14). “*The explanation of leader influence is usually in terms of how the leader causes the subordinate to be more motivated and more capable of accomplishing task assignments. These theories usually focus on leadership behaviors as the source of influence, and on changes in the attitudes, motivation, and behavior of an individual subordinate as the influence process*” (p. 15). “*Most theories of transformational and charismatics leadership were initially conceptualized primarily at the dyadic level*” (Yukl, 2013, p. 16). Hence, researcher assumes that the suitable approach used in this study is a dyadic approach because the main purpose of this study is to investigate whether principal technology leadership practices influence teacher acceptance and use (How a leader influences subordinate motivation and task commitment?) of SMS and teacher ICT competency (How a leader develops a subordinate’s skills and confidence?) in Negeri Sembilan secondary schools.

In term of transformational leadership, Burns (1978) stated that transforming leader must be able to recognize and exploit a potential follower’s demands and needs. Beyond that, the transforming leader also looks for potential motives in follower which seek to satisfy follower's higher needs satisfaction to engage the full cooperation from their follower. The result of the transforming leadership relationship is the mutual elevation and stimulation that converts followers into leaders and also might convert leaders into moral agents. Thus, Burns (1978) define leadership as leaders inducing followers to act for certain goals that represent the values and the motivations - the wants and needs, the aspirations and expectations - of both leaders and followers. Besides, Burns (1978) stated that the transforming approach is able to create significant change in people's life and organizations. It redesigns values and perceptions, and changes aspirations and expectations of followers because leader's traits, personality, and ability to make a change through modelling, articulation of a challenging goal, and energizing vision will have a significant influence on their followers.

Bass (1985) extended Burn's (1978) work using psychological mechanisms to explain on transformational leadership and how transformational leadership could be measured, as well as how it impacts people's performance and motivation. He found that the extent to which a leader is transforming could be measured in terms of his/ her influence on their followers. The followers of such a leader will feel loyalty, trust, respect, and admiration to their leader and thus willing to work harder than originally expected performance (Bass, 1985). These outcomes exist because of the transformational leader able to offer followers something extraordinary which is more than just working for self-gain, they provide followers with an inspiring mission and vision and give them an identity. The followers are transformed and motivated by the leader through their idealized influence, intellectual stimulation, individual consideration and inspirational motivation. In addition, the transformational leaders always encourage their followers to initiate unique and new ways to challenge the status quo they are facing and simultaneously alter the successful environment to support goal attainment.

Besides, Bass and Bass (2008) also proclaimed that the effort for an individual to change the behavior of others is attempted as leadership and the creation of the actual behavior change in others is acknowledged as successful leadership. Hence, they defined effective leadership as successful influence exercise by the leader that results in goal attainment by the influenced followers. Based on Bass's Reinforces change theory, leadership is the observed effort of one member which called as the leader to change the understanding and motivation of other members (followers) or to change their behavior. If a member (leader) is successful, a change is observed in other members (followers) accepting leadership. In other words, transformational leaders are leaders who inspire followers to transcend their own self-interests and who are capable of having a profound and extraordinary effect on their followers. At the same time, the transformational leader will attempt to instill followers' ability and skill established by the leader to achieve higher performance (Bass & Bass, 2008). The authors further identified the general effects of leadership can be expected as a contingent reinforcement which has been the fundamental concept of leadership process consequence. They reviewed the effects on (i) decision acceptance, successful influence, and increased cohesiveness; (ii) subordinate satisfaction; (iii) subordinates involvement and commitment; and (iv) decision quality and productivity (Bass & Bass, 2008).

Yukl (2013) noted that one of the useful basis for evaluating the success of an influence attempt is to examine the outcome. The agent may achieve the intended effects on the target, or the outcome may be less than what was intended. For an

influence attempt that involves a single targeted person, it is more meaningful to differentiate among three distinct outcomes called commitment, compliance, and resistance.

Figure 2.5: Effect of leader influence behavior on influence outcomes (Yukl, 2013, p. 215)

(a) Commitment

The commitment outcome occurs when the targeted person makes a great effort to implement the decision or carry out the request effectively. This outcome is usually the most successful one for a complex, difficult task that requires enthusiasm, initiative, and persistence by the targeted person in overcoming obstacles.

(b) Compliance

The compliance outcome happens when the targeted person is willing to carry out a request but is apathetic rather than enthusiastic about it and will make it with the minimal effort only. With compliance, the targeted person is not convinced that the action or decision is the best thing to do but even that it will be effective for accomplishing its purpose. However, for a simple, routine request, compliance may be all that is necessary to accomplish the leader's task objectives.

(c) Resistance

The resistance outcome occurs when the targeted person is opposed to the request or proposal, rather than merely indifferent about it. Resistance can take several different forms; refuse to carry out the request, explain why it is impossible to carry out the request, try to persuade for changing or withdrawing of the request, ask higher authorities to overrule the request, delay their action and hope the request agent will forget about it, and pretense to comply with it but try to sabotage the task.

Transformational leadership is a leadership approach that causes the change in individuals and social systems. The end goal of an ideal form of transformational leadership is to create positive and valuable change in the followers and transform followers into leaders. Enacted in its authentic form, transformational leadership enhances the morale, performance, and motivation of followers through a variety of mechanisms. These include connecting the follower's sense of self-identity to the mission and the collective identity of the organization, challenging followers to take greater ownership of their work, being a role model for followers that inspires them, and understanding the strengths and weaknesses of followers, so the leader can align followers with tasks that optimize their performance. (Bass, Avolio, Jung, & Berson, 2003; Bass & Bass, 2008).

In educational research, transformational leadership appears as the most frequent research writing topic since the late 1980s (Leithwood & Jantzi, 2005). Leithwood (1994) has provided the most fully develop conceptualization model of transformational leadership specifically for school context. Leithwood’s model (1994) conceptualized transformational leadership along eight dimensions, which are (i) building school vision, (ii) establishing school goals, (iii) providing intellectual stimulation, (iv) offering individualized support, (v) modelling best practices and important organizational values, (vi) demonstrating high performance expectations, (vii) creating a productive school culture, and (viii) developing structures to foster participation in school decisions. The eight dimensions of Leithwood’s model establish a framework of the transformational leadership continuum that can be associated with specific transformational leadership practices and problem-solving processes in a school setting (Leithwood, 1994). Therefore, there are dimensions associated with other conceptualizations of transformational leadership that are either absent (charisma) or are given quite different significance (transactional practices) when compared to Leithwood's model (Leithwood & Jantzi, 2006). Furthermore, being designed specifically for schools from his own qualitative and quantitative research, Leithwood's model includes dimensions of practices which are not found in prior models of transformational leadership (Leithwood & Jantzi, 2005, 2006). "*For example, in recognition of what it is about schools that are unique, this model:*

(i) depends not at all on charismatic practices or leader characteristics

(ii) assumes a wide distribution of its practices and functions across roles within and outside the school

(iii) focuses as much or more on building the capacity of staffs as on motivating them

(iv) takes the creation of opportunities for collaborative work among staff as the major challenge to be addressed

(v) acknowledges the interdependent relationship among leadership and managerial activities

(vi) works toward the creation of roles in schools for parents and members of the community as partners and co-producer of student learning." (Leithwood & Jantzi, 2005, p. 38).

The central focus of transformational leadership should emphasize on the contribution of organizational members' capacities and commitment development. Higher levels of personal commitment to the organizational goals and increased capacities and commitment to accomplishing those goals are assumed to result in the extra effort and greater productivity (Leithwood & Jantzi, 1999, 2005, 2006). Besides, Leithwood (1994) suggested that there are some empirical research findings support for the essentially normative transformational leadership model. He reports on seven quantitative studies and concluded that transformational leadership practices, considered as a composite construct which had direct and indirect effects on progress with school-restructuring initiatives and teacher perceived outcomes. It is because of these distinctions and significance for school research that Leithwood's model of transformational leadership was chosen as the theoretical framework of principal technology leadership practices for this study.

Recently, the promotion of change and development in individual, groups or organizations has been given increasing attention. Hence, the need to deal with resistance and to promote change has, in turn, led to an emphasis on relation-oriented leadership. This paradigm shift has tremendously increased the extent to which researchers able to account for the impact of leadership on followers' performance and effort. Leadership studies have been frequently focused toward such change processes to maintain the quality or quantity of performance, to reduce resistance to particular changes, to shift attention from one's action to another, to substitute one's goal with another, or to implement decisions within a contextual framework. All these require an accelerated increase rate on people's performance effort in term of higher order change. Such higher order changes involving significant changes in people's values, beliefs, attitudes, and needs are the changes that many organizations around the world are searching for in the midst of major transformations (Avolio & Bass, 2004).

Furthermore, J. P. Kotter (2012) noted that the primary leadership function is to produce development and change. Hence, leadership is about seeking for constructive and adaptive change, in another words leadership is about coping with change. Thus, leaders need to establish direction for the future by developing a shared vision, and then they must widely communicate this vision to align people and inspire others to overcome hurdles.

However, change does not happen overnight when people's attitudes, beliefs, values, and the expectations of their work roles need to change. Thus, the role of competence becomes important within an organization. The concept of the importance of skills of staff, of shared goals, of trust, loyalty, and involvement, all suggest that a focus on people performance, and on the link of that people performance to the shared goals, is an essential component of the organizations' future success. So, competence reflects as the expectations of workplace performance to improve performance at all levels and competencies are defined as knowledge, skills, and abilities which are the only components of individual performance that can be developed and assessed (Fletcher, 1997; Goktas, Yildirim, & Yildirim, 2009).

In term of competence, the path-goal theory of leadership (House, 1971, 1996) explained that leaders enhance the psychological states of followers by raising followers motivation to perform and achieve higher satisfaction from the job to be done. The stated objective of this leadership theory is to enhance employee satisfaction and performance by focusing on employee motivation. "*Path-goal theory emphasizes the relationship between the leader's style and the characteristics of the subordinates and their work setting*" (Northouse, 2013, p. 137). The leaders would clarify their followers' goal as well as the paths to achieve those goals. Leaders can carry out this practice in two methods. First, leaders can engage in followers' behaviors that help them to facilitate goal attainment (e.g., by providing information and other resources necessary to obtain the desired goals). Second, leaders can engage in followers' behaviors that able to remove obstacles that might hinder followers' to pursuit of their goals (e.g., by removing workplace factors that reduce the chances of goal attainment). By doing this, they enhance followers' higher needs satisfaction with the work itself and valued extrinsic rewards contingent on the followers' performance. Hence, a path-goal theory is an explanation of the leader behavior influence on followers' motivation, satisfaction, and performance. House (1971, 1996) postulated that initially, leaders intentionally increase followers task skill, and then leaders centralized decision and consideration increase followers motivation. In turn, followers' skill and motivation will improve their performance effectiveness. In other words, leaders play a vital role in enabling others to develop the necessary capabilities in a climate of developments and change. So, leaders need to develop high levels of expertise and competence in order to influence and empower others to enhance the quality of provision (Jones & Pound, 2008).

The principal technology leadership practices that researcher discussed in this study does not fit precisely into any one of the formal leadership theories presented above. One of the purposes of presenting those leadership theories is to demonstrate that technology leadership is not so much a theory on its own but rather it is a product of the progression of leadership theory (Creighton, 2011).

This section analyzes a selected number of leadership theories, giving special attention to how each theoretical approach could be applied in real-world organizations like schools. In essence, the purpose is to explore how an understanding of leadership theory can direct and inform the way leadership is practiced (Northouse, 2013). According to Chin (2010), when compared with the traditional types of leadership theory, technology leadership differ because it does not focus on the actions or characteristics of the leaders but instead emphasizes that leaders should manage, guide, apply, and develop technology to improve operational organization's performance. Thus, technology leadership can be considered as a type of functionally oriented leadership practice.

According to Fullan (2011), practices have been used as the fertile learning ground for most effective leaders. "*They never go from theory to practice or research evidence to the application. They do it the other way around; they try to figure out what's working, what could be working better, and then look into how research and theory might help*" (p. xii). "*Practice-driven leadership is more accessible than theory-driven leadership. It takes leader into reality, where impressive empathy is more important than strategic plans, and where a deliberate practice is the true hallmark of leadership because the deliberate practice is purposeful, action-oriented and reflective*" (p. xiv).

Creighton (2011) asserted that leaders must play a more proactive role in educational technology implementation by interfacing the information technology with the human components. The problem of overemphasis of the technological aspect at the exclusion of human resource function needs to be scrutinized. The essence of technology leadership is a social influence process mediated by technology to produce the change in feelings, behavior, thinking, attitudes, and performance with individuals. Hence, in order to carry out the technology leadership improvement, principals must be willing to change existing professional activity or leadership practice in most schools, and they must also be opened to participate in transforming traditional leadership knowledge, skill, and habit.

It is important to realize that there are many different views of leadership and many successful ways to lead. Based on that, the theory that researcher applied to explain this study was an integrated theory of transformational leadership and path-goal theory.

The transformational theory was used to study the effects of leader behavior on followers' satisfaction, performance, commitment, and motivation. This theory indicates that transformational leaders engage the aspirations of followers, energize their emotional and mental resources, tap their inner motivations, and involve them enthusiastically in the work to be done. This type of leadership does not merely obtain followers' compliance; it evokes their personal commitment as they embrace the goals to be achieved as their very own, seeing it as an opportunity and willing to invest their effort in it. It transforms the roles of both leaders and followers so that they become virtually interdependent, their values, aspirations, and motives merged in a mutual commitment to achieve the shared goal. The transformational model is comprehensive in that it provides a normative approach to school leadership which focuses primarily on the process by which leaders seek to influence school outcomes, rather than in the nature or direction of those outcomes (Leithwood & Jantzi, 2006).

Furthermore, Leithwood & Jantzi's model (2006) describes three broad clusters of leadership practices, which are (i) *setting direction* which includes building a shared school vision, developing consensus about goal and priorities, and creating high performance expectations, (ii) *developing people* which includes providing individualized support, offering intellectual stimulation, and modelling desirable values and professional practices, and (iii) *redesigning the organization* includes developing a collaborative school culture, creating structures to foster participation in school decision-making processes, and building productive community relationships (Leithwood & Jantzi, 2006; H. Yu, Leithwood, & Jantzi, 2002).

The researcher found that these three broad clusters of transformational leadership practices are very similar to the five dimensions of principal technology leadership practices (i.e. visionary leadership, digital age learning culture, excellence in professional practice, systemic improvement, and digital citizenship) used in this study. Hence, as applied to this study, this theory holds that researcher would expect the principal technology leadership practices to influence teacher acceptance and use of SMS because very often, the teachers are found to be relating their performance to the principals leadership practices of their schools. When teachers perceive a good leadership from their principals, they seem to be actively involved in all the programs that are developed or implemented by the principal (Sathiamoorthy et al., 2012).

This was further supported by DasGupta (2011) who defined "*e-leadership as a social influence process mediated by advanced information technology to produce a change in attitudes, feelings, thinking, behavior, and/or performance with individuals, groups, and/or organizations*" (p. 2). Therefore, the transformational leader has been noted as one of the most important elements in affecting the educational technology integration and has input into all the essential conditions that promote the integration of educational technology (Afshari, Kamariah, Wong, Bahaman, & Foo, 2008). Besides, Benwari and Dambo (2014) also noted that a school management information system needs to be driven by a transformational (visionary) leader who is able to lead school management to achieve greater efficiency and effectiveness.

Moreover, "*transformational school leadership practices have both direct and indirect effects on teachers' practices, the indirect effects being realized through leaders' influence on teachers' motivation, capacity, and work settings*" (Leithwood & Jantzi, 2006, p. 204). This was further supported by the path-goal leadership theory (House, 1971, 1996; Northouse, 2013) which focuses on how leaders motivate followers to accomplish designated goals. The main focus of this leadership theory is to enhance followers' performance and to arouse followers' higher satisfaction through motivation.

"*The underlying assumption of the path-goal theory is derived from expectancy theory, which suggests that followers will be motivated if they think they are capable or felt competent of performing their work*" (Northouse, 2013, p. 137). Hence, a leader needs to provide support in term of the necessary skills and competence to their subordinates for work-goal attainment. Moreover, previous research has indicated that the failure of most educational innovations usually caused by teachers are not provided with the necessary skills and knowledge needed to carry out the task (Buabeng-Andoh, 2012b; Pelgrum, 2001). As apply to this study, the researcher would expect that when principal technology leadership practices able to enhance teacher ICT competency, indirectly this will influence teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

Based on the assumptions made, researcher frames the theoretical framework for this study to investigate whether principal technology leadership practices have a direct influence on teacher acceptance and use of SMS or have an indirect influence which is mediating by teacher ICT competency. Figure 2.5 shows the theoretical framework of the variables used in this study.

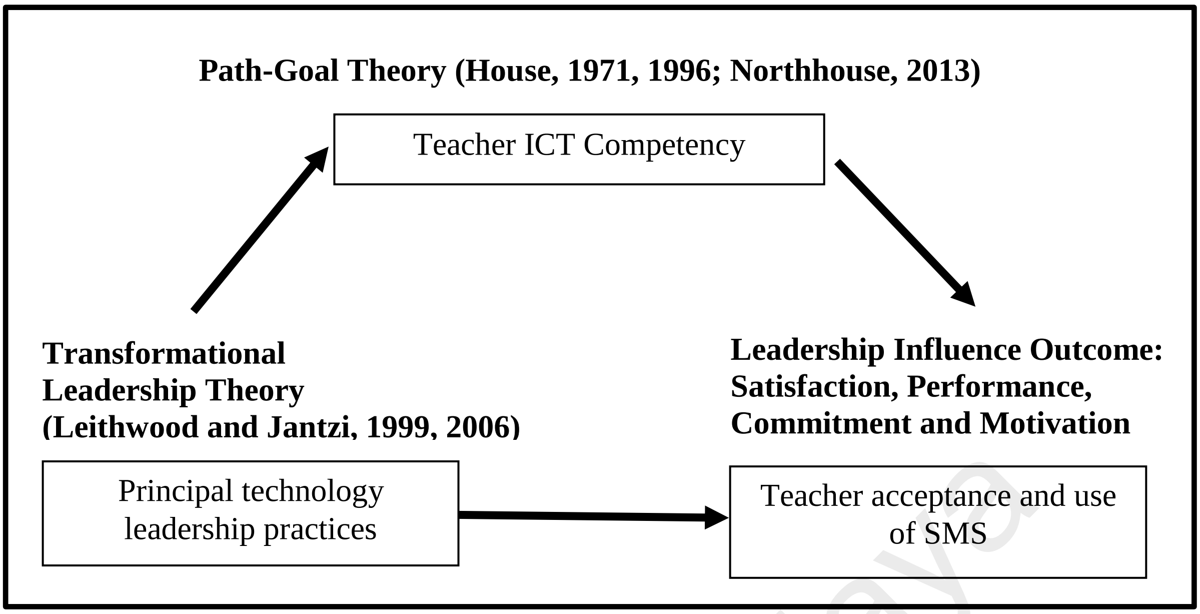


Figure 2.6: Theoretical framework of the variables used

The theoretical framework elaborates the relationships among the variables, explains the theory underlying these relations, and describes the nature and direction of the relationships (Sekaran, 2003). Based on this theoretical framework, in the next section, the researcher would like to present various theories and models related to teacher acceptance and use of technology which reflects as the leadership influence outcome in this study.

2.2.3 Theories and Models related to Technology Acceptance and Use

The stream of research to examine individuals acceptance and use of technology has evolved into one of the most matured and richest research streams in the Information Systems field (Jeyaraj, Rottman, & Lacity, 2006; Priyanka & Ashok, 2013; Silva & Dias, 2007; Straub, 2009; Sun & Zhang, 2006; Venkatesh, Davis, & Morris, 2007; Venkatesh et al., 2003). Straub (2009) emphasized that individuals' technology acceptance and use is a complex and inherently social developmental process where individuals will construct a unique but malleable perception about the technology and this perception will influence their acceptance and use behaviors. The author further defined adoption theory as a theory aimed to examine individual's choices of accepting or rejecting a particular innovation. Historically, behavior change is understood and considered as an adoption process. Hermans, Tondeur, van Braak, and Valcke's (2008) empirical study of 525 primary school teachers to measure their technology usage in supporting the teaching and learning process found that teachers' beliefs are significant predictors in fostering teachers' technology adoption. Moreover, Straub (2009) stated that the decision for adopting an innovation can be a one-time event because individual's beliefs and attitudes are formed over time and this could influence their decision on the innovation of adoption behavior. Based on this justification, this current study which measures on teacher acceptance and use of SMS in Negeri Sembilan secondary schools could be conducted as a cross-sectional study.

There are a number of good theories and models can be employed to study regarding the individuals' technology adoption behaviors. The strength of most influential theories is that they all focus on the benefits of the use from the perspective of an individual. Hence, individuals play an essential and active role in illustrating successful technology implementation in organizational settings (Korpelainen, 2011). Therefore, it is important to understand such process from the aspect why does one individual choose to accept a technology while another resist (Straub, 2009).

This trend of research usually applies the social psychology theories and its respective models which focused on people's intention to engage in certain behavior (i.e., acceptance and use of information system) as a major theoretical foundation (Y. Kim & Crowston, 2011). From the review of the theoretical history of current studies on information systems, the most influential models of information systems acceptance and use are Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology Model (UTAUT). These two models are originally from the computer science research field which is specifically designed to answer research questions about technology adoption (Straub, 2009).

These two models also have been applied in many educational settings (Wahdain & Ahmad, 2014) to explain acceptance and use of educational technology including examining technology adoption by pre-service teacher (Fusilier & Durlabhji, 2005; Hu et al., 2003; Ma, Anderson, & Streith, 2005), acceptance of computer or laptop-based assessment (Baker-Eveleth, Eveleth, O'Neill, & Stone, 2007; Terzis, Moridis, Economides, & Mendez, 2013), adoption of online learning or e-learning (Alshibly, 2014; Bhuasiri, Xaymoungkhoun, Zo, Rho, & Ciganek, 2012; Chiu & Wang, 2008; M.-C. Lee, 2010; Y.-H. Lee, Hsieh, & Hsu, 2011; Liao, Palvia, & Chen, 2009; Park, 2009; Saade & Bahli, 2005; Wu, Tsai, Chen, & Wu, 2006; Zhang, Zhao, & Tan, 2008), adoption of mobile learning (Yang, 2013), using course management system or learning management system (Marchewka & Kostiwa, 2007; Raman & Yahya Don, 2013), acceptance and use of interactive whiteboard (K.-T. Wong, Teo, & Goh, 2014), adoption of cloud computing (Dhulla & Mathur, 2014), continued usage of teaching blogs (C.-P. Chen, Lai, & Ho, 2015), and the use of Facebook as a collaborative and communicative tool (Raman & Lateh, 2015; Raman, Ruuhina, & Paramjit Kaur, 2014). The wide applicability of these models is due to its predictive power about information systems acceptance and use by providing quantifiable variables (Straub, 2009). Based on this justification, teacher acceptance and use of SMS in this study could be conducted using a quantitative research approach.

According to S.-H. Lau and Woods (2008), studies about user's perceptions and attitudes towards learning object as the factors in promoting effective use of various information systems have become increasingly essential to improve our understanding and prediction of users' acceptance and use of information systems. Since individual acceptance and use intentions are conceptualized as the major outcome variable that is influenced by various independent variables (Y. Kim & Crowston, 2011). Hence, in order to study what are the variables used to measure teacher acceptance and use of SMS in this study, the researcher found that it is imperative to present the revolution of the technology acceptance and use theories and models by analyzing the available literature.

Next few paragraphs are the reviews of the most influential adoption theories and models that are related to this study. Four theories which are Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Social Cognitive Theory (SCT) and Diffusion of Innovation Theory (DOI) are presented as the theoretical framework for the building of the four technology acceptance models which include Technology Acceptance Model (TAM), Extended Technology Acceptance Model (TAM2), Unified Theory of Acceptance and Use of Technology (UTAUT), and The Extended Unified Theory of Acceptance and Use of Technology (UTAUT 2) model.

2.2.3.1 Theory of Reasoned Actions (TRA)

Theory of Reasoned Actions (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) is originated from social psychology field which was developed to examine the relationship between the beliefs, subjective norm, attitudes, intentions, and behaviors of individuals. "*TRA was based on the concept that beliefs influence attitudes which lead to intention and ultimately behavior*" (Priyanka & Ashok, 2013, p. 145).

This theory assumed that individual's behavior is determined by his/ her behavioral intention to perform a behavior, and this behavioral intention is determined by the person's attitudes and his/ her perceptions of the subjective norms towards the behavior. The attitude is defined as an individual's positive or negative feelings about performing the targeted behavior and the subjective norm refers to "*the person's perception that most people who are important to him think he should or should not perform the behavior in question*" (Fishbein & Ajzen, 1975, p. 302).

This theory has been used as the fundamental theoretical framework of ICT adoption research. Besides, it also has been combined with other theories and models. Both subjective norm and attitude are found to be the significant determinants of peoples' intentions to ICT adoption and use (Y. Kim & Crowston, 2011; Venkatesh & Davis, 2000).

2.2.3.2 Theory of Planned Behavior (TPB)

Theory of Planned Behavior (TPB) is a well-established social psychology theoretical model presented by Ajzen (1991), which focuses on cognitive self-regulation as an important aspect of human behavior. The Theory of Planned Behavior (TPB) provides a theoretical foundation for the link between intentions and behavior (Ajzen, 1991). The TPB is a theoretical extension of the Theory of Reasoned Action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). It is very similar to the TRA model, but the difference is that it takes into account an additional construct, namely perceived behavioral control. Perceived behavioral control refers to people's perceptions of control over the performance of the desired behavior. The behavior is the product of a succession of cognitive and affective events, preceded many times by the conscious intention of acting. In TRA rational considerations determine the choices and behaviors of individuals, and individual intentions determine behavior. Intentions refer to individuals' plans and motivations to commit a specific action. Intentions also reflect individual attitudes and the extent to which individuals perceive a specific action as desirable or favorable.

This theory suggests that human behavior is governed by personal attitudes, but also by social pressures and a sense of control. Similar to studies using TRA, many studies have indicated the significant relationships between subjective norm, attitude, perceived behavioral control and behavioral intention (Y. Kim & Crowston, 2011). This is a popular theory as a way to understand the relationship between intention as a mediator between action and attitudes. This theory postulates that an individual's behavior is a result of their attitudes about the expectation of a behavior and social norms about a particular behavior. Attitudes are constructed based on an individual's perceptions about an innovation.

The TPB links a set of beliefs with a person's intention, and intention to actual behavior. The TPB also provides theoretical justification for linking beliefs and intentions in the current model. Besides, people's behavior is strongly influenced by their confidence in their ability to perform the given task (Ajzen, 1991). Hence in this study, it is suggested that teachers' beliefs about ICT competence are linked to teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

Furthermore, habit is also studied as a major construct that influences the continued or discontinued use of an information system (Y. Kim & Crowston, 2011). In term of habit, Ajzen (2002) found that the frequently performed behaviors should include past behavior as a predictor of both intention and future behavior. According to Ajzen

(2002), "*the observed correlation between frequency of prior and later behavior is no more or less than an indication that the behavior in question is stable over time...Thus, behavior stability may be attributable not to habituation but to the influence of cognitive and motivational factors that remain unchanged and are present every time the behavior is observed*" (Ajzen, 2002, p. 110). The author further noted that the crucial factors of interest on TPB are intentions and perception of behavioral control. So he found that as long as these factors remain unchanged, the behavior should also remain unchanged. However, habituation requires repeated enactment of a behavior and he noticed that when habituation is added to the TPB, there is a significant improvement in the predictive power of intentions and perception of behavioral control on actual behavior (Ajzen, 2002).

In the context of information system acceptance and use, habit can be defined as "*the extent to which people tend to perform this behavior (use of information system) automatically because of the learning process*" (Limayem et al., 2007, p. 705). During the initial acceptance and use of information system, individuals are most likely involved in an active cognitive process in determining their own intentions to the information system acceptance and use. However, with any repetitive behavior occurring after the acceptance and use of the information system, the reflective cognitive process occurs over time and this leading to the non-reflective routinized behavior (Y. Kim & Crowston, 2011). In other words, "*frequently performed behaviors tend to become habitual and thus automatic over time*" (Limayem et al., 2007, p. 705).

2.2.3.3 Social Cognitive Theory (SCT)

Bandura's (1986) Social Cognitive Theory is one of the most influential theories in psychosocial and education field especially applicable to understand individual's innovation of adoption in terms of their belief and attitude development. SCT highlights the idea that majority of the human learning process occurs in a social environment (Bandura, 1977). In terms of information system adoption, social learning through modeling where individuals observed others adopting a particular innovation may be more inclined to consider adoption themselves. Someone's experience that is either successful or unsuccessful in information usage may influence others. By observing others, people acquire knowledge of skills, beliefs, attitudes, rules, and strategies (Bandura, 1986). Besides, individuals also learn about the appropriateness and usefulness of behaviors by observing certain agents who act as models. The consequences of modeling others behaviors, individuals tend to act in accordance with their beliefs concerning the expected performance outcomes. SCT suggests that behavior is affected by both self-efficacy and outcome expectations while self-efficacy and outcome expectations are in turn influenced by prior behavior. Self-efficacy refers to the "*beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments*" (Bandura, 1997, p. 3).

To predict human behavior, people belief that their actions contributed to the success on a specific task, and a self-assessment of their capabilities to accomplish the task also should be considered (Bandura, 1997). McFarland and Hamilton (2006) stated that although these beliefs are separate, but they are not independent of one another. ''*Beliefs that outcomes are determined by one's own behavior can be either demoralizing or empowering, depending on whether or not one believes one can produce the required behavior*'' (Bandura, 1997, p. 20). By combining these beliefs, people develop self-images of future success or failure states. These self-conceptualizations of the future serve to guide and motivate behavior (McFarland & Hamilton, 2006). Hence, in terms of information system acceptance and use, individuals' judgments about their capability for completing the given tasks have been linked to their attitudes towards its usage which is in turn linked to their future information system acceptance and use.

2.2.3.4 Diffusion of Innovations Theory (DOI)

Roger's Diffusion of Innovations Theory (Rogers, 2003) is a general theory employed to study individuals' innovations adoption. DOI provides a framework for understanding the technology impact on school systems and the schooling processes. According to this theory, people's innovations adoption behavior is determined by their perception regarding on five technological characteristics or attributes which are relative advantage, compatibility, complexity, observability, and trialability on such innovation, as well as social norms (Rogers, 2003). "*Relative advantage is the degree to which an innovation is perceived as being better than the idea it supersedes*" (Rogers, 2003, p. 229). "*Compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters*" (Rogers, 2003, p. 240). "*Complexity is the degree to which an innovation is perceived as relatively difficult to understand and use*" (Rogers, 2003, p. 257). "*Observability is the degree to which the results of an innovation are visible to others*" (Rogers, 2003, p. 258). "*Trialability is the degree to which an innovation may be experimented with on a limited basis*" (Rogers, 2003, p. 258). Thus, a technology innovation will be increasingly diffused if the potential adopters perceived that the innovation has an advantage over previous innovations; is compatible with existing practices; is not complex to understand and use; shows observable results; and can be tested on a limited basis before adoption process (Albirini, 2006).

The researcher found that one of the factors that influence and determine the adoption of an innovation is the attribute or characteristics of the innovation itself (Rogers, 2003). For example, the School Management System (SMS) is considered as an innovation since it is something new in this country. Hence, the extent of teacher acceptance and use of this SMS in school management greatly depends on the five attributes stated in DOI. Relative advantage refers to how far this new SMS holds the upper hand against the usual management practice. If the teachers view SMS usage as more profitable in term of time, effort and management gains, there would be a great possibility that teachers would readily to accept and use SMS in school management. Compatibility refers to how the new SMS is similar to the values, knowledge, and skill already existing in the teachers. If the use of SMS does not really require teachers to learn new skills and knowledge, it is very likely that the technology will be accepted more easily. Moreover, if the teachers can see that using SMS is not that complicated and that it can be tried with the immediate results, teachers would be more likely to use the SMS for management purpose.

Table 2.2: Summary of Technology Adoption Theories

Year	Researcher	Theory	Variables for Adoption Behavior/ Characteristics of Change

1975 & 1980	Fishbein & Ajzen	Theory of Reasoned Action (TRA)	(i) Beliefs (ii) Attitude (iii) Subjective norm
1991	Ajzen	Theory of Planned Behavior (TPB)	(i) Beliefs (ii) Attitude (iii) Subjective norm (iv) Perceived Behavioral control (v) Habit (2002)
1986 & 1997	Bandura	Social Cognitive Theory (SCT)	(i) Outcome Expectation (ii) Self-Efficacy
2003	Roger	Diffusion Of Innovation Theory (DOI)	(i) Relative Advantage (ii) Complexity (iii) Compatibility (iv) Observability (v) Trialability

Based on these four technology adoption theories as for the fundamental theoretical framework, four technology acceptance and use models have been proposed by scholars in order to study what are the determinants that influence individual acceptance and use of technology or any kind of innovations. The four technology acceptance models are Technology Acceptance Model (TAM), Enhanced Technology Acceptance Model (TAM2), Unified Theory of Acceptance and Use of Technology (UTAUT), and The Extended Unified Theory of Acceptance and Use of Technology (UTAUT 2) model.

2.2.3.5 Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) is the "*first research model used to study how an individual's perceptions of a technology innovation affect the eventual use of that technology*" (Straub, 2009, p. 638). F. D. Davis (1989) presented TAM to explain the determinants of users acceptance and use behavior of a wide range of end-user information technologies, that is, what causes the potential users to accept or reject the information system usage. Theoretically, TAM is derived from the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975).

F. D. Davis (1989) has identified two theoretical constructs that he believed are able to predict the information system's usage outcome, these constructs are perceived usefulness and perceived ease of use. These two constructs are considered as the fundamental determinants to predict users' attitudes toward the information system usage, that is, predict about user's willingness to accept and use of an information system. Perceived usefulness refers to "*the degree to which a person believes that using a particular system would enhance his or her job performance*" (F. D. Davis, 1989, p. 320), and perceived ease of use refers to "*the degree to which a person believes that using a particular system would be free of effort*" (F. D. Davis, 1989, p. 320).

Two central hypotheses in TAM stated that perceived usefulness and perceived ease of use positively influence an individual's attitude towards using a new information system, which in turn influences the person's behavioral intention (F. D. Davis, Bagozzi, & Warshaw, 1989) to use it. Finally, the intention is positively related to actual use.

Davis's work was important because it began the conversation about the importance of individual perceptions of a technology acceptance and use (Straub, 2009). "*The key purpose of TAM was to provide a basis for discovering the impact of external variables on internal beliefs, attitudes, and intentions*" (Marchewka & Kostiwa, 2007, p. 94). Even though TAM has been empirically proven to be a valid theoretical framework to study individual acceptance and use by many scholars, the model explains only a fraction of the observed information system usage and it does not fully consider and appreciate the impacts of contextual variables (McFarland & Hamilton, 2006). According to Park (2009) TAM able to account for 40% to 50% of the variance on user acceptance. Besides, it has been criticized for its several limitations which include; does not consider the non-organizational setting (Venkatesh & Davis, 2000) and overlook at the moderating effects of individual acceptance and use in different situations (Sun & Zhang, 2006).

2.2.3.6 Enhanced Technology Acceptance Model (TAM2)

In order to overcome the limitations of TAM, Venkatesh and Davis (2000) proposed and tested empirically a theoretical extension of TAM referred to as Enhanced Technology Acceptance Model (TAM2), which explains perceived usefulness and individual usage intentions with the help of social influence processes (subjective norm, image, voluntaries and experience) and cognitive instrumental processes (job relevance, result demonstrability, and output quality) that are lacked in the original TAM (Venkatesh & Davis, 2000). Since the mediating role of attitude has been doubtful from the beginning of the model development, therefore, it was not considered in later assessments of the model (Schepers, Wetzels, & Ko de, 2005). TAM2 also included diverse variables in order to enhance the predictive power of a system acceptance and use, but many times TAM2 only managed to explain a low percentage of a system acceptance and usage (J. Lu, Yao, & Yu, 2005). According to Park (2009), TAM2 model has been tested in both mandatory and voluntary settings. The result indicated that TAM2 was able to explain 60% of variance on user acceptance and use of technology (Venkatesh & Davis, 2000).

2.2.3.7 Unified Theory of Acceptance and Use of Technology (UTAUT)

As TAM2 was developed in order to increase the predictive power of the original TAM, the Unified Theory of Acceptance and Use of Technology Model (UTAUT) was developed to address the limitation in TAM2 (Venkatesh et al., 2003). Venkatesh et al.

(2003) presented a comprehensive review of various theories that researchers used to predict user acceptance and use of technology in the past few decades. These are primarily quantitative theories used to inform organizations about who will adopt an innovation most quickly. However, most of the individual theories are criticized as being fragmented, lacking a cohesive model that accounts for the numerous factors that influence technology use (Venkatesh et al., 2003).

Based on that criticism, Venkatesh et al. (2003) developed Unified Theory of Acceptance and Use of Technology (UTAUT) model through reviewing eight of the most prominent theoretical framework and models which explain individual acceptance and use of technology, namely TRA, TPB, SCT, DOI, the motivational model, TAM, a model combining TAM and TPB and the model of PC utilization. The reviewers found that the eight theoretical frameworks and models of technology acceptance and use individually explained 17% to 53% of the variance in various types of technology acceptance and use. UTAUT provides a refined view of how the determinants of intention and behavior evolve over time.

The purpose of UTAUT is to explain user's intentions to use ICT and the subsequent user behavior. The UTAUT model considers four constructs as direct determinants of user acceptance and use behavior, namely performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003). Jasperson, Carter, and Zmud (2005) suggested that these four constructs are most influential on post-adoptive intentions behavior – given a particular time and context, an individual's intentions to engage in post-adoptive behavior are the best predictors of that individual's actual post adoptive behaviors. Besides, four key moderating variables: gender, age, experience, and voluntariness of use (Venkatesh et al., 2003) are also evaluated in this model. UTAUT was tested using the original data and found to outperform the eight individual models which contributed 69% of variance in user acceptance and use of technology. UTAUT was then confirmed with the similar result with the data collected from two new organizations. Empirical testing of UTAUT shows that performance expectancy, effort expectancy, social influence, and facilitating conditions have a significant relationship with the intention to use technologies (Venkatesh et al., 2003).

In line with this finding, Marchewka and Kostiwa (2007) found that these four constructs in UTAUT model contributed 70% of the variance in usage intention which is better than any of TAM studies alone (Avci Yucel & Gulbahar, 2013). Although UTAUT provides great promise to enhance our understanding of technology acceptance, the initial UTAUT study focused on large organizations. In addition, the scales used in UTAUT model are new as they are the combination of a number of prior scales, and therefore, the suitability of these scales needs to be further tested (Pynoo et al., 2012; Straub, 2009).

Y. Kim and Crowston (2011) have conducted a review on technology acceptance and use theories based on the four theories and three models mention above, they found that there are similarities between the constructs used to explain individual users' technology acceptance and use. Table 2.3 below showed the similarities of the constructs in TRA, TPB, SCT, DOI, TAM, TAM2, and UTAUT.

Table 2.3: Similarities of the Constructs Found in Previous Theories and Models Related to ICT Adoption (Y. Kim & Crowston, 2011, p. 5)

TRA	TPB	SCT	DOI	TAM	TAM2	UTAUT
Beliefs, Attitude	Beliefs, Attitude	Outcome Expectations	Relative Advantage	Perceived Usefulness	Perceived Usefulness	Performance Expectancy
	Perceived Behavioral	Self-Efficacy	Complexity	Perceived Ease of	Perceived Ease of Use	Effort Expectancy

	Control			Use		
Subjective Norm	Subjective Norm				Subjective Norm, Image	Social Influence
			Compatibility, Observability, Trialability		Job Relevance Output quality	Facilitating Conditions

2.2.3.8 The Extended Unified Theory of Acceptance and Use of Technology (UTAUT 2)

Although a lot of studies have been conducted to access user's acceptance and use of technology, however, previous research on information systems acceptance and use mainly focuses on the binary condition of people's initial phase of adoption behavior (pre-adoption behavior), these studies have not captured the dynamics of the post-adoption behavior in information systems acceptance and use (Y. Kim & Crowston, 2011). As the extension of information systems acceptance and use research, scholars have started to stress on the post-adoption and continuance usage behavior to assure a successful information system implementation (Hong, Thong, & Tam, 2006; S. S. Kim & Malhotra, 2005; Y. Kim & Crowston, 2011; Limayem, Cheung, & Chan, 2003). These studies mainly approached the post-adoption behavior as a cognitive process where people consciously examine their information systems during the usage stage.

According to Bhattacherjee (2001), information system continuance behavior refers to a usage stage when information systems usage transcends conscious behavior and becomes part of the normal routine activity. These post-adoption studies have applied new theoretical frameworks called Expectation Confirmation Theory (ECT) that address the phenomenon of increasing experiences with an information system over a time period is an important consideration in studying the continued or discontinued information system usage (Bhattacherjee, 2001). The ECT employed only three variables to explain individual's behavioral intention to continue IT usage, namely the level of satisfaction, confirmation of expectations, and post-adoption expectations (M.-C. Lee, 2010).

Wu et al. (2006) applied an integrative framework of computer self-efficacy and the expectation-confirmation model as the theoretical framework to predict the continuance use of electronic learning systems. Their findings indicated that there are significant relationships among online learners' computer self-efficacy, their perceived usefulness, confirmation of expectations, and satisfaction levels. Since ECT's objective is to evaluate an individual's continuance and loyalty for a system usage, thus, user satisfaction is the most important requirement to determine user's continued use intention (Liao et al., 2009).

According to a recent study conducted by C.-P. Chen et al. (2015) to explain and predict Taiwanese teachers' continued usage of teaching blog, the results showed that confirmation has a direct effect on perceived usefulness while satisfaction is determined by both perceived usefulness and confirmation. Besides, the findings revealed that satisfaction and perceived usefulness contributed 34% of variance on teachers' continuance intention of teaching blog usage, and perceived voluntariness and habit contributed 42% of variance on teachers' continued usage of teaching blog.

At the same time, Limayem and Hirt (2003) have validated that the subconscious (automatic) behaviors, also known as habits which able to increase the explanatory power to the previous behavioral models like TRA and TPB. Since past use may explain the variance in user's future use of information systems, hence, habit is also studied as a major construct that influences the continued or discontinued use of information system (Y. Kim & Crowston, 2011; Limayem et al., 2003) in UTAUT2 model. As apply to this study, since the use of SMS is mandatory in all public secondary day schools, the researcher believes that teacher acceptance and use of SMS will be affected by their usage experience or habit.

From the motivation perspective, people make an effort to use an information system due to both intrinsic and extrinsic motivation. Extrinsic motivation refers to the desire to perform an activity because it is perceived to lead to distinct and values outcomes, while intrinsic motivation refers to the desire to engage in an activity for no other reason than just the process of performing it because of happiness, enjoyment, and curiosity (F. D. Davis, Bagozzi, & Warshaw, 1992).

Besides, intrinsic motivation in social psychology has indicated that perceived enjoyment plays an important role in determining a person’s behavior (Yi & Hwang, 2003). Prior research on technology acceptance behavior has examined the effect of enjoyment on perceived ease of use (Venkatesh, 2000). However, it has not received much attention with regard to technology acceptance (Yi & Hwang, 2003). Since hedonic motivation has been included as a key predictor in prior information system research in the consumer technology acceptance and use context (S. A. Brown & Venkatesh, 2005), it is added as another construct in UTAUT2 model. As apply to this study, researcher beliefs that when the using of SMS can bring them enjoyment and pleasure, teachers will be intrinsically motivated to accept it.

The UTAUT2 model developed by Venkatesh et al. (2012) based on a research conducted in Hong Kong incorporates three new constructs (hedonic motivation, habit and price value) into the original UTAUT model (Venkatesh et al., 2003). Price value is considered as an important determinant when consumers have to bear the cost associated with the purchase of devices and services (Raman & Yahya Don, 2013).

However, in this study, price value is excluded as a determinant because the cost is not a concern in teacher acceptance and use of SMS. Compared to the original UTAUT, the extensions proposed in UTAUT2 produces a substantial improvement in the variance explained in behavioral intention and technology use (Venkatesh et al., 2012).

Table 2.4 : Typology of Determinants for Individual Technology Acceptance and Use

Year	Researcher	Model	Determinant for Individual Technology Acceptance and Use
1989	Davis	Technology Acceptance Model (TAM)	(i) Perceived usefulness (ii) Perceived ease of use
2000	Venkatesh and Davis	Enhanced Technology Acceptance Model (TAM2)	(i) Perceived usefulness (ii) Perceived ease of use (iii) Subjective norm (iv) Image (v) Job Relevance (vi) Output quality
2003	Venkatesh, Morris, Davis & Davis	Unified Theory of Acceptance and Use of Technology (UTAUT)	(i) Performance expectancy (ii) Effort expectancy (iii) Social influence (iv) Facilitating condition
2012	Venkatesh, Thong & Xu	The Extended Unified Theory of Acceptance and Use of Technology (UTAUT2)	(i) Performance Expectancy (ii) Effort Expectancy (iii) Social Influence (iv) Facilitating Conditions (v) Hedonic Motivation (vi) Habit (vii) Price Value (Excluded)

Table 2.4 summarized all the determinants of the individual technology acceptance and use in the four models discussed above. These acceptance and use models aimed to explain or predict as much of the variance in user acceptance and use of technology as possible (Pynoo & van Braak, 2014). As UTAUT2 is the most robust model which rationalizes and summarizes the user adoption literature to provide a compelling and simplifying model to explain behavioral intention for the information system acceptance and use. The researcher builds upon this model by arguing that teacher perceptions of effort expectancy, performance expectancy, facilitating conditions, social influence, hedonic motivation, and habit will be positively impacted by their

perception of principal technology leadership practices ingredients; Visionary leadership, Digital age learning culture, Excellence in professional practice, Systemic improvement, and Digital citizenship (NETS.A, 2009). Besides, the UTAUT2 model is also suitable for dealing with a specific type of innovation (Straub, 2009) like SMS. Thus, the researcher decided to use this model for investigating what is the level of teacher acceptance and use of SMS in Negeri Sembilan secondary schools in this study.

2.2.4 Summary

Based on all the theories presented above, Figure 2.7 denote the theoretical framework of this study. It begins with the Organizational Behavior Theory or more specifically Sociotechnical System Theory (Owens & Valesky, 2007) in section 2.2.1 which clearly explained on the setting of this current study which focuses on the human subsystem in Negeri Sembilan secondary schools that involves principals and teachers. In section 2.2.2, the relationships among the three main variables used in this study - principal technology leadership practices, teacher ICT competency and teacher acceptance and use of SMS, are explained by two leadership theories. These are Transformational Leadership Theory (Leithwood & Jantzi, 1999, 2006) and Path-Goal Theory (House, 1971, 1996; Northouse, 2013). Finally, three technology acceptance and use theories - Theory of Reasoned Actions (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), Theory of Planned Behavior (Ajzen, 1991) and Social Cognitive Theory (Bandura, 1986, 1997), are used to explain the leadership influence outcome which is teacher acceptance and use of SMS in this study.

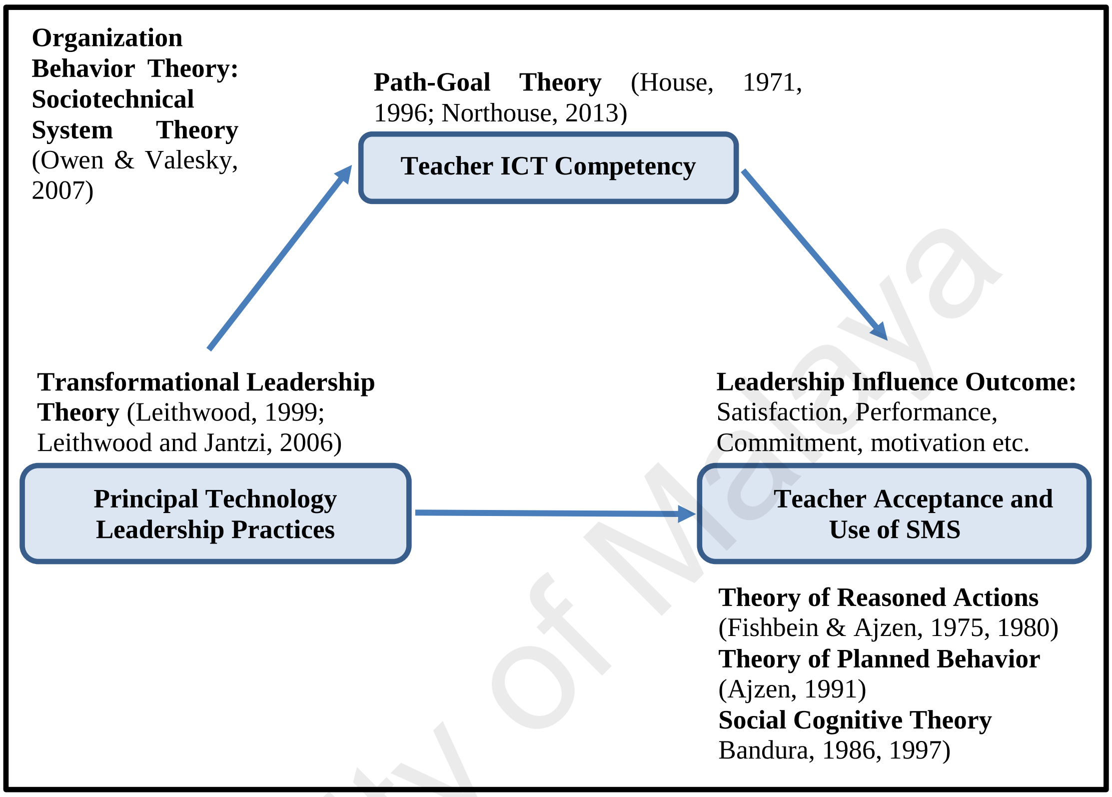


Figure 2.7: Theoretical framework of the study

2.3 Related Literature and Previous Research

This section focused on the related literature reviews and empirical studies pertaining to the variables used in this study. This study investigates teacher acceptance and use of SMS as the endogenous (dependent) variable in relation to principal technology leadership practices as the exogenous (independent) variable and teacher ICT competency as mediating variable with teachers' demography as the moderating variable. Each of these four main variables is reviewed critically to give a clearer picture to the readers about what are the related constructs or dimensions should be included in each of these latent variables before the construction of the measurement models for the dimensions which explain on these latent variables.

2.3.1 Teacher acceptance and use of SMS (Endogenous Variable)

School is a complex organization with various functional roles and the information related to its students, teachers, and staffs are overloaded. According to Kelly and Downey (2011), "*schools are having difficulty acting on the huge amount of data available and, in particular turning it to the task of raising pupil outcomes*" (p. 417). School principal is the one who needs to handle and manage this large quantity of data which they need to process speedily to provide information responsiveness to their stakeholders need (Adeyemi & Olaleye, 2010). This is because decision making is the central role of every school leader and it is impossible to decide without information (Demir, 2006).

The value of information for internal or external use depends on factors such as its relevance, completeness, accuracy, clarity, and timeliness. Thus, the secret of effective decision-making is having the right information at the exact time about the problems to solve at hand (Hussein, 2013). Besides, the usage of ICT has a positive impact on information management and service delivery. Thus, ICT has been increasingly incorporated into school management to improve its effectiveness and efficiency (Madiha Shah, 2014; Prokopiadou, 2012). Since information management system has ensured notable benefits for school management, "*a well-designed SMS should be able to provide the principal, as well as other personnel in the school for rapid, updated and accurate access to a wide variety of data stored in the school computer for data-driven decision-making processes. These data may relate to students, staff, finances,* *materials, athletics, grades, or any other part of the school*" (Ubben, Hughes, & Norris, 2004, p. 303).

It was commonly acknowledged that full utilization of SMS could offer invaluable support to schools, which are increasingly being granted autonomy in the school development policy (Bosker et al., 2007). SMS have changed school management in leadership areas, communication, decision-making processes, human resource management, workloads, and planning. This system can assist the school leaders in determining the school's goals, distributing resources, formulating strategic plans, and evaluating staff performance as well as organizational success. The main objective of SMS is to implement and design the routine school's procedures and processes that are able to provide suitable detail reports in a consistent, accurate, and timely manner (Madiha Shah, 2014).

Many reasons could be cited for the relative failure of SMS integration in education management including lack of time, lack of good training and appropriate material, lack of confidence and skills, poorly conceived implementation plans, unrealistic goals or expectations, insufficient funding, lack of senior management support, and lack of technical support (Bisaso, Kereteletswe, Selwood, & Visscher, 2008; Chong, Horani, & Daniel, 2005; Gulbahar & Guven, 2008; T. Kowalski, 2009; Madiha Shah, 2014). However, most of these problems can be corrected over time, attention, and appropriate actions. But a fundamental lack of belief in the user acceptance and use of a new SMS will ultimately prove to be the death of even the best-conceived plan (Kearsley & Lynch, 1994).

Hence understanding information systems acceptance and use is considered crucial because the expected benefits of information systems' usage such as to improve effectiveness, productivity, or efficiency would not be realized if the individual user does not accept the usage of these systems in the first place (Bhattacherjee & Sanford, 2006). Besides, "*understanding the determinant structure of key driver of user acceptance and usage is critical because it will provide leverage point to create favorable perceptions, and thus foster user acceptance and use*" (Venkatesh, 2000, p. 343) of SMS. Thus, fostering teachers' technology acceptance and use remains a critical challenge faced by the current technology advocates, school administrators, and relevant government agencies (Teo, 2010a).

Although a lot of research efforts have been directed to discover user acceptance and use of new technologies, it is still unknown what stimulates individual professionals to decide on technology acceptance and use (Yi, Jackson, Park, & Probst, 2006). As organizations continue to increase their investment in information systems, people are more aware of the importance of users' information system acceptance and use as the critical prerequisite for the productivity gains from these information systems. In other words, users' acceptance and use is the most important determinant of the success of the information system integration (Silva & Dias, 2007). As such, understanding end-users' decision in information systems acceptance and use has generated considerable interest in both industry and academia (Hong et al., 2006).

According to Asmah, Abu Daud, and Maimunah (2011), the term 'readiness' is used in a variety of contexts, from readiness in terms of behavioral change to organizational readiness and technology readiness. Readiness assessment is conducted to assess the preparedness of an individual or organizational for change, either in terms of behavioral change, or their willingness and preparedness to accept and use an innovation.

As human parameters influencing the acceptance and use of SMS, educators' attitudes and opinions towards this new SMS significantly influence the extent and level of its exploitation (Prokopiadou, 2012). Hence, it is important to know what factors cause teachers to accept and use a new technology (Pynoo et al., 2011).

Gulbahar and Guven (2008) found that teachers' support and attitudes are the key determinants of the success of educational technology innovation. If teachers' show positive attitudes towards an educational technology innovation usage, easily they can provide useful insight about the acceptance and use of innovation either into instructional or management processes (Buabeng-Andoh, 2012b).

Based on a study conducted by Demirci (2009) to examine the extent of the diffusion of Geographic Information System (GIS) throughout secondary school geography lessons in Turkey by focusing on teachers' attitudes towards the GIS usage. Data were collected from 79 geography teachers who teach in 55 different high schools located in 33 separate Turkey's provinces using a questionnaire. The findings revealed that although some external barriers such as lack of hardware, software, and data existed, but teachers positive attitudes towards GIS is a significant determinant which contributes to the successful integration of GIS into future geography lessons in Turkey.

At the same time, based on another study to investigate English as a Foreign Language (EFL) of the Syrian teachers' attitudes toward ICT, Albirini (2006) also found that the key factor for proper ICT usage in school is teachers' positive attitudes towards its usage. He has predicted teachers' attitudes in terms of computer attributes, computer competence, and cultural perceptions. He further argued that the development of teachers' positive attitudes towards ICT usage is the key factor not only for enhancing ICT integration in school but also for avoiding teachers' resistance to ICT usage.

In another similar study, a survey of 139 pre-service teachers was conducted by Teo (2008) to examine their attitude towards the computer usage in Singapore. Teachers' attitude was assessed using questionnaire with four factors: perceived usefulness, affect (liking), perceived control, and behavioral intention to the computer usage. He noted that gaining information about teachers' attitudes towards computer usage may provide useful insights into their technology acceptance and use in teaching and learning processes. The results indicated that teachers were more positive about their affect towards computers and intention to computer usage than their perception of the computer usefulness and their control over the computer usage. The mean for overall computer attitude is above the average and this indicated that the teachers held a positive attitude towards the computer usage.

This was further supported by Omoogun, Ephraim, and Omoogun (2013), who found that regardless of the amount of ICT infrastructure and its sophistication, it will not be used unless practitioners have the necessary skills, knowledge, and positive attitudes to infuse it into their instructional practices. In other words, the technology usage only can be revolutionized by the effective teachers. Besides, the researchers also noted that many past educational reforms failed due to the negligence of the end-users attitudes and needs.

Based on a study to investigate teachers' personal characteristics, computer practices, and attitudes among 764 primary and secondary schools' teachers from both public and private school sectors in Quebec, Wozney, Venkatesh, and Abrami (2006) found that technology innovations are most likely to be accepted by teachers if the perceived value of the innovation usage and its' expectancy of success are high. They revealed that perceived value of innovation usage and expectancy of success was the most crucial issues in differentiating teachers' computer acceptance and usage level. This meant that "*teachers' decisions to use an innovation in the classroom relate to (a) how highly they value it, (b) how successful they expect to be, and (c) how highly they perceive the costs to be*" (p. 177).

However, Meyer, Abrami, Wade, and Scherzer (2011) study indicated that there is no significant relationship emerged between high expectations and high usage of the electronic portfolio called ePEARL. Their finding was not in line with the conclusions reported by Wozney et al. (2006) who reported that "*factors related to the expectancy of success were the most predictive of computers use*" (p. 195). This meant that some low implementers had expressed high expectations and some high implementers had expressed low expectations. One possible explanation for this is that moderate expectations may be more motivating when integrating a new approach in one's teaching. If one has high expectations and then experiences some barriers or difficulties, it may be disappointing and demotivating. Whereas, if one has moderate expectations and begins to see positive results that exceed expectations, then this may be more motivating to continue to engage in the project (Meyer et al., 2011).

Kripanont (2006) conducted a study to investigate academician's acceptance of the internet usage in Thailand, found that the internet usage helped to improve academician professional practice such as teaching in class, preparing teaching materials, conducting research, and handling administration tasks, helped to improve their personal developments such as improving their academic and personal knowledge, and helped to improve their quality of working life.

Another study was conducted by Mas Nida et al. (2011) to assess the impact of laptop ownership on the professional development of Mathematics and Science teachers in two secondary schools located at Johor. Teachers' professional development was measured in term of six dimensions, one of the dimensions in the professional development deals with the impact of laptop use on the administrative practice of the teachers. They found that majority of the teachers agreed that the use of laptops served much of their time as they are able to complete their work in a shorter time, their works are better organized, and improve their work quality and efficiency in class management. Besides, majority of this teachers claimed that they used laptops to create examination sheets or worksheets, keyed-in, calculated and analyzed examination marks on the spreadsheet, and to store students' information. In terms of workload, nearly one-third of teachers disagreed that their workload has increased since they started using laptops. The results revealed that laptops play an important role in aiding teachers in terms of their administrative practices. The results suggested that the use of laptops has indeed improved the way teachers organize and manage their work.

By extending and applying the TAM in an educational context, Teo (2010b) conducted a path analysis to examine pre-service teachers' attitudes towards computer usage among 239 pre-service teachers who enrolled at the National Institute of Education in Singapore found that the TAM (perceived usefulness and perceived ease of use), subjective norm, facilitating conditions, and technological complexity were significant determinants of pre-service teachers' attitudes to computer usage. Based on Y. Kim and Crowston (2011), the perceived usefulness in TAM is similar to the performance expectancy construct in UTAUT2, perceived ease of use in TAM and the technological complexity are similar to the effort expectancy construct in UTAUT2, and the subjective norm is similar to the social influence construct in UTAUT2. Hence, the result of Teo's study (2010b) indicated that performance expectancy, effort expectancy, social influence, and facilitating conditions able to contribute 48.7% of the variance on pre-service teachers' attitude to computer use.

According to Ma et al. (2005), social influence refers to a teacher's perceptions about the significant opinions or suggestions of others concerning his/ her information system acceptance and use. Within a school setting, a teacher's decision on information system acceptance and use might be influenced by the importance of others opinions or suggestions. Based on their collected survey questionnaires, the result indicated that social influence did not have any direct or indirect significant effects on teachers' intention towards technology acceptance and use. On contrary, based on a quantitative study conducted by Franklin (2007) to examine the primary school teachers' instructional technology usage, the result of the factor analysis indicated that personal support (social influence) is one of the factors that influence teachers' instructional technology usage.

Previous studies found inconsistent results of the social influence construct towards information system acceptance and use (Venkatesh & Davis, 2000). Furthermore, "*based on four longitudinal field studies, the researchers found that social influence to be significant in predicting acceptance and use in mandatory use setting only*" (Venkatesh & Davis, 2000, p. 195). Since the usage of SMS in this study is mandatory, the researcher found that the social influence construct should be taken into account to measure teacher acceptance and use of SMS.

An online survey was conducted by W.-T. Wang and Wang (2009) to investigate teacher acceptance and use of web-based learning systems, The results indicated that perceived usefulness (performance expectancy) and subjective norms (social influence) are the factors that influenced teacher acceptance and use (intention to use) of web-based learning. The result indicated that performance expectancy was the main drive of teacher acceptance and use of web-based learning, while perceived ease of use (effort expectancy) influenced teachers' acceptance indirectly, through perceived usefulness.

Raman (2011) conducted a survey on 120 Malaysian pre-service teachers to investigate the extent of computer usage based on TAM2 model. The results of his study indicated that perceived usefulness (performance expectancy), perceived ease (effort expectancy), and subjective norm (social influence) were positively related to computer usage. In other words, performance expectancy, effort expectancy, and social influence are the significant determinants of computer usage. The findings also revealed that performance expectancy, effort expectancy, and social influence contributed 46% of the variance in the participants' computer usage.

In term of facilitating condition, a survey was conducted by Hernandez-Ramos (2005) to examine teachers' technology usage in Santa Clara Country, California. The results indicated that 87.2% of the respondents with no technical support at school said that they had to wait days rather than hours to receive technical support when they faced problems with the technology usage. This revealed that the availability of technical support could affect teachers' technology usage.

Similarly, Bisaso et al. (2008) conducted a study to investigate the use of Computerized Information System (CIS) in 55 Uganda's secondary schools also found that the availability of technical support from the systems administrators (technically competent person) was a significant determinant of the level of CIS usage. The researchers further argued that support accessibility was the most crucial factors for the successful CIS implementation, especially for those beginner users. On contrary, Kripanont (2006) study indicated that the availability of technicians and training motivated the academician's acceptance and use of the internet less compared to the availability of the good facilities.

Based on a preliminary data collected from 41 educators to assess their acceptance of Virtual Reality Technology in the classroom of a post-secondary institution in Perak, Malaysia using the UTAUT model, Hussin, Jaafar, and Downe (2011) found that social influence and effort expectancy significantly influenced educators' behavioral intention to the acceptance of Virtual Reality Technology. However, the result indicated that the performance expectancy was not a significant predictor of the behavioral intention of the educators. This is contrary to the previous studies and researchers argued that such an outcome could be as a result of respondents' inability to fully understand the usefulness of the proposed application or this situation may occur because respondent cannot imagine the scenario for the Virtual Reality adoption in a classroom.

Based on another study conducted by Oye, Lahad, and Rabin (2011) to examine teacher acceptance and use of ICT in higher education institution. The researchers found that all the four constructs (effort expectancy, performance expectancy, facilitating conditions, and social influence) in UTAUT model (Venkatesh et al., 2003) were significantly correlated with teachers' behavioral intention on the acceptance and use of ICT. Besides, their findings also indicated that performance expectancy exerted the strongest effect on teachers' behavioral intention on the acceptance and use of ICT. This revealed that performance expectancy is the most influential factor for teacher acceptance and use of ICT.

A cross-sectional study was conducted by Pynoo et al. (2011) to investigate secondary school teacher acceptance and use of digital learning environment using UTAUT as the theoretical framework. The questionnaire was completed by 72 teachers. The results indicate that social influence and performance expectancy exerted by superiors to use the digital learning environment were the main predictors of user acceptance and use of digital learning environment while the provision of facilitating conditions and effort expectancy were the minor determinants.

Teo (2011) noted that teachers are the key players in any effective instructional technology integration. The researcher conducted a study to propose and test a model to explain in-service teachers' behavioral intention to use technology. There are five constructs proposed in the model which are perceived ease of use, perceived usefulness, facilitating conditions, subjective norm, and attitude towards technology use. By collecting self-reported data from 592 in-service Singaporean teachers, the findings showed a good model fit when the data were analyzed using structural equation modeling (SEM). These results revealed that the five suggested constructs were significant predictors in explaining in-service teachers' behavioral intention to use technology. Besides, the results also indicated that these five constructs are capable in explaining 61.3% of the variance in the Singaporean in-service teachers' behavioral intention to use technology.

By using UTAUT model (Venkatesh et al., 2003) with four constructs (effort expectancy, performance expectancy, facilitating conditions, and social influence) as the theoretical framework, Teo and Noyes (2014) conducted a study to explain pre-service teachers' intention to information technology usage. Based on the responses collected from 264 Singaporean pre-service teachers' self-reported intention to information technology usage, the overall results indicated that effort expectancy, performance expectancy, and social influence were significant determinants of pre-service teachers' behavioral intention to information technology usage. The structural equation modeling showed that the UTAUT model is a useful model in explaining pre-service teachers' intention to information technology usage. The four constructs in UTAUT model contributed 40% of variance to pre-service teachers' intention to information technology usage.

Based on the four constructs presented in UTAUT model (Venkatesh et al., 2003) as the theoretical framework, Raman, Yahya Don, Rozalina, et al. (2014) conducted a similar study to examine the level of teacher acceptance and use of Smart Board among 68 primary school teachers in Terengganu, Malaysia. The respondents are teachers from five schools which are among the many schools that are provided with Smart Board by the Terengganu government. The results indicated that two out of four constructs in UTAUT model: performance expectancy, and facilitating conditions, showed positive significant influence towards teachers' behavioral intention of Smart Board usage. Besides, the regression analysis revealed that both performance expectancy and facilitating conditions contributed 72% of variance to teachers' behavioral intention of Smart Board usage.

In information system research, hedonic motivation which is conceptualized as perceived enjoyment has been found to influence technology acceptance and use directly (Heijden, 2004; Thong, Hong, & Tam, 2006). According to Heijden (2004), hedonic information systems aim to provide self-fulfilling value to the user. Bruner II and Kumar (2005) have incorporated a measure of fun or enjoyment (hedonic aspect) along with all the original TAM components. Their finding indicated that fun/ enjoyment which was categorized as hedonic aspect had a direct effect on attitude and this effect was more than the effect of cognition on attitude toward the use of a technology product.

In line with this, Liaw, Huang, and Chen (2007) conducted a survey to investigate teachers and students attitudes toward the e-learning usage. Based on the perceptions of 30 teachers, the results indicated that teachers have positive perceptions toward the using of e-learning as a teaching assisted tool. The authors suggested that as teachers' attitudes on e-learning become more positive, they will have a greater behavioral intention to use it. Their findings also revealed that teachers' behavioral intention to use e-learning is influenced by perceived enjoyment, perceived usefulness, and self-efficacy. Lewis et al. (2013) also stated that individuals intention to perform certain behaviors that initially do not perceive as enjoyable, although these behaviors are viewed as the positive behaviors. However, when they experience subsequence success from their behavior performance, their level of enjoyment from the behavior may increase.

In a study to explore what factors influencing secondary school teacher acceptance and use of a teaching blogs, H.-M. Lai and Chen (2011) collected 325 valid questionnaires to be analyzed. The results indicated that the decisions to accept and use teaching blogs by these teachers are strongly associated with eight factors: perceived enjoyment, codification effort, compatibility, perceived ease of use, personal innovativeness, enjoyment in helping others, school support and perceived usefulness, ordered by their relative importance. Based on Y. Kim and Crowston (2011) similarities of the constructs found in previous theories and models related to ICT acceptance and use in Table 2.3, researcher found that these eight factors could be categorized into five construct according to UTAUT2 model: (i) performance expectancy (perceived usefulness); (ii) effort expectancy (perceived ease of use, codification effort and personal innovativeness); (iii) social influence (enjoyment in helping others); (iv) facilitating condition (compatibility and school support); and (v) hedonic motivation (perceived enjoyment).

Hedonic motivation as an important determinant of intention to use technology is reported in an article entitled "*An Assessment of the Influence of Perceived Enjoyment and Attitude on the Intention to Use Technology among Pre-service teachers*" published in Computer & Education journal, wrote by Teo and Noyes (2011). This study was conducted to examine the influence of perceived enjoyment on Singaporean pre-service teachers' intention to use technology. Data were collected using a survey questionnaire from 153 Singaporean pre-service teachers. The results of SEM showed that perceived enjoyment was a significant predictor of pre-service teachers' intention to use technology.

Based on a mixed method research design to investigate the extent of ICT adoption among 212 Malaysian secondary school teachers of Mathematics and Science, B. T. Lau and Sim (2008) found that more frequent teachers spend their time in using ICT, the more positive their perception toward the ICT. The teacher's positive perceptions are expected to foster teacher acceptance and use of ICT. In other words, teachers' prior use or previous usage experiences have an impact on habit on technology acceptance and use.

Pynoo et al. (2012) conducted a study using a Combine TAM and TPB framework to examine teacher acceptance and use of an educational portal. The results showed that all the predictors in the combine TAM and TPB model influence teachers' portal acceptance, but their significance level varies depending on the types of user. The findings indicated that attitude and perceived usefulness (performance expectancy) are the strongest predictors of behavioral intention to teacher acceptance and use of the educational portal. The usage data collected after twenty-two months later showed that teachers become more efficient and majority of the teachers use the portal more frequently. This finding revealed that teacher acceptance and use of this educational portal have become part of their daily work and its usage has been inculcated as a habit in carrying out their routine work. By analyzing the same data collected using logistic regression, Pynoo and van Braak (2014) found that teachers with a more positive attitude toward the portal and higher perceptions of control were more likely to upload information into the educational portal.

Phua, Wong, and Rosini Abu (2012) conducted a study to examine factors influencing the home economics teachers' behavioral intention to use the internet as a teaching-learning tool. The extended TAM which contained four factors (perceived ease of use, perceived usefulness, perceived enjoyment, and internet attitude) is employed to explore 106 home economics teachers' behavioral intention to use the internet. The results indicated that home economics teachers' behavioral intention to the internet usage is positively correlated with all the four factors. The findings revealed that perceived enjoyment with the highest r value (r=.70), follow by internet attitude (r=.67), perceived usefulness (performance expectancy) with r=.63 and lowest is perceived ease of use (effort expectancy) with the r=.54. Since the behavioral intention is a measure of individual's intention to perform a specific behavior (Fishbein & Ajzen, 1975). Hence, strong behavioral intention to use an information system will reflect a high level of individual acceptance and use of information system (Phua et al., 2012).

According to Gogus, Nistor, and Lerche (2012), UTAUT (Venkatesh et al., 2003; Venkatesh et al., 2012) have been proposed as the major model of educational technology acceptance, but it has been validated only in few languages and cultures only. Thus, researchers conducted a study aiming to extend the applicability of UTAUT in Turkish culture. Based on the data collected from a large sample (N=1,723) of Turkish teachers, the result indicated that UTAUT questionnaire displays good convergent and discriminant validity. Besides, SEM confirmed the model validity. These findings suggested the applicability of UTAUT in educational practice.

Through the sequential mixed-method approach, K.-T. Wong et al. (2014) conducted a study to develop and provide an initial psychometric evaluation of the Interactive Whiteboard Acceptance Scale to assess the level of acceptance and use of the interactive whiteboard. The data were collected from 149 pre-service teachers from a teacher education institution in Australia. The principle component analysis yielded a five-factor model comprising 14 items. These five factors are effort expectancy, performance expectancy, facilitating conditions, social influence, and self-efficacy. The factorial validity was confirmed through the use of confirmatory factor analysis (CFA) with SEM. The scale also reached the minimum requirement for an acceptable model fit. Besides the factorial validities, the convergent validity and discriminant validity both achieved satisfactory validity and good internal consistency for all the five constructs. Hence, it can be concluded that the scale developed can be considered a valid and reliable instrument designed specifically for assessing interactive whiteboard acceptance among pre-service teachers. The result also showed that the theoretical five constructs in the interactive whiteboard scale explained 70.98% of the total variance in pre-service teacher acceptance and use of the interactive whiteboard.

By using UTAUT2 as the theoretical framework, Raman and Yahya Don (2013) conducted a survey to investigate pre-service teacher acceptance and use of a learning management system (Moodle). The researchers found that all the constructs in UTAUT2 model (effort expectancy, performance expectancy, facilitating conditions, social influence, hedonic motivation, and habit) have a significant influence on pre-service teachers' behavioral intention of Moodle usage. The results of the regression analysis revealed that effort expectancy, performance expectancy, facilitating conditions, social influence, and hedonic motivation contributed 29.5% variance on pre-service teachers' behavioral intention of Moodle usage. This verified that five of the constructs in UTAUT2 model are considerable predictors of the pre-service teachers' behavioral intention of Moodle usage. Besides, the findings also indicated that facilitating condition is the most significant predictor of the extent of behavioral intention followed by hedonic motivation. However, the habit does not have significant effects on behavioral intention or the Moodle usage behavior. This might be due to the Moodle usage is voluntary. In this study, the use of SMS is mandatory, hence, the researcher believes that the habit will have an influence on teacher acceptance and use of SMS.

There are many studies have been conducted to examine the pre-service teacher acceptance and use of various technologies (Raman, 2011; Raman & Yahya Don, 2013; Teo, 2008, 2010a, 2010b, 2012; Teo & Noyes, 2014; K.-T. Wong et al., 2014). However, the pre-service and in-service teachers' working environments are different and these variations may influence their responses to the acceptance and use of technology (Wright & Wilson, 2005). Thus, it will be questionable that how far the perception of the pre-service teachers and in-service teachers' technology acceptance and use could coincide with one another? Based on the inconclusive pieces of evidence that there were similarities in the perception of these two groups of teachers, Teo (2015) conducted a study to compare the factors that explain pre-service and in-service teachers' technology acceptance by collecting data from 817 respondents (430 in-service teachers and 387 pre-service teachers). The main purpose of the study is to examine the validity of a research model to explain pre-service and in-service teachers' technology acceptance and use. The study's results showed that the seven variables which are perceived ease of use, perceived usefulness, attitude towards computer use, subjective norm, facilitating conditions, computer self-efficacy, and technological complexity, were valid in explaining the technology acceptance of the teachers from both service groups. Hence, it can be concluded that there is no significant difference in the perception of the pre-service teachers and in-service teachers' technology acceptance and use.

Lewis et al. (2013) also conducted a study using UTAUT2 as the theoretical framework to examine teacher acceptance and use of an established and emerging information technology in higher education classrooms. The main purpose of the study is to test the theoretical explanations of the UTAUT2 constructs in the context of higher education. Data were collected via an online survey from 46 respondents. The findings indicated that the most important predictors of teacher acceptance and use of technology for classroom purpose are effort expectancy, performance expectancy, social influence, and habit. Besides, the results also showed direct effects of all UTAUT2 variables used in this study (effort expectancy, performance expectancy, hedonic motivation, social influence, and habit) were significantly correlated with teachers' behavioral intention to use classroom technology.

From the above literature reviews, the researcher found that most of the prior researches were carried out to find out and validate what are the predictors contributed to individual's acceptance and use of information technology. It can be concluded that teachers' belief, attitude and behavioral intention is the key measure reflected on teacher acceptance and use of information system. Besides, the reviews also found that there are six main constructs which significantly contributed to teacher acceptance and use of information system, there are effort expectancy, performance expectancy, facilitating condition, social influence, habit, and hedonic motivation. These six constructs are consistent with the six constructs found in the UTAUT2 model. As UTAUT2 model showed the highest predictive power to explain user's acceptance and use of technology in this review, hence, UTAUT2 model was applied to measure teacher acceptance and use of SMS in this study. The composite mean of these six constructs was defined as the level of teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

In term of level of technology use, Lecklider, Clausen, and Britten (2009) surveyed on 57 school leaders to identify principals' observations of technology use in their schools. The results showed that approximately 60% of participants agreed that technology usage has a critical impact on students' achievement. They also identified their schools as being average or below average in terms of teacher technology usage. Besides, they observed that teacher technology usage focused on technologies like the internet, e-mail, presentation, and word-processing software that require little change in their practices. Only 13% of participants in this study observed their teachers use instructional software and technologies on a daily basis.

Furthermore, based on a survey conducted on 460 randomly selected Jordanian teachers to investigate the level of ICT use for educational purposes in Jordanian rural secondary schools, Al-Zaidiyeen, Leong, and Fong (2010) found that teachers have low level of ICT use for educational purpose but teachers hold positive attitudes towards the use of ICT. The findings of this study also revealed that there is a significant positive correlation ($r=.50$; $p<.05$) between teachers' level of ICT use and their attitudes toward the use of ICT.

Similar findings also reported by Varol (2013), who conducted a study to identify the relationship between primary school teacher ICT competency with their attitudes towards technology usage in classroom instruction. The findings showed that teachers' have very low level of technology usage in instruction but their attitude toward technology usage is at the moderate level. The results also revealed that teacher ICT competency predicts their attitude towards instructional technology usage.

The researcher found that limited research has been reported regarding teacher acceptance and use of SMS in the local context. However, few local studies have been conducted to examine teachers' usage of different types of school information management systems. According to Mahmod (2001) and Affendi (2004), computers are mainly used for school management (office, curriculum, co-curriculum, discipline, and library). Murad's study (2003) found that the co-curricular management has been well carried out in one of the secondary school in Muar, Johor by using a computer-based management system which is designed to enhance the efficiency of co-curricular management.

Another study was conducted by Jamalludin (2003) to examine the use of Students' Application Information System at a secondary school in Jerantut, Pahang. His results indicated that the use of Students' Application Information System to manage students' information such as discipline, co-curriculum, school-leave certificate, co-curricular certificate and other really enhance the effectiveness and efficiency of school's information management.

Sofia Nor (2006) conducted a study to examine the usage of an automation software in the management of school resource centre in three secondary and three primary schools in Hulu Langat also found that majority of the teachers agreed that the use of this automation software able to provide smooth and efficient management of the school resources centre.

In term of the level of information system usage, Mohd. Nazri (2005) conducted a study to investigate the usage and effectiveness of the use of smart school information management system in Kedah. His findings showed that all the five aspects of schools management were at the high level of usage and effectiveness. These five aspects are educational resources management (M=4.04, S.D.=.15), student affair management (M=4.60, S.D.=.14), library resources management (M=4.01, S.D.=.09), hostel management (M=3.99, S.D.=.13), and external resources management (M=3.75, S.D.=.15).

Another study was conducted by Low (2008) to examine the level of Student Information System usage by the teachers and school's administrators in a primary school in Gombak, Selangor. The study findings showed that the level of Student Information System usage was moderate. In line with Low's finding, Ting (2007), who conducted a quantitative study to investigate the level of ICT usage amongst Malay language, English language, Science and Mathematics teachers from four secondary schools in the district of Sarikei, Sarawak, also found that the level of ICT usage among these teachers was moderate.

There is a local study conducted by Jeffrey (2007) to investigate factors influencing the actual usage of computer among 318 Mathematics, Science and English Language teachers from 65 secondary schools in the district of Petaling, Selangor. The factors investigated in his study were attitude, perceived usefulness, perceived ease of use, computer self-efficacy, job relevance, computer compatibility, subjective norm and teachers' demography. Overall, his study found that actual computer usages among these teachers were at the moderate level. Besides, the constructs of attitude, perceived usefulness, perceived ease of use, job relevance, and computer compatibility showed a significant positive relationship with actual usage of computer. Next, the step-wise multiple regression indicated that the predictors of actual usage of computer according to the variance contributed were perceived ease of use, perceived usefulness, job relevance, computer compatibility, and attitude. This five-factor model contributed

54.5% of the variance on Mathematics, Science and English Language teachers' actual usage of computer.

Leong (2010) conducted a study to investigate the level of teacher' ICT application in a Malaysian secondary school and she found that the level of teacher ICT application was at the moderate level. This finding was similar with Maseli (2005), who also found that the level of ICT application in teaching and learning management at two government secondary schools in Lundu, Sarawak is at the moderate level. However, Mohd Jamil (2011) found that the overall mean for the teacher ICT application in a Malaysian Smart School is 3.32 and this is interpreted as above average.

Based on the above literature, the researcher found mixed results for the level of teachers' ICT application and information systems usage. Moreover, the previous studies (Leong, 2010; Low, 2008; Maseli, 2005; Mohd Jamil, 2011) reported the level of teachers' ICT application based on frequency of use in carrying out their routine works and were not based on any theoretical models in information system research. Although few local studies (Hussin et al., 2011; Phua et al., 2012; Raman, 2011; Raman & Yahya Don, 2013; Raman, Yahya Don, Rozalina, et al., 2014) were conducted based on these theoretical models, but these studies were carried out to find out the factors contributing to individual's acceptance and use of information technology, and not on the level of acceptance and use. There is only one local study (Jeffrey, 2007) that used some of the constructs in TAM & UTAUT to measure teachers' actual usage of computer, but his study only concentrates on Mathematics, Science and English Language teachers.

As School Management System (SMS) is a newly introduced system in Malaysian public secondary schools (Haslina et al., 2014), thus, researcher found that no studies pertaining to teacher acceptance and use of SMS had been carried out in Malaysia using the UTAUT2 model as the theoretical foundation to measure the level of teacher acceptance and use of SMS. Hence, this study used UTAUT2 model as its primary theoretical understanding on the teacher acceptance and use of SMS in Negeri Sembilan secondary schools with the justification that UTAUT2 model showed the highest predictive power to explain user's acceptance and use of technology in this review.

Despite the high predictive ability of the UTAUT2 model, there is still not enough systematic practical guidance about how managers, designers, and trainers could enhance user's acceptance and use by influencing their perceptions (Venkatesh et al., 2007). In response to calls for research in this area, this study was carried out to investigate teacher's perceptions of the influence of principal technology leadership practices on teacher acceptance and use of SMS. Principal technology leadership practices are the new antecedent that helped to deepen researcher understanding about what other factors could be the key predictors of information system acceptance and use based on the organizational behavior theory and leadership theories presented as the theoretical framework for this study in the earlier sections.

According to Venkatesh et al. (2007), "the study of key antecedents and various interventions are key indicators of scientific progress and practical applicability in the information system acceptance and use research as it deepens our understanding of the phenomenon and provides levers for managerial action" (p. 270). Hence, this study could be considered as an intervention which principal technology leadership practices is proposed as a new antecedent to teacher acceptance and use of SMS.

2.3.2 Principal technology leadership practices (Exogenous Variable)

Since 1990, the stream of research related to technology leadership has been explored in developed country like United Kingdom. Technology leadership has been defined in terms of its nature, indicators, concepts, and behavioral characteristics, which emphasized that technology leadership could be implemented as a function of schools' innovations (Chang, Chin, & Hsu, 2008). Chang et al. (2008) emphasized that evaluation of principals' technology leadership is necessitated and needed for further exploration. This could help to better prepare the current and future leaders to implement technology integration policy successfully and to deal more effectively with technology.

Educational technology has become increasingly vital in today's modern information explosion environment and principals with efficient technology leadership skills are the key to successful technology integration plans and policies (Bolman, 2012; Norazah, Yusma, & Kamaruzaman, 2010). Flanagan and Jacobsen (2003) emphasized that in order to achieve successful technology integration in schools, leadership goals, competencies and responsibilities are required. Although school principals may have formally mandated technology leadership responsibilities, this could be problematic since they often do not have the background and training to deal confidently with technology. In other words, school principals should possess some basic ICT knowledge, skills and literacy (Langlie, 2008; Scott, 2005) in order to support teachers and staff for preparing students to face the exploration of information age challenges.

In accordance to these, technology has emerged as a major factor in leadership development and preparation program worldwide (Alan Seay, 2004; Duncan, 2011; Grey-Bowen, 2010; LaFrance & Beck, 2014; Redish & Chan, 2007; Richardson & McLeod, 2011; Sherman & Beaty, 2007; Watts, 2009) and this program would reshape how educational leaders learn, interact, and conceptualize their professional technological practices (Webber, 2003).

Based on a study conducted to examine the status of the aspiring leaders' current experience in K-12 virtual schools in United States, LaFrance and Beck (2014) found that field-based learning experience and authentic course are necessary for leadership preparation program. Furthermore, the researchers argued that future leaders should begin mentoring and internships activities in real-world settings early in the program and should be engaged in activities that prepare them to lead in an increasingly advanced technological world.

According to Richardson, Bathon, Flora, and Lewis (2012) content analysis of the review of the published scholarly literature that focuses on some of the elements in the updated ISTE Standards•A (2009), they identified that school technology leadership research in the next decade will be informed by how this field of research is carried out in both K–12 schools and educational leadership preparation programs. They also found that school success is often closely related to educators mastering a given set of professional standard and the purpose of having that educational professional standard is to improve professional practice. As technologies became increasingly important in educational systems, there is a need to arise school administrators' understanding about their respond and impact toward these technological changes.

The major responsibility for the principal who acts as a school leader is initiating and implementing school change through the ICT usage and facilitate complex decision to integrate it into teaching and learning, and school administration (Afshari et al., 2008). Afshari et al. (2008) gathered a plot test data from 30 secondary school principals in Tehran, Iran. The researchers found that school principals are using computers for administrative and instructional purposes. Besides, the results showed that these principals demonstrated a moderate level of competency in computer applications. In the information age, principals must be able to act as a role model by integrating ICT into their daily practice and to provide support for technology use in the instructional process. In fact, principals must be technology leaders for their schools. However, their results indicated that 43.3% of principals used computers two or three times a week for a variety of administrative and instructional tasks. The researchers suggested that, if Iranian principals want to practice their new role as technology leaders successfully, they need to understand the role of ICT in their routine work and acquire appropriate skills to use this technology. In other words, principals' technology leadership will be improved only if the principal becomes proficient in the technology usage and able to provide leadership in the technology usage for instructional and administrative functions. Hence, as Iranian principals become more competent with technology usage in education and this will enhance their technology leadership skills and allowing them to infuse a clearer vision for technology usage in their schools.

Based on the above data, Afshari, Kamariah, Wong, Bahaman, and Foo (2009b) explored on how principals' leadership styles affect the ICT usage in school. The result of Pearson product moment correlations showed that there was strong and significant positive relationship ($r=.84$, $p<.05$) between principals' transformational leadership and ICT usage. Besides, there was a strong and significant positive relationship ($r=.88$, $p<.05$) between principals' level of computer usage and their computer competency. Thus, Afshari, Kamariah, Wong, Foo, and Bahaman (2009) suggested that the policy maker should design professional development programs to cultivate the future principals about the more effective and efficient utilization of technology for learning.

Next, Afshari, Kamariah, Wong, and Saedah (2012) proclaimed that effective training programs could help the schools' leaders to better utilize educational technology for finding and accessing related information and new knowledge. Besides, these would help them to develop a more effective management process for problem-solving and decision making which eventually cause in better accountability. Hence, the authors suggested that in order to fulfill the Iranian principals' role as technology leaders, considerable opportunities need to be provided for ongoing professional development.

By using the same set of questionnaire mentioned above, Afshari, Kamariah, Wong, Foo, et al. (2009) collected data from 320 Iranian secondary school principals to examined the extent of principals' computers usage, competency, and leadership styles. Their findings showed that principals' transformational leadership and computer competence contributed significantly to the level of principals' computers usage. The result showed that there was a moderate and significant positive correlation between principals' transformational leadership and their level of computer usage ($r=.69$, $p<.05$), this indicated that as higher the principals practice transformational leadership styles, their level of computer usage will be increased as well. Based on the coefficient of determination analysis, it was found that 47% of variance in the level of principals' computer usage can be explained by their transformational leadership. Afshari, Ghavifekr, Saedah, and Rahman Sukor (2012) noted that principals' computer competence and their level of ICT usage are the key factors that influence their technology leadership behaviors. Hence, these researchers suggested that policy makers should provide necessary professional development for principals so that they become proficient in all the competency areas.

Weber (2006) noted that school administrators may have the basic skills to use technology successfully in their daily on-the-job activities, but they may not have had training regarding the effective integration of technology in classroom instruction. Hence, he conducted a study to examine Texas primary school principals' level of computer use and their leadership in technology integration activities according to the National Educational Technology Standard for Administrators, NETS.A (2002). Data were collected from 216 Texas public primary school principals and the results indicated that these principals have a high level of computer use and technology leadership performance to the NETS.A standard. Besides, the Pearson correlation analysis showed that there was a significant weak positive relationship ($r=.203$, $p<.01$) between the level of principals' computer use and their technology leadership.

However, studies conducted by these groups of researchers (Afshari, Ghavifekr, et al., 2012; Afshari et al., 2008; Afshari, Kamariah, et al., 2009b; Afshari, Kamariah, et al., 2012; Weber, 2006) concentrated on the discussion of the principals' perception of their personal use, competence, and leadership styles which could be referred as intra-individual theories (Refer Table 2.1). These researchers revealed that the principals' transformational leadership styles showed a significant strong positive relationship with their own computer usage. As discussed in the leadership theories presented in the earlier section, leadership is dealing with the exercise of influence on others through social interaction (Bass & Bass, 2008; Bush, 2011; Northouse, 2013; Owens & Valesky, 2007; Robbin & Judge, 2013; Yukl, 2013). Besides, the "*transformational leadership was conceptualized at the dyadic level*" (Yukl, 2013, p. 16) which focuses on the relationship between principal and teachers. Hence, in this study, the researcher would like to investigate teacher's perceptions on whether principal technology leadership practices influence teacher acceptance and use of SMS and teacher ICT competency in Negeri Sembilan secondary schools. The present study is different from the prior studies in term of the leadership focuses.

Besides, new technology-related standards and performance indicators for administrators have been developed, and principals' roles as technology leader have been explored as a way of enhancing teachers' and students' performance and supporting effective technology integration into schools (Richardson et al., 2012). In the next few paragraphs, researcher would like to present various related empirical studies pertaining to the construction of the measurement models for the principal technology leadership practices according to each of the dimensions of ISTE Standards•A (2009).

Based on a qualitative case study through face-to-face interviews with six Turkish primary school principals guided by the NETS.A from ISTE (2009) to examine what obstacles faced by the school principals in practicing technological leadership, Sincar (2013) found that in carrying out their role as technology leaders, school principals have faced various obstacles, the five main obstacles including lack of resources, lack of in-service training, resistance to innovation, poverty, and bureaucracy.

Deryakulu and Olkun (2009) also conducted an interview with 74 Turkish computer teachers to examine computer teachers' professional memories about their experiences with school administrators. Content analysis of their memories showed that school administrators have unsupportive attitudes towards the computer teachers and not collaborate with computer teachers in implementing the best technology practices. Their findings revealed that majority of school administrators were unable to provide adequate technology leadership for their computer teachers mainly due to lack of computer skills and knowledge, and administrative skills. Since many school administrators are unfamiliar with computer technology, they often disregard the computer teachers' requests for software and hardware or their demands for repairing broken-down computers. Instead, they expect these computer teachers to deal with such problems. These unsupportive attitudes of the administrators have led to job stress in most of the computer teachers.

In a similar study, Wachira and Keengwe (2011) used a mixed method approach to investigate on mathematics teacher's perceptions about the technology integration barriers in urban school found that lack of technical support and technology leadership from the administrators in ensuring that technology is available and reliable and that technical support is available and efficient are the main external barriers facing the teachers. Based on the perception of these teachers, the lack of principals' technology leadership has led to the acquisition of 'mismatch' of technology, tools, and human, where when one teacher is put with the technology, some of which may not be useful to the teachers at all.

According to Tan (2010), the functional roles of principals' technology leadership is where principals act as a change agents (Kamala, 2008; Liu, Albert, & Cathy, 2013;

Mohd Jamil, 2011; Nazri, 2011) to affect four areas of change: (1) Infrastructural change, (2) organizational and policy change, (3) pedagogical change and (4) cultural change. Technology infrastructure includes software, hardware, and resources. School leaders play a vital role in providing the robust infrastructure that is conducive for teachers to use the educational technologies. Organizational and policy change is another action normally taken by school leaders which include the appointment of different levels of technology leaders, school technology budget, setting up of technology support services, intellectual property policy and staff appraisal policy (Tan, 2010).

In terms of pedagogical change, students' learning outcomes have been the main focus of debate between opponents and advocates of educational technology. Principals should acknowledge their roles as technology leaders in enhancing students' learning outcomes and pedagogical quality through technologies usage (Tan, 2010). "Technology-smart" and "student-centered" learning were identified as a new vision of learning environment for the Canadian public school technology-enhanced classroom (Sheppard & Brown, 2014). School leaders should emphasize that student learning is the main focus for making any decision related to schools' ICT policies, and teachers should be encouraged to experiment (adventurous learning) with instructional technology usage (Tan, 2010).

"School Cultural Characteristics" refer to "the way people think, perceive and feel about things in schools" (J. Tondeur, Devos, van Houtte, van Braak, & Valcke, 2009, p. 226), or the basic assumptions, cultural artifacts, and values and norms that are shared by school communities, which influence their functioning at school (Maslowski, 2001). Since, cultural change is one of the most difficult but effective ways to achieve high quality and sustained technology integration into instruction (Yuen, Law, & Wong, 2003), the initiator which is normally the school leader must understand how the culture will accept the change and where the culture may need to be modified. Based on the change models, Yuen et al. (2003) explored the leadership issues in ICT implementation by analyzing the results of change in a case study involve 18 Hong Kong schools which trying to integrate ICT usage across the school curriculum. The researcher found that the strategy used by these school in promoting such change in instructional technology usage is affected by the school leaders' vision and their understanding of the impact and role of instructional technology, their objectives and purpose for ICT integration, as well as the history and culture of the school and its general schools' mission and vision.

Playing the role of visionary or motivator, the leader must bring to bear all of his energy, convictions, and knowledge so that the people he/ she leads are invested with the sense of responsibility and spirit to translate the vision for redesign and change into reality (Muhammad Rais, 1999). Vision is probably the most important statement in any school's strategic planning because these declarations will describe what school will look like at some designated point in the future to meet their missions (T. J. Kowalski, 2012).

Chang et al. (2008) used SEM with prospective data – 1,028 teachers randomly selected from 188 Taiwan's elementary schools to test for model fit on the observed data and the proposed model. The findings identified the four constructs comprised of principals' technology leadership are school vision, infrastructure support, evaluation and research, and staff development. These results revealed that in order to be effective technology leaders, principals need to implement and develop a visionary long-range technology strategic plan, provide necessary training and staff development for their teachers and students, ensure that the technology infrastructure in their school is well supported, and establish an assessment and evaluation plan for the technology use in their schools. These constructs of behavior significantly explain the effectiveness of principals' technology leadership. They argued that the main function of technology leadership is to identify the relationship between technology, school mission, school vision, and educational policy. Moreover, school leaders must understand the importance of ICT for their students as well as provide a technology-enriched learning environment; empower, encourage, and collaborate with local businesses and experts to support school-wide technology infrastructure; and model technology leadership behaviors that promote teaching and learning to promote a learning environment in their organization. In other words, principals should play a critical technology leadership role to create a digital age learning culture in schools.

In line with Chang's views, Richardson, Flora, and Bathon (2013) also emphasized the importance of school principals in fostering a school technology vision as the first step in any technology planning for the school. They proclaimed that school principals are the one responsible to lead, navigate, and change schools into the modern digital learning environment. Hence, having a technology integration vision for the school is the central role of the school principals' to prepare and embrace with this new educational learning environment. In other words, school principals who successfully practiced technological leadership should be able to inspire a shared vision for the comprehensive technology integration and at the same time able to foster a culture and conducive environment for the realization of this vision.

A qualitative approach was designed to examine technology leadership of the principal's live experiences in ten ICT-enriched schools in New Zealand, Canada, and the United States, Yee (2000) found that successful school principals able to inspire a shared vision for comprehensive technology integration to improve students learning and to foster a culture or environment conducive to the attainment of that vision. By the way, these principals should display a passionate commitment to provide appropriate professional staff development to enhance their teachers' ICT skills. At the same time, each principal should be a very skillful entrepreneur who utilizes their social network to locate creative sources of ICT software, hardware, and expertise for technology integration. However, Davies (2010) argued that Yee's (2000) work is functional in nature which aimed at analyzing the ICT roles of principals but does not discuss the effectiveness of this type of leadership in enhancing instructions processes.

Ritzhaupt, Hohlfeld, Barron, and Kemker (2008) carried out a large-scale survey (N=2,482) across the state of Florida to investigate the trend of technology funding and planning in Florida's K–12 public schools. The result indicated that there was a significant increase in the number of schools that revised their technology plans on a regular basis; a significant increase in the frequency with which Florida's K–12 public schools are seeking funds for technology-related initiatives; and a significant increase in parents, students, teachers, and administrators involvement in the technology planning process. Thus, successful technology integration throughout a school system should be consistent with the school district's overall educational mission, vision, and strategic plan. The intent of this mission and vision component is to provide a perspective on what the district considers to be vital and important related to technology use to improve student performance. The results clearly suggested that school administrators and other authorities are investing an increasing amount of time in planning the ICT integration into the instruction and seeking funding to support these costly initiatives. Meanwhile, technology planning trend showed that it slowly involving more teachers, parents, and students. These researchers suggested that school administrators should not only rely on purposeful change to achieve students' learning but also must try to create new funding for the sustainable technology resources, even if the change entails creating external partnerships of the educational system. Research has demonstrated that educational technology has its potential to improve teaching and learning. Hence, the school must develop a plan that incorporates thoughtful planning and appropriate funding to make its vision a reality.

Kara-Soteriou (2009) categorized school administrator who uses technology to improve communication, productivity, and school management goals, as well as access evaluation data that tracks teachers and students performance as a visionary leader because they managed to establish a technology culture in their school and understood how the learning environment for students and teachers can be transformed using technology. Hence, school administrators play an important role in deciding how well technology is used in their schools, by gaining a thorough understanding of computer technology's capabilities, embracing technology usage in their own professional lives, and by taking a leadership role in using technology efficiently and effectively (Brockmeier et al., 2005). This leadership can be reflected through the administrators' multiple practices, roles, initiatives, and beliefs.

Based on a survey conducted on 57 school leaders to identify the principals priority for technology in basic administrative tasks (i.e., school improvement and budgeting) and their observations on their schools technology usage, Lecklider et al. (2009) found that school administrators are attempting to create a culture at their schools that promote learning-centered environments and instructional innovation. Data from the study showed that if principal perceptions of technology use are accurate, then there is a connection between those schools that integrate technology to promote instructional innovation and the priority which the administration places on technology in relation to school improvement and budgeting. Besides, data from this study also portrays little to no knowledge of The National Educational Technology Standards for Administrators, NETS.A (nearly 60% had no awareness of these standards) or the conditions that support technology use by teachers developed by the ISTE in 2002 (71% of participants noted little to no awareness). Thus, there is a critical need to educate school leaders in how technology can change instructional practice, improve student learning and support school improvement. In other words, they emphasized that professional development for administrators should be the priority compared with other aspects of the technology integration process.

However, successful ICT implementation within the school will require the leader to be more conscious of the future development and possibilities of technology usage and how the school might integrate these into teaching and learning. Hence, it is important for principals to seek advice and assistance from a technology committee or experts, benchmark other schools, brainstorm ideas, and train those 'technology-savvy' teachers for the betterment of their schools (Afshari et al., 2008).

According to Dessoff (2010), it is important to reach the digital natives within the school by providing a learner-centered environment infused with technological resources to help students' learning. Along with providing a learner-centered environment for digital natives, this researcher proposed that teachers need to be provided with access and resources to learn more about technology and methods to integrate it into their classroom instruction.

DasGupta (2011) found that the main goals of leadership have not changed, but the new technology leader needs to implement those goals electronically on computer-mediated virtual teams that are dispersed over space and time. What is very different is that the technology leader may never physically meet one or more of their followers, and the main communication medium is through the usage of computer technology. This new paradigm provides a wide-range of new opportunities in terms of the ability to instantly communicate one-to-one with teachers, parents or stakeholders; the ability to empower; the opportunity to enhance organizational performance, and to improve students' performance; and scope for better management and administrative tasks. These can positively impact an organization's competitive advantage.

Since, the role of technology leaders has changed from supporting the technologies use to how leaders develop and manage complex technology systems to effect change in school (Halverson & Turner, 2004). Educational leaders must understand, promote and implement the notion that technology integration is not about the technology, it focuses on the development of the future generations and leading teachers to change their instructional strategies to enhance 21st century student's achievement (Kozloski, 2006). In her interviews with principals, Kozloski (2006) found that majority of the principals advocate that the best way to show teachers about technology integration in education is through modelling, although in some situations, the teachers may not have the same perspective as how their principals' practice or use ICT applications. Besides, she found that being a technology leader, the school leader must ensure that their teachers receive adequate professional development, resources, and technical support to attain the benefits of technology usage in their instructions.

However, technology leadership is much more than management and resource acquisition. Instead, Flanagan and Jacobsen (2003) argued that technology leadership has various dimensions caused by the complexity of schools as learning organizations. Since many principals have not been prepared for their new role as technology leaders, therefore, have been struggled to develop both the technical and human resources necessary to achieve ICT outcomes in their schools. They found that lack of informal leadership is one of the barriers to technology integration in Alberta schools. Flanagan and Jacobsen (2003) also found that successful experience with ICT integration can provide important information for principals who are anxious to achieve similar outcomes in their own schools. Increasingly, research is providing evidence that ICT integration can facilitate school reform initiatives and positively impact student learning. The diverse examples of successful practice have five key elements in common: (1) shared vision; (2) student engagement; (3) professional development; (4) equity of access; and (5) ubiquitous network.

Furthermore, the technology leadership concept has been regarded as principals' decision about technology budgets, goals, committees, policies, and other structural supports for improving technology usage in learning (Anderson & Dexter, 2005). Based on a nation-wide survey of 1,150 U.S. schools to examine the characteristics of technology leadership and their effect on indicators of technology outcomes, Anderson and Dexter (2005) found that although technology infrastructure is important for educational technology to become an integral part of instruction, but technology leadership is even more necessary for effective utilization of technology in schooling.

Sathiamoorthy et al. (2012) conducted a survey of 106 secondary school principals randomly selected from two neighbouring states (Federal Territory & Selangor) in Malaysia to examine the strategies used by principals in leading the ICT integration among their teachers. They found that principals use all the three strategies (creating opportunities, promoting, and modelling) but at varying degrees of strengths. Modelling is found to be the strategy with the highest degree of strength followed by creating opportunities, and finally promoting strategy. The researchers suggested that if these principals are provided with the appropriate professional development in technology leadership, then they can really excel to even higher levels in exhibiting ICT leadership for their teachers. Hence, effective principals need to be actively involved in technology implementation process which including modelling technology use and promoting an ongoing curriculum-integrated technology staff development.

Based on the survey responses from 64 New Zealand school leaders, Stuart, Mills, and Remus (2009) found that these principals had reasonably high levels of ICT competence. Besides, their results also indicated that these school leaders used ICT frequently and were also likely to perceive themselves as technology leaders in their schools. It is widely accepted that the senior management’s leadership behavior plays a vital role in determining the success or failure of an ICT implementation (Neufeld et al., 2007). Therefore, there is a need for strong leadership in ICT implementations in any organizations. As school administration becomes increasingly computerized, school leaders must address the challenges of implementing new technologies, such as student management systems. By effectively modelling the use of this information system, school leader was able to ensure the effective practice of information system usage in their school. Stuart et al. (2009) also found that these school leaders preferred collaborative and hands-on professional development so that they can act as a role model for others in their school.

Coffman (2009) examined how educational leaders collaborated with the Virginia Department of Education and policy makers to create a statewide initiative for introducing a workable technology integration vision throughout the Virginia school system. These educational leaders want to infuse technology into the curriculum to improve communication, data-driven decision-making, task efficiency, instruction, and ultimately, student performance. They understood that in order to achieve this vision, every school divisions in the state would need to have its own technology leaders. The main goal for Virginia's technology integration program is to create a productive environment for all teachers to develop the skills and knowledge they need to integrate technology throughout the curriculum. Thus, the instructional technology resource teachers are the heart of this plan because they can provide in-house professional development to support leaders and teachers with knowledge and skills in the effective use of technology.

In line with this, Place and Lesisko (2005) also wrote about the importance of hiring the most qualified instructional technology specialist as the technology leader. When hiring a highly competent individual, schools can utilize this person to frame out a workable technology vision and direction for how technology can be used efficiently. The main duties of school technology experts include: develop a comprehensive K-12 instructional technology plan for the district; work with faculty and administration to integrate technology into the curriculum; routinely evaluate the instructional technology program; develop the yearly technology budget; review, evaluate, and purchase instructional technology resources; and work with principals and their staffs to effectively utilize all available resources that promote the use of technology.

In order to promote technology usage, Dyal, Carpenter, and V. Wright (2009) discussed on how school leaders should provide learner-centered environments and ensure instructional innovation related to the use of technology for enhancing students' learning. The researchers mentioned that equitable access is an important part of a school leader's duties. They also suggested that school leader should act legally and ethically in providing necessary technology devices and services to improve students' achievement. Hence, researchers viewed that the facilitation of policies and a shared school culture should include in the 21st century learning.

According to Garland (2009), as schools begin to enter the second decade of the new millennium, there are great promises for the transformation of learning through the use of new technology tools, such as wireless multimedia devices and web 2.0. Thus, school principals as technology leaders should advocate for access and equity to new technologies in their schools, with an awareness of student diversity in language, race, gender, and special needs. The principal has a duty to become an informed activist in promoting access to technology by all students and teachers. Besides, school leaders have additional responsibilities to promote safe internet use policies, protect student privacy, adhere to copyright laws, and establish student health and environmentally sound procedures. By closing this "*digital-divide*" gap, the educational leader can meet the challenges of emerging technology use.

An article entitled "*Educational Leadership in an Online World: Connecting Students to Technology Responsibly, safely, and Ethically*" wrote by Ribble and Miller (2013) strongly emphasized that school principals who lacked technology leadership can cause serious problems when they are asked to prepare educational technology environment for their schools. This is because the rapid growth of the social networks is being intensified by today's students. Usage of technologies do provide opportunities for students to express and explore ideas across all social networks but at the same time, this can also be used to victimize users. In other words, increased usage of technologies has caused the cyberbullying potential to grow exponentially. Hence, authors suggested that school principals should adopt the Digital Citizenship model as a potential new tool for their school communities to reduce technology abuse and misuse.

Brockmeier et al. (2005) conducted a survey of 268 Florida school principals to investigate the readiness and expertise of school principals with computer technology integration. The participants responded to the Computer Technology Survey, which consisted five subscales with respect to computer technology: perceptions, needs assessment, curriculum integration, professional development, and acquired expertise. The researchers found that 60% of participating school principals believed that the Technology Standards for School Administrators, TSSA could actually help in facilitating computer technology integration into instruction. In respond to the important role of the technology leader, 59% of the respondents agreed that their technology expertise resulted in them being viewed as a technology leader. However, these principals requested more professional development opportunities to explore on how to assess computer technology's influence on student achievement; how to use computer technology to collect and analyze data; how to integrate computer technology into school curricula and in their administrative or managerial work as principals but they need less professional development in understanding ethical and legal issues of computer technologies application. Besides, two-thirds of the principals (66%) reported that they spent a significant amount of time to assist teachers in integrating technology into their instruction and 76% of the principals agreed that facilitating the integration of computer technology into the curriculum was one of their important instructional tasks. While 82% of principals agreed to provide teachers release time to become familiar with the capabilities of computer technology devices, only 55% agreed to provide release time for teachers to evaluate the appropriateness of software for integrating into school curricula. Researchers assumed that this is a very important finding because teachers' familiarity with the capabilities of computer technology devices or to ascertain the appropriateness of software for inclusion in instruction is essential. Researchers believe that the computer integration will be inhibited if teachers are not provided the time to learn how to use new computer technologies in their instruction. Overall, their study revealed that while school principals recognized the importance of giving teachers time to develop their expertise require to integrate computer technology in instruction, student achievement will be enhanced.

Sharija and Watters (2012) wrote about school principals' innovative leadership in embedding ICT in Kuwaiti School. The case study examined on what technological leadership strategies are applied by the two secondary school principals whose schools have been acknowledged as had well-established ICT programs and were nominated by the MOE as the leading schools in embedding ICT into their schools. The finding identified three key strategies to maximize the impact on teachers for incorporating ICT into their instructional. These strategies included: (a) encourage teachers to integrate ICT into their teaching practices; (b) support teachers with the necessary material and human needs to meet the usage of ICT; and (c) provision of instructions and guidance for teachers in how and why ICT can be used as a tool to enhance students' learning. They also recognized that in order to achieve education technological reform, principals need to become "*learning leaders*". Hence, principals not just able to facilitate and support the uptake of ICT but also can guide and impact the appropriate technological usage to instructional reform. Besides, they constructed a model comprise of five components of effective leadership practices based on leadership literature to guide the data collection and data analysis. These five components are finance management, setting direction, building collaboration, principal agency, and developing staff. They found that school principals play the fundamental role in embedding the usage of ICT in schools, and they are responsible for providing opportunities for school development and improvement. Embedding ICT, however, required the principal to prioritize ICT requirements, and to provide ICT infrastructure, as well as to overcome the challenges of insufficient funding for the ICT embedding process. They found that the principals' practices in effectively managing financial matters have a positive influence on the ability and motivation of staff to incorporate ICT into teaching. Hence, they suggested that there is a need to link the school's budget, instructional needs, and school activities for the successful ICT embedding process. Second, the principals must be able to pursue and establish a shared vision which aligns with individual teachers' beliefs and views. By setting direction, the principals managed to motivate and inspire the school community to promote a mutual understanding and establish a positive morale to facilitate the ICT implementation. Third, building collaboration is identified as another important component influencing successful ICT implementation in this study; both principals recognized the advantages of building collaboration with the school community to effectively embed ICT. The fourth component, principals' agency, was exhibited by both principals, who lead the ICT embedding process by understanding the how and why of ICT, especially in terms of improving educational outcomes. Both principals led and encouraged the teachers, and systematized the processes so that ICT use became an integral component of the teaching and learning practices. Finally, both principals built ICT capacity and developed the school community socially and professionally in term of the fifth component related to developing staff. Based on these findings, they concluded that principals' leadership practices were recognized as the main driving force toward ICT embedding and contributed to the development of ICT use in schools.

Larson, Miller, and Ribble (2010) suggested five considerations, aligned with ISTE's NETS for Administrator, for initiating a shared vision that embeds technology integration into all aspects of teaching and learning. First, all school leaders which involved the principals, administrators, and instructional technology staff need ownership in the vision to keep the technology plan moving in the right direction. Secondly, the concepts of teaching and learning have changed drastically over the past decade. Teachers are no longer the sole providers of knowledge because information is easily accessible on the Internet. Hence, teachers need to be able to connect with their students' digital worlds to motivate and engage a very different type of learner. Third, school leaders at all levels need to identify gaps in their technology needs related to the shared vision of their schools. Action plans should reflect on current realities but also continue to move forward, toward the long-term goal. Administrators, instructional technology staff, and teachers must be able to communicate with each other about perspectives and needs. Teachers should communicate with instructional technology staff about their needs; instructional technology staff must understand those needs to support teachers in the classroom; and administrators need to be able to talk with, listen to, and act on requests from instructional technology staff and teachers. To continue improving the organization through the effective and creative use of technology resources, leaders must provide digital age leadership. Fourth, professional growth opportunities that match the vision are essential to the implementation process.

Only through consistent, ongoing and leveled professional development opportunities, users can gain the technology skills and confidence needed to teach the new literacies. Since technology raises many challenging issues for school leaders (for example, copyright and what constitutes appropriate use of Internet material), to avoid litigation, school leaders must become knowledgeable about at least the fundamental of technology-related school law (Slowinski, 2003). Finally, in order to let all users understand the social, ethical, and legal issues and responsibilities related to technology, it is the obligation of all educational leaders to lead by example. Educators can provide that information to their students as everyone needs to work together to identify and understand the appropriate and effective use of technology in education.

Based on the above review on principal technology leadership practices, researcher makes a conclusion that the five dimensions of ISTE Standards•A (2009): (i) Visionary leadership; (ii) Digital age learning culture; (iii) Excellence in professional practice; (iv) Systemic improvement; and (v) Digital citizenship, are the most important determinants of principal technology leadership practices. For each of the five dimensions, ISTE has developed three to five performance indicators that give more specific descriptions of the overall standard and this could provide school administrators with a guide to achieve the standard (Richardson et al., 2012). As applied to this study, the measurement model for each of the five principal technology leadership practices dimensions would be constructed according to the indicators provided in line with the literature reviews. Hence, this study applied the five dimensions of ISTE Standards•A to measure principal technology leadership practices in Negeri Sembilan secondary schools.

From the Leadership Development Program document, Flanagan and Jacobsen (2003), found that a five-part leadership model could be applied to describe the five roles and responsibilities of principals' to effective technology implementation. These included principals as (1) leader of learning – to encourage teachers to reflect on the continuous improvement; to provide meaningful learning opportunities for all; and improved students ability to solve problems, collaborate, and use technology to support the construction of knowledge; (2) leader of student entitlement – to ensure equitable access to technology resources and learning opportunities for all students; and to use technology in ways that support democratic principles; (3) leader of capacity building - to develop a shared vision for the use of ICT in learning; to develop leadership capacity in all members of the school community; and to establish a climate that encourages creativity, risk-taking, and collaboration; (4) leader of community – to gain community support for ICT integration; to involve parents in the decision-making process; to use technology to improve communication between school and community; and to extend students' learning beyond the school into community; and (5) leader of resource management – to provide teachers and students with the technology resources necessary for achieving the ICT outcomes; to develop a computer network that supports collaboration and inquiry; and to ensure that equipment is available to teachers and students whenever it is needed.

Alan Seay (2004) conducted a survey to examine the principals' technology leadership in Texas High School by using the NETS.A (2002) as the framework which contained six dimensions. He found that the principals demonstrated a high mean score for all NETS.A dimensions. However, the lowest mean score was Leadership and Vision dimension (Mean=3.15, S.D.=.50), and the highest mean score was Support, Management and Operations dimension (Mean=3.51, S.D.=.34). This finding indicated that principals need to improve their skills and knowledge in leadership and vision dimension so that they can lead successful technology integration into their schools. In other words, effective technology integration requires a skillful leader and has a clear vision for change. Thus, he proposed that principals need continued training in providing leadership and vision for technology integration. This was further supported by Galla (2010) who stated that leadership that supports the adaptation of change and a culture that can embrace technology are vital to the educational technology implementation process.

The effectiveness of educational technology innovations as an instructional tool fundamentally depends on the role of the school principals. Based on the mentor-mentee relationship between two categories of school principals: the practicing principal – mentor and the aspiring principal – mentee, C. Yu and Durrington (2006) used a survey instrument to investigate the principals' perceived level of competency based on TSSA (2000). The respondents consisted of 16 mentors and 57 mentees from the state of Mississippi. The result indicated that there were no significant differences between these two categories of school principals in term of their perceived competency to perform TSSA. Besides, the findings also showed that these two categories of principals perceived that their performance competencies are at the average level. The mentees rated their perceived competency to perform the Teaching and Learning dimension as the highest and the Support, Management, and Operations dimension as the lowest, whereas, the mentors rated their perceived competency to perform the Social, Legal, and Ethical issues dimension the highest and rated the Support, Management, and Operations dimension the lowest.

Using National Educational Technology Standards for Administrators (NETS.A) as the theoretical framework, Persaud (2006) conducted a study with mixed method approach to examine the school administrators' perspectives on their leadership role in the technology integration. The purpose of the study is to determine the level of proficiency of school administrators' technology leadership and the professional development they need in order to become a better technology leader. The mean and standard deviation were calculated for the ratings of each item on the survey based on the six constructs in NETS.A and rated from the most proficient to the least proficient. The results indicated these principals were most proficient on Standard 6: Social, Legal, and Ethical Issues, followed by Standard 3: Productivity and Professional Practice, Standard 2: Learning and Teaching, Standard 1: Leadership and Vision, Standard 4: Support, Management, and Operations, and Standard 5: Assessment and Evaluation. The findings revealed that these schools' administrators are proficient in technology for data management and analysis and for administrative purposes. However, they were deficient in the areas of instructional technology. Besides, the results indicated that these schools' administrators need professional development in all constructs in NETS.A. To overcome their weaknesses, he suggested that the schools' administrators should be aware of the NETS.A standards and design professional development to develop their personal competency in the area of technology integration.

This was further supported by Sears (2006) who proposed that school administrators should improve their knowledge and experience as well as the use of NETS.A in technology integration. Sears (2006) conducted a survey of 102 secondary school principals to examine their attitudes and perceptions toward technology integration and to determine their knowledge and use of the NETS.A. The correlation analysis indicated that there were statistically significant correlations between principal's attitudes and perceptions of technology integration with knowledge and use of the NETS.A ($r=.437$, $p<.01$), and principal's attitudes and perceptions of technology integration with experience and training ($r=.327$, $p<.01$). These results revealed that principals should acquire knowledge regarding NEST.A and proper experience and training in order to successfully integrate technology into their school curricula. This was further supported by Kozloski (2006) who noted that today's upcoming principals are required not to only manage the school's daily activities but also must focus on standards, data-driven decision-making, student's learning and restructuring efforts based on the usage of the latest technology.

Technology Leadership has been viewed as the correlation between technology and leadership, whereupon the leaders must play a more proactive role in implementing technology, and more specifically strive to interface the information technology components and human (Mohd. Izham & Rusnah, 2007). Based on the Technology Leadership Model proposed by Anderson and Dexter (2005) and NETS.A (2002), Mohd. Izham and Rusnah (2007) conducted a study to explore the concept of technology leadership in Malaysian education setting. Data were collected from 63 secondary school administrators in the state of Negeri Sembilan to measure the level of administrators' Technology Leadership. Their finding indicated that some of the technology leadership elements do exist in Malaysian secondary schools, but school administrators scored average on the Leadership and Vision, and Teaching and Learning dimensions and below average on the Productivity and Professional Practice dimension.

According to Redish and Chan (2007), schools that have made the most progress toward technology integration and adoption have school leaders with a clear vision of what is possible through the technology usage. These school leaders support best practices in instruction and assessment, model the use of technology, and provide professional learning opportunities for their staff. They conducted a survey to investigate the aspiring administrator's perceptions of their preparation for technology leaders in an educational leadership master's program at a large suburban university. Participants are 58 teachers who enrolled in their last semester of a master's degree program in educational leadership. The descriptive analysis result indicated that these aspiring administrators' total average perception was 3.602 out of a six-point scale. When the data were analyzed by subscale, the mean for the aspiring administrators' perception of leadership and vision was 3.645, for learning and teaching was 3.786, for productivity and professional practice was 4.014, for support, maintenance, operations, and finance was 3.137, for assessment and evaluation was 3.372, and for social, legal, and ethical issues was 3.759. While the mid-point of a six-point scale was observed at 3.5, aspiring administrators' total average perception was slightly above average. Four of the subscales' average perceptions (leadership and vision; learning and teaching; productivity and professional practice; and social, legal, and ethical issues) were rated above average. Two subscales' average perceptions (support, maintenance, operations and finance; and assessment and evaluation) were rated below average. The findings of this study clearly showed that aspiring administrators gave the educational leadership program, an overall, barely average rating in preparing them as technology leaders.

Based on the NETS.A framework, Billheimer (2007) conducted a study using mixed methods approach to examine the perceptions of the 425 West Virginia principals about the importance of technology standards, their interest in professional development and the implementation of NETS.A to ensure effective instructional technology leaders. The results indicated that the principals rated the technology standards as highly important to the principals' role as the instructional technology leader in their school. The findings showed that principals perceive teaching and learning is at the highest level of importance followed by the social, legal and ethical issues; support, management and operations; productivity and professional practice; assessment and evaluation; and the lowest dimension is leadership and vision. In addition, the results showed that these principals are interested in participating in the professional development related to the NETS.A to build their necessary capacity in leading technology implementation in their schools. Further, to be identified as effective technology leaders, these principals recognized NETS.A as important and useful guideline for the implementation of technology integration in their schools.

There are not many studies regarding principal's technology leadership that have been published in the local literature. Based on a mixed method approach, a study was conducted by Kamala (2008) on a secondary school in one of the districts in the state of Negeri Sembilan to identify the role of principal's technology leadership. She reported that the teachers perceived that their principal performing technology leader role at the average level. The results showed that the principal demonstrated above average in three out of the six dimensions of TSSA (2001) with the mean greater than the overall mean of principal's technology leadership, these dimensions are leadership and vision; teaching and learning; and assessment and evaluation. While other three dimensions have lower mean than the overall mean, these dimensions are productivity and professional practice; support, management and operations; and social, legal and ethical. She explained that the mean for leadership and vision dimension is higher than the overall mean revealed that the school principal has a clear shared vision and goals for the technology integration and a strong school's culture on ICT application in schools. The second dimension was teaching and learning dimension. This implied that the school principal is knowledgeable about the ICT integration in teaching and learning, hence, teachers are competent and confident to apply ICT in their classroom for effective instructions. The third dimension was evaluation and assessment dimension. This showed that the principal is able to evaluate and assess students' performance through the ICT usage and the principal always supervise the ICT usage among teachers' instruction practices.

Next, in a study conducted by Norazah et al. (2010) entitled "*A Quantitative Analysis of Malaysian Secondary School Technology Leadership*" to examine the technology leaders' roles among 63 secondary school administrators in Negeri Sembilan. The quantitative survey was used to measure the level of principals' technology leadership. The instrument was modified from the Principals' Technology Standard Assessment (PTLA). However, only three out of six dimensions that were stipulated in the ISTE (2002) were tested in this study. The finding showed that technology leadership elements do exist in schools and the respondents scored above average on Leadership and Vision, and Teaching and Learning dimensions, but below average on Productivity and Professional Practice dimension. Furthermore, the t-test scores revealed that there were no significant differences between male and female school administrators in all the dimensions of Leadership and Vision, Learning and Teaching, and Productivity and Professional Practice.

According to Grey-Bowen (2010), principals' technology leadership is essential to the successful technology integration in schools. Based on NETS.A as the theoretical framework, Grey-Bowen (2010) conducted a descriptive study to examine Miami-

Dade Country primary public schools principals' self-rated proficiency and perceived importance of technology leadership. Data were collected from 103 primary school principals. In respond to the proficiency aspect, these principals rated themselves as most proficient in Productivity and Professional Practices among the six dimensions of NETS.A. The second proficient dimension is Leadership and Vision followed by the third proficient dimension of Learning and Teaching. The dimension of Social, Legal, and Ethical Issues is the fourth proficient area. Results also revealed that principals are least proficient in the areas of Assessment and Evaluation and Support, Management, and Operations with both having the lowest mean score. In term of perceived importance, these principals place the highest importance in the Leadership and Vision dimension. Social, Legal, and Ethical is rated as the second important dimension followed by Learning and Teaching dimension. The fourth important dimension is Support, Management, and Operation followed by Productivity and Professional Practice dimension. Similar to their response to self-rated proficiency, the assessment and evaluation dimension also was rated as the least important dimension.

Another similar study was conducted by Rivard (2010) through a mixed-method approach to analyzing the extent to which Michigan primary school principals employed technology leadership behavior in NETS.A (2002). Quantitative data were collected from 280 primary school principals to determine how principals rated the level of importance of the NEST.A and their interest in professional development. The qualitative data were collected through in-depth interviews with ten principals to describe their training and practice for technology leadership. The findings showed that principals rated two out of six dimensions in NEST.A as very important; these two dimensions are Learning and Teaching, and Productivity and Professional Practice. The other four dimensions were rated as important and these dimensions are

Leadership and Vision; Support, Management and Operations; Social, Legal and Ethical Issues; and Assessment and Evaluation which arrange accordance to their degree of importance. In term of professional development interest, the highest score was Learning and Teaching dimension, followed by Assessment and Evaluation, Leadership and Vision, Support, Management and Operations, Productivity and Professional Practice, and Social, Legal, and the lowest score was Ethical Issues dimension.

Based on a quantitative study to examine teachers' perception of their principal's technology leadership according to NETS.A (2002) in a Day School, Leong (2010) found that the level of principal's technology leadership is at the average level (mean=2.82). However, she claimed that although the level of principal's technology leadership is at the average level, but teachers already perceived it as a positive indication that the principal is beginning to realize his technology leadership role in the integration of ICT in the school. Further analysis showed that only the social, legal, and ethical issues dimension has mean that is above average. This is quite evident as the principal is said to be always alerting the teachers about the misuse of ICT and how it can result in jeopardizing the reputation of other people. The principal is also reported to be issuing warnings as well as advice to teachers about the actions that can be taken against them for overriding copyrights of others. Besides that, the teachers are also being continuously alerted about the social, legal, and ethical issues related to technology during the professional development programs organized by the principal. Perhaps, recent reports on cyberbullying in the social media could also be attributed to his proactive actions. The second highest mean was equally shared by three dimensions (learning and teaching, productivity and professional practice, assessment and evaluation), followed by the support, management, and operations dimension. Surprisingly, the lowest mean was obtained for the leadership and vision dimension.

Similar findings were reported by Banoglu (2011), Billheimer (2007) and Alan Seay (2004) where the leadership and vision dimension showed the lowest mean. Banoglu (2011) conducted a survey to examine the elementary and secondary school principals' technology leadership competency among 134 school principals in Istanbul by adapting an instrument called PTLA. The result of Confirmatory Factor Analysis (CFA) indicated goodness of fit indices in three of the principals' technology leadership dimensions (leadership & vision, learning & teaching, and assessment & evaluation) for the data collected. Besides, the Exploratory Factor Analysis (EFA) revealed that these three dimensions able to explain 64% of total variance of the principals' technology leadership competency. The result also showed that school principals were adequate for technology leadership at a 'significant' proficiency level, these revealed that school principals have positive perception on ICT usage in education. However, these principals have the lowest level of competency for leadership & vision dimension. This finding was contradicted with few previous studies (Chang et al., 2008; Kara-Soteriou, 2009; T. J. Kowalski, 2012; Richardson et al., 2013; Ritzhaupt et al., 2008) which emphasized the importance of a vision statement in school technology integration.

Mohd Jamil (2011) conducted a study by using the same set of standard and questionnaire as Leong (2010) to investigate teachers' perception on the level of principal's technology leadership in a Smart School and found that the overall mean for the principal's technology leadership is at the average level. The descriptive statistics indicated that productivity and professional practice dimension recorded the highest mean and above the average mean. This is followed by the support, management, and operations, assessment, and evaluation, leadership and vision, teaching and learning, and the dimension that recorded the lowest mean is social, legal, and ethical issues dimension. The researcher found that majority teachers agreed that their principal sets vision for ICT application and most of them said that they have been involved in the vision setting. They are clear about the vision, and its needs for ICT integration. They also indicated that the principal can be a role model in the ICT applications. The teachers do agree that the principal uses ICT application in school meetings and professional development courses. The principal seems to be using web pages, portal or even school blog to throw out his ideas and communicates with the staff through emails and short message service. The principal also uses ICT-based management programs to access students' and teachers' personal data. Besides, the principal often sends teachers for professional development in ICT.

Duncan (2011) conducted a statewide survey to assess the Virginia principals engagement and involvement around technology issues regarding the NETS.A (2002). The findings revealed that the public school administrators are barely meeting minimum standards in five out of the six dimensions. These dimensions are Productivity and Professional Practice; Learning and Teaching; Assessment and Evaluation; Support, Management, and Operations; and Social, Legal, and Ethical Issues. The mean for the Leadership and Vision dimension was the lowest and below the midpoint of the scale, hence, researcher denoted this dimension does not meet the minimum standards. Thus, the researcher suggested that the schools of education in Virginia should modify their coursework for public school administrator preparation to identify areas of weakness.

Using NETS.A (2002) as the theoretical framework, Abd. Manaf (2014) conducted a survey of 41 principals to examine the level of principals' technology leadership of

Maktab Rendah Sains MARA. The results showed that the level of principals' technology leadership was moderate. Besides, the results also indicated that these principals showed a high level of principals' technology leadership in two out of six NETS.A dimensions (Professional Practices and Productivity, and Support, Management and Operation dimensions). While the other four dimensions (Assessment and Evaluation; Leadership and Vision; Teaching and Learning; and social, legal, and ethical issues) are at moderate level.

Another local study was conducted by Moktar (2011) to investigate the principal's technology role as a role model, change leader and staff development supporter in a religious secondary school in Kuching, Sarawak. Data were collected from 55 teachers using a set of questionnaire. The results indicated that this principal demonstrated a high level of technology leadership. A similar finding was reported by Nazri (2011), who conducted a survey to determine the level of principal's technology leadership in the ICT implementation process. Data were collected from 90 teachers in a secondary school located in Kuala Krai, Kelantan. The results indicated that the principal demonstrated a high level of technology leadership in the ICT implementation process. Besides, the multiple regression analysis showed that three of the principal's technology leadership dimensions contributed 65.6% of variance in the level of ICT implementation in that particular school. These three dimensions are assessment and evaluation, professional practice and productivity, and teaching and learning.

This was further supported by Faridah (2011), who examined the level of technology leadership practices among 96 administrators from 12 High-Performing Schools in Malaysia. By using the NETS.A (2002) as the theoretical framework to access the administrators' technology leadership practices, the result showed that the level of technology leadership practices demonstrated by these administrators was high. The Teaching and Learning dimension showed the highest mean, followed by Support, Management, and Operations, Vision and Leadership, Professional Practice and Productivity, assessment, and evaluation and social, legal and ethical dimension have the lowest mean. Her result on social, legal and ethical dimension is contradicted with Leong's (2010) finding, who found that social, legal and ethical dimension scored the higher mean among the NETS.A dimensions.

Richardson and McLeod (2011) noted that principals who serve Native American students have a unique role as technology leaders. Hence, they conducted interviews with nine principals in federally-funded, Bureau of Indian Education schools that serve Native American students to explore various topics related to technology leadership described in NETS.A (2009). They found that these principals have met various components of the NEST.A in unique ways but have missed many components of the standards entirely. Themes related to Standard 2: Digital Age Learning Culture and Standard 5: Digital Citizenship were least discussed by the school principals while themes related to Standard 1: Visionary Leadership, which includes funding and planning, were most often discussed. In general, the principals had a good grasp on technology leadership at the systems level. Most respondents spoke of fully understanding issues of funding, access, technology hardware, planning, and professional development but these leaders rarely adopted technologies for their personal use, failed to focus on technology integration at the classroom level, did not fully understand digital age learning, did not actively use technology to improve teaching and learning, and did not fully comprehend digital citizenship.

Eren and Kurt (2011) conducted a survey with 870 Turkish's primary school principals from 16 cities in Turkey to investigate principals' technology leadership behaviors regarding the supply and use of educational technologies. The instrument used in this study was adapted from the NET.A (2002) which contains six dimensions. The result indicated that generally, principals demonstrated a high level of principals' technology leadership behavior in providing supply and using of educational technologies. The school principals showed the highest mean for the evaluation and assessment dimension, followed by leadership and vision dimension, and the lowest mean for the support, management and processes dimension. It can be concluded that the school principals demonstrated a moderate level of principals' technology leadership behavior for the support, management and processes dimension and high level of principals' technology leadership behavior for all the other five dimensions in the process of supply and use of educational technologies.

By using a questionnaire as the instrument to survey about technology integration and technology leadership in Turkish elementary schools from the perspective of leadership in learning organizations, Cakir (2012) found that school administrators of schools which include principals and assistant principals showed a positive attitude towards technology integration. Besides, findings from the interviews indicated that school administrators embraced educational technology and would like to expand the usage of educational technology in their schools.

Based on a survey research design conducted with 135 Saudi Arabian high school principals to investigate the principals' technology leadership behavior regarding the supply and usage of educational technology, Alkrdem (2014), found that the principals demonstrated a high level of technological leadership behavior. In this study, the principals' technology leadership behavior was measured according to six dimensions of NETS.A (2002). The finding indicated that principals demonstrated highest mean for the assessment and evaluation dimension, followed by leadership and vision dimension, and the lowest mean for the support, management and processes dimension. Hence, it can be concluded that the school principals demonstrated a moderate level of leadership behavior for the support, management, and processes dimension while high level of leadership behavior for the other five dimensions of technology leadership.

Many studies have been conducted to measure and evaluate the level of principal technology leadership as shown in the above literature review. The researcher found that majority of these studies (Alkrdem, 2014; Banoglu, 2011; Cakir, 2012; Duncan, 2011; Eren & Kurt, 2011; Faridah, 2011; Mohd. Izham & Rusnah, 2007; Norazah et al., 2010; Redish & Chan, 2007; Richardson & McLeod, 2011; Rivard, 2010; C. Yu & Durrington, 2006) concentrated on the principals' self-rated or self-assessment about their own level of principal technology leadership. However, leadership is not a concept for self but it should be rightly perceived by the followers (Sharma, 2011). As mentioned in the earlier section, leadership is dealing with exercise of influence on others through social interaction (Bass & Bass, 2008; Bush, 2011; Northouse, 2013; Owens & Valesky, 2007; Robbin & Judge, 2013; Yukl, 2013), hence, researcher found that in order to precisely measure the level of principal technology leadership practices, it should be better rated by teachers as teachers are their direct followers (Sharma, Sun, & Sathiamoorthy, 2012). Besides, Luo (2004) stated that perceptions about principals as leaders by their teachers indicate an important dimension to evaluate the leader's capacities. This was further supported by Scott (2005) empirical study on educator perceptions of principal technology leadership competencies, who found that teachers and principals perception about principal technology leadership competencies were significantly different. Thus, this study was carried out to measure the level of principal technology leadership practices based on their teachers' perception.

There are few studies (Kamala, 2008; Leong, 2010; Mohd Jamil, 2011; Nazri, 2011) attempted to report on the teachers' perception on their principals' level of technology leadership practices. However, these studies involved a small sample size and only one principal is assessed in each case. Hence, these studies are not representative as the results obtained from the study could not be generalized to a bigger population. Thus, this study was carried out to examine the level of principal technology leadership practices in Negeri Sembilan secondary schools.

One large scale (n=1,028) study (Chang et al., 2008) has reported on the teachers' perception of the level of principal technology leadership practices in Taiwanese Elementary schools. However, their study does not apply any standard proposed by the ISTE as the basic theoretical framework; these researchers develop their own technology dimensions and technology standards for leaders in terms of school management and development from the Taiwanese context which is different from the Malaysian schools. Thus, this current study is carried out to investigate the level of principal technology leadership practices based on the latest set of ISTE Standards•A (2009). The overall mean for the five composite dimensions was defined as the level of principal technology leadership practices in Negeri Sembilan secondary schools.

Polizzi (2011) noted that school principals play a crucial role in managing information system and technology integration into instruction since they can foster teacher acceptance and use of information system at action or strategic level. Based on his survey of 95 school principals to measure their support for ICT integration in Palermo, Italy, he found that principals' support for ICT integration behaviors depends on both contextual-level and individual-level (principals' technology leadership) variables. Contextual variables include the amount of ICT equipment available for teachers in school, teachers' ICT competence, the frequency of use and teachers' attitudes towards the ICT usage. One of these contextual variables is in line with the path-goal theory of leadership (House, 1971, 1996; Northouse, 2013), which emphasized that leader should provide the necessary skills and competence to their subordinates for work-goal attainment because teachers will be motivated if they think they are capable or felt competent of performing their task. In turn, teachers' competence will improve their performance effectiveness in term of acceptance and use of SMS. Hence, teacher ICT competency is proposed as a mediator in this study.

2.3.3 Teacher ICT competency (Mediating Variable)

Technological advancement has created a greater pressure on teachers to engage with various types of technology tools in preparing, delivering, and conceptualizing their ways of instruction (Teo, 2015). However, technology usage will not be sufficiently exploited if technology end-users do not have the knowledge, competence, and spirit to incorporate and use it into their work on a daily basis (Prokopiadou, 2012). In view of the acceleration pace of technological advancement, teachers need to be constantly adapted to new technologies and refine their knowledge, skills, and competencies in order to be able to integrate technology into their classroom instruction efficiently and effectively (Pynoo et al., 2011).

In United States, Knezek and Christensen (2002) wrote about the impacts of new information technologies on students and teachers, found that teacher ICT competency is the principle determinant to influence teachers effective use of ICT in teaching. They hypothesized that the higher levels of teachers' ICT skills and competency would produce a higher level of technology integration into the classroom. The authors also emphasized that successful technology integration in any education setting required teachers' willingness and competence to handle those technologies. Thus, teacher ICT competency has been viewed as the critical factor that affects teachers' decision about their classroom practices (Varol, 2013).

However, a significant impediment to the successfulness of technology integration is teacher limited access to appropriate ongoing professional development. Many teachers have lacked meaningful opportunities to acquire the competency needed to meet the ICT outcomes (Archibong, Ogbiji, & Anijaobi-Idem, 2010; Flanagan & Jacobsen, 2003). To be able to integrate technology into the curriculum, teachers must possess certain amount of technology competencies and technology must be rooted in curriculum goals and integrated with subject matter content technology (Franklin & Bolick, 2007).

Teachers are expected to be on the frontline of educational technology reform, hence in order to ensure that teachers are able to integrate technology into their instructional practices to enhance students' learning, the groundwork must be laid at the pre-service teacher's level (W. Chen, Lim, & Tan, 2010; K.-T. Wong, Teo, & Russo, 2012). Since ICT competency development for educators is paramount, several states in United States have passed mandates on teacher ICT competency; for example, Idaho and North Carolina have launched a plan which requires teachers to demonstrate technology competent for certification and licensure (Slowinski, 2003). At the same time, United States Department of Education has provided hundreds of "*Preparing Tomorrow's Teachers to Use Technology*" grants to consortia of teachers training colleges and local education agencies with the aim to change the way teachers are trained and to prepare them to integrate technology into their instruction (Brent, Brawner, & Dyk, 2002). In Hong Kong, all new teachers must achieve an IT Benchmark when they graduated from teacher training institutions to make sure that the future teachers will be able to apply ICT in their teaching and learning (Han, 2002).

Galanouli, Murphy, and Gardner (2004) noted that in order to convince teachers that ICT should be integrated as part of their teaching practices, various approaches have been tried. One of the prominent approaches is the dissemination of good practice through appropriate training programs designed to raise teachers' competence levels and foster teachers' positive attitudes towards the usage of technology. Based on their survey of 450 teachers in Northern Ireland schools, the results indicated that the "*New Opportunities Fund*" training for all United Kingdom teachers has had a measure of success in increasing teachers' competence and confidence in using computers in their teaching.

Another study was conducted by Wetzel and Williams (2004) to evaluate the "*Preparing Tomorrow's Teachers to Use Technology*" project which aimed to improve pre-service teachers' technology usage. The results of their analysis revealed that massive technology use aligned with the National Educational Technology Standards for Teachers (NETS.T) by their faculty members in their courses appeared to be an important contributor to pre-service teacher abilities to integrate technology into their instruction.

W. Chen et al. (2010) noted that the rapid development of ICT has greatly affected the way young generation interact, work and socialize. In order to gather the baseline data on new generation pre-service teachers' technology experiences and competencies, the researchers conducted a survey of 1,554 young Singaporean pre-service teachers. The results clarified that ICT has permeated all aspects of lives in the new generation pre-service teachers. These teachers are comfortable with a core set of ICT applications such as email, chatting, networking, watching video, listening to music, reading online news, searching online information and using productivity tools but are less comfortable with the specialized technologies and only minority of them are engaged in content creation activities using multimedia tools. The results revealed that these pre-service teachers perceived themselves as competent in using ICT applications for networking, communication, and media consumption but unfamiliar with creating or editing digital images, audio and video files. In term of using ICT for teaching purposes, the results showed that pre-service teachers are very familiar with presentation software and communication tools for teaching but they tend to be unfamiliar with storyboard or comics creation tools, virtual learning, and conferencing platforms. Nevertheless, these pre-service teachers perceived their ICT competency for teaching is lower than their perceived ICT competency for everyday use. This indicated that the pre-service teachers are not well prepared for the effective ICT integration in their instruction.

The use of ICT as a tool within the school context includes use for school management and administration; teaching and learning of ICT related skills for enhancing the instructional presentation; teaching and learning repetitive tasks; teaching and learning of thinking, intellectual and problem-solving skills; stimulating creativity and innovative; for teachers and students research; and as a communication tool (Yusuf & Balogun, 2011). Since the use of ICT as a tool for enhancing students' learning, teachers' instruction, and as a catalyst to improve the access to quality education has become a necessity, another survey was conducted by Yusuf and Balogun (2011) to examine Nigerian pre-service teachers' competence and attitude towards ICT. Data were collected from 382 Nigerian pre-service teachers. The results indicated that majority of the pre-service teachers demonstrated positive attitudes towards ICT usage and they perceived themselves as competent in the usage of few basic ICT tools. According to the authors, this positive attitude is an important indicator of the pre-service teachers' willingness and the first step in effective ICT integration into instruction. However, their findings also revealed that majority of the pre-service teachers' are lacked necessary competence in various ICT applications and equipment operations that are important to support and enhance their instructional practices. Hence, they couldn't fully utilize or integrate ICT into their curriculum. This finding is in line with W. Chen et al. (2010) who also noted that the Singaporean pre-service teachers are not well prepared for the effective ICT integration in their instruction.

With the integration of ICT into the education system, teachers will have new roles to play, such as introducing instructional technology into their teaching goal. Besides, teachers should be encouraged to create or design more technology-based activities, and share information and strategies dealing with instructional technology among their communities so that they will collectively gain a better understanding of the new digital era technology (Sa'ari, Wong, & Roslan, 2005b). It was clearly acknowledged that the appropriate use of technology already characterizes successful practice on students engagement in authentic learning experience (Flanagan & Jacobsen, 2003). Moreover, technology integration best practices also identify engaged student learning and authentic performance assessments through multiple modes of expression as the key components in the ideal learning environment (Kozloski, 2006).

This was further supported by Varol (2013) who noted that effective use of ICT has a critical role in successful student learning. These modern ways of learning are able to extend beyond the classroom setting through online collaboration, research and communication, and sometimes with experts in the field. Hence, teacher's roles change from who controls the dissemination of knowledge to that of a wise mentor who supports students as they construct their own meaningful learning. Such changes required teachers to be more careful about what type of learning objectives to achieve, which content need to be covered, which strategies are suitable to be employed, which technological resources and tools need to be used to enrich their instruction, and so on (Varol, 2013).

A large-scale survey (N=2,156) was conducted by Barron, Kemker, Harmes, and Kalaydjian (2003) in one of the Florida school districts to investigate teachers' use of technology in the classroom. Based on teachers' instructional modes related to technology integration as outlined in the National Educational Technology Standards (NETS), four out of six areas of technology competencies in NETS were selected as focal points for the study. These four domains are technology research tools, technology productivity tools, technology communicational tools, and technology problem-solving and decision-making tools. The results indicated that more than half of the respondents were using technology as a classroom communication tools whereas smaller percentages were reported for technology integration as a research, productivity, and problem-solving tools.

According to Jo Tondeur, van Braak, and Valcke (2007), ICT has a noticeable impact on the educational curricula development. In order to define a framework of the ICT competencies related to the skills, knowledge, and attitudes that students are expected to achieve during their primary education, The Flemish MOE has formulated an ICT competencies framework with three clusters of competencies. The central ICT competencies are focused on the learning process which empowers students to use ICT in a functional way like co-operating on an assignment; presenting and communicating information; creating, practicing and independent learning; and collecting and processing of information in such a way that they fit into their learning process. The second cluster of competencies is the technical competencies or operating skills, such as being able to use the computer, peripheral equipment, the technical system, and software. The third cluster of competencies comprises the social and ethical dimension of the ICT usage. A survey was conducted among 570 teachers from 53 primary schools to examine whether teachers are using ICT in accordance with the ICT competencies framework proposed by their government. The results showed that teachers focus on the development of the operating skill while social and ethical competencies and ICT competencies related to the learning process gain significantly lower priority level. The main finding of this study revealed that teachers in primary education still stress to a large extent on technical skills while less emphasize on the ICT competencies for supporting the learning process, and social and ethical dimensions. The use of ICT in education has caused a significant change in communication, operations, planning, management, curriculum, and decision-making. Hence, teachers must also focus on safety, legal, and ethical behaviors as they pertain to use instructional technology (Raob, Al-Oshaibat, & Ong, 2012).

Researcher found that majority of the prior studies still concentrate on teachers' perceived competency in basic computer application like spreadsheets, word processing, presentation tools, statistical tools, e-mailing, internet browsing, and teaching courseware (Buabeng-Andoh, 2012a; B. T. Lau & Sim, 2008; Slaouti & Barton, 2007) but less emphasize on the advance ICT competencies. In recent years, there has been a shift in the focus of teacher ICT competency from the basic or technical computer skills to the pedagogical aspects of ICT competencies (Markauskaite, 2007). At the same time, literature also indicated that the components needed for successful educational technology integration in the 21st century which include a list of competencies such as global awareness, understanding new sources of information, creativity, and social skills (Raob et al., 2012).

Markauskaite (2007) noted that there is a growing concern about the insufficient level of ICT competency among pre-service teachers. Hence, she conducted a survey to explore and identify the main components of pre-service teacher ICT competency. Based on the self-rated ICT competencies data collected from 122 pre-service teachers, the CFA yielded two areas of ICT competencies which are general cognitive competency and technical competency. General cognitive competency comprised of two elements which are problem-solving, and communication and metacognition while the technical competency comprised of three elements which are basic ICT competencies, analysis and production with ICT, and information and Internet related competencies. She found that general cognitive and technical competencies are two separate areas of ICT competency. However, in line with Jo Tondeur et al. (2007), she also reported that the basic ICT competencies which is one of the elements of the technical competency are an important component of pre-service teacher ICT competency.

According to Peciuliauskiene and Barkauskaite (2007), ICT competency could be categorized into two structural components which are basic and educational ICT competence. The basic competence includes the ability to use and manipulate ICT; and knowledge and skills about social, legal, and ethical ICT-related issues. The educational ICT competency includes the ability to apply ICT in educational practices and to develop learners' ability to plan, operate, and analyze the process of instruction. The researchers found that these two structural components are disclosed in the NETS.T. Their findings indicated that the pre-service teachers have fully mastered some of the basic and educational ICT competencies like working with text, using electronic databases, and producing visual instructional material.

In order to establish a set of Information Literacy Competence Standard for Taiwanese primary and secondary schools' teachers, Wen and Shih (2008) conducted two round-table discussions with ten experts and employed three rounds of Delphi Technique to establish this standard. Three dimensions of teacher ICT competency were identified based on NETS.T. These dimensions are knowledge, skills, and attitudes. The knowledge dimension comprised of 2 standards which are information professional literacy (with two indicators – computer and network; and ethics issues) and integration IT into instruction (with three indicators – plan learning environment; curriculum management; and evaluation). The skill dimension comprised of 2 standards which are IT application skills (with three indicators – computer application; network application; and multimedia application) and integration IT into instruction (with two indicators – instruction management; and curriculum integration). The attitude dimension has three standards which are IT cognition (with two indicators – acceptance attitude; and ethics attitude), IT learning (with only one indicator – use IT to learning), and IT application (with two indicators – use IT into instruction, and use IT to communication).

Teachers must be equipped with adequate ICT competencies in order to use ICT effectively in their daily works. In line with Wen and Shih (2008), Goktas et al. (2009) also noted that both teachers' ICT competencies in term of basic and advanced competencies and how teachers perceive the role of ICT (attitudes) in carrying their daily works are the most important determinants to the successfulness of educational technology integration process. Since the demand for teachers with high ICT competencies increased drastically, Goktas et al. (2009) conducted a large scale (N=1,429) survey to investigate the perceive level of Turkish secondary school teacher ICT competency based on the NETS.T. Their findings indicated that majority of the teachers do not perceive themselves as competent in both basic and advances ICT competencies. Basic competencies are related to basic computer operation, and the use of an array of software that supports and enhances professional productivity, whereas, advanced competencies extend the application of basic competencies to teaching, administration, and other professional activities. The results also revealed that majority of the teachers were at the moderate level regarding both basic and advances ICT competencies. This finding showed that teachers perceive themselves to be less competent in integrating ICT into their instruction, or teachers are taught and trained in basic ICT applications rather than in advanced ICT applications. The researchers suggested that teachers not only must learn how to use ICT but also must know how to integrate it into their future instruction. Besides, teachers demonstrated higher mean than the overall mean in few of the basic ICT competencies subscales. These include the use of the operating systems; identify legal, ethical, and societal issues related to the use of ICT; and use of word processors for personal and institutional purposes. In the advanced ICT competencies cluster, teachers demonstrated higher mean than the overall mean in the subscales such as use of communication tools to support instruction; use of ICT to enhance personal development; use of ICT to support instruction out of classroom; use of ICT to support instruction process in classroom; use of computer-aided instruction materials; and use of ICT in assessment process.

In order to determine the factors contributed to teacher ICT competency, Raob et al. (2012) conducted an exploratory factor analysis of the data collected from 317 secondary school teachers from Islamic private schools in Pattani province of Thailand. The factor analysis yielded three factors which explained 30.33% of the total variance on teacher ICT competency. These factors are basic technology operation, personal use of technology tools and instructional technology. The basic technology operations include opening and closing applications; printer setup and selection; install or uninstall software; changing desktop settings; and keyboard shortcuts. The personal use of technology tools includes Microsoft Word; Microsoft Excel; Microsoft PowerPoints; Microsoft Access; and E-mail software. While the last factor related to the instructional technology usage such as website and web-board; database; Computer Assisted Instruction; music and movie CD; and Facebook and YouTube. The results of the descriptive analysis revealed that teachers demonstrated the highest level of ICT competency in instructional technology followed by basic technology operation while demonstrated lowest level of ICT competency in the personal use of technology tool.

Bukaliya and Mubika (2011) conducted another study to examine the Zimbabwean secondary school teacher ICT competency. The data were collected from 120 secondary school teachers through the use of questionnaire and competence practical test. The results from the practical test indicated that majority of the teachers were unable to use the basic computer software to deliver their instruction. Besides, the findings also revealed that teachers do not have the necessary skills and knowledge related to computer usage.

Similar findings were reported by Badau and Sakiyo's study (2013) who carried out a survey to assess the Nigerian secondary schools ICT teachers' competency for the implementation of ICT curriculum. The data were collected from 1,744 secondary school teachers from six states of the North Eastern Nigeria using a questionnaire. Their results indicated that these ICT teachers demonstrated a low level of competency on policy, pedagogy, curriculum, administration, technology, and professional development in the implementation of ICT curriculum. Since The Federal Government of Nigeria aggressively promotes ICT as an instrument for the attainment of quality education, another study was conducted by Omoniyi and Quadri (2013) to examine the Nigerian secondary school teacher ICT competency in term of basic computer competency. Their findings also revealed that majority of the secondary school teachers in Ogun State, Nigeria do not have the required ICT competency. Hence, the researchers suggested that the present batch of teachers needs to be retrained to improve their ICT competency.

Another study was conducted by Solesa and Solesa-Grijak (2011) to identify the teachers' current ICT competency in the Republic of Serbia. Their findings showed that teachers' demonstrated moderate level of competency in knowing computer as a data processing machine; using of software applications; understanding and knowing the functions of applicative software; using the internet; using the educational programs and educational web portal; using the digital material; and using the web applications and social software, while demonstrated high level of competency in participating in on-line communication and on-line learning; distinction of teaching contents in educational software; and using the possibility of interactive teaching. Their findings are different from the prior studies (Goktas et al., 2009; Markauskaite, 2007; Jo Tondeur et al., 2007) who claimed that teachers' demonstrated a higher level of basic ICT competency than the instructional ICT competency.

It was clearly acknowledged that effective teaching requires appropriate use of ICT resources to enhance students' learning (Ertmer & Ottenbreit-Leftwich, 2010). According to Cennamo, Ross, and Ertmer (2014) teachers need to possess certain competency in order to effectively integrate ICT into their instructional practice, teachers need these competencies to enable them to:

(i) identify which technologies are needed to support specific curricular goals;
(ii) specify how the tools will be used to help students to meet and demonstrate those goals;
(iii) enable students to use appropriate technologies in all phases of the learning process including exploration, analysis, and production; and
(iv) select and use appropriate technologies to address needs, resolve issues, and solve problems related to their own professional practice and growth.

Since, teacher ICT competency is a trendy theme (Badau & Sakiyo, 2013; Bukaliya & Mubika, 2011), this study is very critical due to the change in the definition of good teaching – that is "*teaching that facilitates student learning by leveraging relevant ICT resources as meaningful pedagogical tools*" (Ertmer & Ottenbreit-Leftwich, 2010, p. 277). Such change in definition leads other changes in teachers' knowledge and skills related to ICT. Thus, the definition of teacher ICT competency also changes accordingly.

In this study, teacher ICT competency is defined as the skills and knowledge educators need to teach, work and learn in an increasingly connected global and digital society. NETS.T is a blended concept of ICT competency which integrated technical competency (basic skills to use the ICT tools) with the cognitive competency of problem-solving and information processing (Markauskaite, 2007). This was further supported by Peciuliauskiene and Barkauskaite (2007), who found that the two structural components - basic and educational ICT competencies are disclosed in the NETS.T. When comes to technology usage, The ISTE (2008) also suggested that school teachers should have three areas of competency, these are: (1) basic knowledge of operations and concepts in using computer technology; (2) knowledge of using technology for personal or professional development; and (3) knowledge of using instructional technology (Jang & Tsai, 2012).

Recently an attempt to develop the ICT competency standard for Malaysian Science and Mathematics teachers has been carried out by Fong et al. (2013). These researchers noted that since many previous surveys highlighted the inadequate of the ICT competencies training programs to meet teachers' needs, the development of an ICT competency standard is a necessity and timely to serve as a guideline for the training programs. They also emphasized that the failure of these ICT training programs might be due to the lack of uniformity and the curricula content were designed according to the organizers' view without following any ICT competency standard (i.e. NETS.T). Hence, a corrective action is urgently needed. The research design used for developing this set of ICT competency standard is Delphi technique. The researchers decided to focus on six main categories of teacher ICT competency in designing the draft which include: (1) Knowledge in ICT Operation; (2) Planning and Designing Learning Environment; (3) Smart Pedagogy; (4) Assessment and Evaluation; (5) Lifelong

Learning, Practice and Productivity; and (6) Social, Moral Values and Issues. The NETS.T (2000) and ISTE Standard.T (2008) were selected as the fundamental framework to outline the statements of competency standard indicators. The results indicated that a total of 17 indicators achieved high importance rating and high consensus level. It was found that all the four indicators that were proposed under Lifelong Professional Learning, Practice, and Productivity are regarded as important competencies for Science and Mathematics teachers. These indicators are - used ICT to engage in ongoing professional development and lifelong learning; continuous evaluation and reflection on the use of ICT that support meaningful learning; apply ICT for "*just-in-time learning*" to enhance productivity; and use ICT to communicate and collaborate with colleagues, parents, and other communities to nurture student learning. Besides Lifelong Professional Learning, Practice, and Productivity, the findings showed that teacher ICT competency emphasized on another two categories which are Planning and Designing Learning Environment with four indicators that achieved high importance rating and high consensus level (Design and prepare suitable and relevant ICT integrated lessons to cater students' diverse needs; select and evaluate appropriate curriculum material; plan the usage and management of curriculum material in lesson activities; and plan strategies to integrate ICT in lesson activities and manage student learning), and Social, Moral Values and Issues also with four indicators that achieved high importance rating and high consensus level (Understand the moral and ethical issues concerning the usage of ICT; Inculcate and practice moral values regarding ICT application; promote and support safe and healthy use of ICT tools; and provide all students with fair equitable access to ICT resources). This was followed by another two main categories of teacher ICT competency that have two indicators achieved high importance rating and high consensus level, these included Knowledge in ICT Operation (Show understanding and application basic

ICT-related concepts and skills; and demonstrate constant development and enhancement in the latest ICT-related knowledge and skills), and Assessment and Evaluation (Apply ICT assessing student learning of subject matter using variety of assessment techniques; and apply evaluation criteria to assess students learning, communication, and productivity). Only one of the indicators indicated as highly-importance with high consensus level for the Smart Pedagogy, this indicator is - use ICT-assisted instruction to enhance students' meaningful learning. There are seven indicators which achieved high importance rating with moderate consensus level are take into consideration too. All these indicators are listed under four main categories of teacher ICT competency, such as Planning and Designing Learning Environment (with one indicator – referred to contemporary ICT-related educational research in the preparation of lesson plans); Smart Pedagogy (with four indicators – employ ICT to support students' diverse needs in self-paced, self-assessed, and self-directed strategies; apply ICT to develop critical and creative thinking skills; manage student learning activities in an ICT instructed environment; and integrate ICT in various instructional strategies); Assessment and Evaluation (with one indicator – apply ICT to generate data on students' achievement, to interpret results and communicate findings, so as to improve instructional practice and to maximize students' learning); and Social, Moral Values and Issues (with one indicator – identify and discuss the impact of ICT on the society). The researcher found that the development of teacher ICT competency standard using the Delphi technique is valid and reliable, hence, some of the indicators in Fong et al.'s study (2013) were adapted for the construction of the measurement model for each of the dimensions of teacher ICT competency in this study.

Besides, according to Wen and Shih (2008), NETS.T developed by the ISTE is a well-known standard and most adopted. Moreover, researcher felt that the constructs reported by the prior researchers (Jang & Tsai, 2012; Markauskaite, 2007; Peciuliauskiene & Barkauskaite, 2007; Raob et al., 2012; Jo Tondeur et al., 2007) need to be taken into account to measure teacher ICT competency. Furthermore, the NETS.T also acknowledged the importance of developing and accessing competencies in the authentic context of teachers' work. Hence, the latest version of ISTE Standards•T (2008) was used to measure teacher ICT competency in this study. This standard consists five dimensions which are: (i) Smart Pedagogy; (ii) Digital age learning experiences and assessments; (iii) Digital age work and learning; (iv) Digital citizenship and responsibility; and (v) Professional growth and leadership. The overall mean for these five composite dimensions was defined as the level of teacher ICT competency in Negeri Sembilan secondary schools.

In Jo Tondeur et al.'s (2007) study regarding the integration of ICT competency framework in Flemish primary education, the study revealed that government-imposed ICT competencies do not automatically result in changes in classroom practices. Buabeng-Andoh (2012a) also found that majority of the teachers in public second-cycle schools in Ghana were moderately competent in the word processor, spreadsheet, presentation, search engines, and communication. This showed that teachers have not mastered many ICT's applications skills.

In another study conducted by Varol (2013) to identify the relationship between primary school teacher ICT competency with their attitudes towards technology usage. The result showed that the level of teacher ICT competency is very low. From the perspective of life-long learning, Husa (2010) also found that the level of teachers' ICT competencies is low. However, he noted that information technology was implicitly or explicitly significant in all roles and tasks that teachers need to play in their routine works. Hence, he suggested that further development of these ICT competencies through life-long learning is a necessity.

Furthermore, teachers who successfully using ICT in their work process do not only enhance their students learning outcome, but also benefit personally from work productivity, communication, and increased professional satisfaction (Archibong et al., 2010). Hence, teachers play a crucial role in the adoption, development, and implementation of any educational innovations. Based on a survey research design to examine teacher ICT competency and ICT usage challenges, Archibong et al. (2010) found that majority (53.3%) of the teachers rated their ICT competency level as low, only 6.7% of the teachers rated their ICT competency level as high and 40% of the teachers rated their ICT competency as moderate.

Besides, there were few local studies have been conducted to examine the level of teacher ICT competency in Malaysia context. Yuhanis (2002) conducted a survey to determine the level of teacher ICT competency on three different dimensions - basic computer usage, basic computer software usage, and information technology usage. Data were collected from 50 teachers in a secondary school located in Kuala Lumpur. Her findings indicated that 66.4% of the teachers are either at the level of "*not competent*" or "*limited competent*" regarding the computer usage.

Based on a mixed method approach, Norizan (2003) conducted a nation-wide study involving 1,123 teachers from 274 secondary schools in Peninsular Malaysia to investigate the level of teachers' computer competency. The Delphi process identified eight categories of teachers' computer competency which are Knowledge of Computer and Social Impact; Operational Basics; Basic Internet; Computer Assisted Learning and Teaching; Web-Based Teaching and Learning; Computer Mediated Communication; Computer Assisted Management; and Evaluation and Assessment (Norizan & Mohamed Amin, 2004). Besides, the results showed that teachers self-rated themselves as having a low level of competency in Computer Mediated Communication followed by Web-Based Teaching and Learning. At the same time, respondents rated themselves as having a low competency level in Computer Assisted Management, and Evaluation and Assessment. The Overall findings of the study revealed that 10.3% of the teachers are at a high competency level, 38.0% of the teachers are at the moderate level and 52.2% of teachers are at a low competency level.

Sa'ari, Wong, and Roslan (2005a) also conducted a mixed method study to investigate the level of teachers' ICT integration into their classroom instruction based on the extent of their level of knowledge, skills, and attitudes in Hulu Langat, Selangor. The results showed that teachers demonstrated a low level of knowledge and skill towards ICT integration into their classroom instruction. However, majority of the teachers showed positive attitudes towards that ICT integration into their classroom instruction. Besides, these teachers agreed that the quality of instruction could be enhanced with the appropriate use of ICT.

Another survey was conducted by Sa'ari et al. (2005b) to measure teachers' attitudes and perceived competency towards information technology. The respondents are 160 in-service secondary school teachers from three Malacca schools. Their findings indicated that majority of the teachers possess positive attitudes toward information technology and most of the teachers (55%) showed a moderate level of information technology competency. The dimensions measured were basic computer operation skills, work processing, preparing spreadsheets, and telecommunication. However, the participants have a low level of competency in media communication. The researchers suggested that proper computer training courses in media communication are needed since most of the teachers were unable to perform this task. Besides, they also found that teachers who demonstrated a high level of information technology competence were able to advocate others how to perform computer tasks.

A similar finding was showed in a study conducted by Maseli (2005) to investigate the level of teacher ICT competency in two government secondary schools in the district of Lundu, Sarawak. Based on the data collected from 87 secondary school teachers, the results indicated that teachers demonstrated a moderate level of knowledge and skills related to the ICT usage. Another study was conducted by Ting (2007) in four secondary schools in the district of Sarikei, Sarawak also showed similar result, where data collected from 181 teachers showed that these teachers have a moderate level of ICT competency. In line with these two findings, Moktar (2011), who conducted a survey of 55 teachers in a religious secondary school in Kuching, Sarawak also found that respondents demonstrated a moderate level of ICT competency.

According to Hoo (2007), the increasing availability of ICT has provided many exciting opportunities for teachers to transform their pedagogical practices from the traditional way of teaching to the modern way of teaching. However, this transition required teachers to be competent in ICT to enable it to take place successfully. Hoo (2007) noted that study on the level of teacher ICT competency will help to identify what can be done to move teachers to a higher level of competency. Hence, she conducted a study on 230 public secondary school teachers in eight schools located within Bangsar Zone, Kuala Lumpur to examine the teachers' perception regarding their self-ICT competence. Her findings indicated that teachers demonstrated a moderate level of ICT competency. Moreover, teachers reported that they are competent in operating basic computer task but not competent in operating more advanced computer task.

Harin Hafian (2011) also conducted a similar study to examine the level of teacher ICT competency in a vocational secondary school located in Shah Alam, Selangor. Based on the data collected from 80 teachers, the findings showed that these teachers demonstrated a high level of ICT competency.

Recently there is a correlation and quantitative study conducted by Tasir, Amin Abour, Abd Halim, and Harun (2012) published in The Turkish Online Journal of Educational Technology entitle "*Relationship Between Teacher ICT competency, Confidence Level, and Satisfaction Toward ICT Training Programmes: A Case Study Among Postgraduate Students*". Data were collected using a questionnaire from 184 postgraduate students, who are currently teachers in Malaysian schools. Their findings showed that Malaysian teachers demonstrated a high level of ICT competency, the confidence level in using ICT, and satisfaction towards ICT training programs. High level of ICT competency implied that majority of the Malaysian teachers are able to use most of the ICT tools and resources such as preparing presentation slides for their lessons, searching information from the internet, designing simple websites etc. High level of confidence in using ICT revealed that teachers are able to use appropriate ICT tools and resources into their instructional process. Besides, their findings also revealed that there was a significant strong positive correlation between teacher ICT competency and teachers' confidence level in using ICT ($r=.749$, $p<.01$).

This was further supported by the Umar and Mohd Yosoff's (2014) finding, who conducted a large-scale survey which involves 2,661 secondary and primary schools teachers throughout Malaysia to investigate the levels of Malaysian teacher ICT competency. Teacher ICT competency was categorized into four skills which are (1) Basic ICT skills; (2) Advance ICT skills; (3) Internet skills for information seeking or sharing; and (4) Internet skills for communication. Their findings indicated that teachers are 'highly skilled' in three out of four skills on teacher ICT competency. These three skills are Internet skills for seeking and sharing of information; Basic ICT skills; and Internet skills for communication. Besides, teachers demonstrated a moderate level of competency in Advance ICT skills. These findings revealed that Malaysian school teachers are competent in Basic ICT skills such as word processing, spreadsheet, and slide presentation; Internet application for seeking and sharing information; and Internet application for communication. However, these teachers claimed that they lacked some competencies in Advanced ICT skills like graphics, animation, and multimedia production. Hence, researchers suggested that teachers should be exposed to the training related to the advanced ICT skills.

Since technological development is changing rapidly but quickly becomes obsolete, teachers require new knowledge and skills to be mastered frequently (Tasir et al., 2012). In order to keep abreast with the contemporary technologies (Badau & Sakiyo, 2013), ongoing research regarding the level of teacher ICT competency is needed for related authorities to plan and design suitable professional development which suits with teachers' need. Besides, the literature also indicated inconsistency level of teacher ICT competency in Malaysia context, hence, this study was carried out to access the current level of teacher ICT competency in Negeri Sembilan secondary schools based on ISTE Standard•T (2008).

2.3.4 Teacher demographic Variables (Moderating Variable)

Literature indicated that respondents’ demographic could make a difference in their perception of educational issues (Redish & Chan, 2007). Based on the literature reviews mapping drew by the researcher regarding teacher demographic variables, the researcher found that demographic variables such as gender, age, teaching experience, educational level, and experience in using computer could influence teacher acceptance and use of information system (Afshari, Kamariah, Wong, Bahaman, & Foo, 2009a; Buabeng-Andoh, 2012b; Nagamani & Muthuswamy, 2013; Norhayati, 2000; Schiller, 2003; Venkatesh et al., 2003).

Based on a study conducted by Niederhauser and Stoddart (2001) to examine the relationships between teachers' instructional perspectives and their effective use of the instructional software. Their finding indicated that there was a significant difference in software use between male and female teachers. The female teachers reported using skill-based software more that the male teachers. However, in the usage of a combination of skill-based and open-ended software, male teachers reported higher usage than the female teachers. Besides, the female teachers reported lower usage in open-ended software if compared to the male teachers. Their findings showed that years of teaching experience did not significantly differentiate the types of instructional software used among teachers.

In order to develop an instructional technology profile of Virginia and North Carolina secondary agricultural education teachers, Alston, Miller, and Elbert (2003) conducted a correlation study to determine which selected demographic and program variables could be utilized. However, their findings showed that all the demographic variables such as gender, age, educational level and teaching experience were found to be not significant indicators to develop the instructional technology profile.

Another quantitative study was conducted by Maseli (2005) on 87 secondary school teachers in two government secondary schools in the district of Lundu, Sarawak to examine the effect of teachers' gender, age, level of education and teaching experience on teachers' ICT application in teaching and learning management. The t-test and ANOVA analysis indicated that there are no significant differences in term of teachers' gender, age and teaching experience with teachers' ICT application in instructional management. However, the t-test analysis showed that there is a significant difference in teachers' level of education with teachers' ICT application in instructional management. This result revealed that non-graduate teachers demonstrated a higher level of ICT application than the graduate teachers.

Based on a study conducted by Gorder (2008) to determine teachers' perception of instructional technology integration into the classroom. The findings showed that teachers who use technology regularly are more likely to integrate technology into their instruction. However, the results also indicated that there were no significant differences existed for technology use and integration based on gender, age, teaching experience, and educational level.

Hence, based on instructional technology usage literature mentioned above, the researcher concluded that study conducted by Niederhauser and Stoddart (2001) indicated that gender does have effects on teachers' instructional technology usage.

But the extent of instructional software usage differences varies according to the type of software. This was further supported by Wozney et al. (2006), who found that male school teachers reported using computers for "*analytic, communicative, creative, and expansive*" purposes significantly more than females teachers. On the other hand, female teachers reported using computers for "*instructional*" purposes significantly more than male teachers. On contrary, studies conducted by Alston et al. (2003), Maseli (2005), and Gorder (2008) revealed that gender does not have effects on teachers' instructional technology usage.

Based on TAM as the theoretical framework, Yuen and Ma (2002) and Ma and Yuen (2006) conducted a study to explore the gender differences in teacher computer acceptance. Data were collected from 186 pre-service teachers who enrolled in the one-year full-time teacher education program at the University of Hong Kong. The results showed that there was a significant difference in teachers' computer acceptance in term of gender. The findings showed that perceived usefulness (performance expectancy) and perceived ease of use (effort expectancy) will influence intention to use computers more strongly for females than males, and perceived ease of use (effort expectancy) will influence perceived usefulness (performance expectancy) more strongly for males than females.

In order to explore the role of gender and computer teaching efficacy on the teachers' technology acceptance (TAM) in an educational context, K.-T. Wong et al. (2012) conducted a survey of 302 pre-service teachers to measure their responses to computer teaching efficacy, perceived usefulness, perceived ease of use, attitude towards computer usage, and behavioral intention. The results indicated that gender is a significant moderator for computer teaching efficacy with perceived usefulness, perceived ease of use, and attitude towards computer usage. However, the gender does not have moderating effects on perceived usefulness with behavioral intention, perceived usefulness with attitude toward computer usage, perceived ease of use with attitude toward computer usage, and attitude toward computer usage with behavioral intention. This finding is contrary with Yuen and Ma (2002) and Ma and Yuen (2006) findings.

Adams (2003) conducted a study to examine teachers' concerns related to the technology integration into their teaching practice and compares these concerns and the level of technology integration with teachers' demographic variables. The results revealed that teacher demographic variables such as gender, age, and teaching experience correlate with teachers' concerns and level of technology integration. The results indicated that younger female teachers with less teaching experience expressed higher order of concerns and higher level of technology integration into their teaching practices.

Another quantitative survey was conducted by van Braak, Tondeur, and Valcke (2004) to investigate the factors affecting different types of computer use. The determinants such as demographics (gender and age), computer experience (computer experience expressed over time, computer training, intensity of computer use), and attitude measures are measured related to the use of computer as a supportive tool (administrative task) and the classroom computers usage. Based on the data collected from 468 primary school teachers, these researchers found that both supportive computer use and classroom use are significantly related to the demographic variables, the computer experience variables, and the attitude measures. The results of the path analysis indicated that classroom use of computers is not age related. Gender, however, seems to have a significant effect on classroom use of computers. Male teachers, as opposed to their female colleagues, reported to integrating computers more often. Computers are intensively used for professional support by those who have more years of computers experience, those who are frequent computer users and those who have high experience with computer training.

Based on the results of a survey conducted by Hernandez-Ramos (2005) to examine teachers' technology usage in Santa Clara Country, California. The results showed that male teachers had a significantly higher mean than the female teachers in the technology usage. Besides, age and years of teaching experience also seem to influence teachers' attitudes towards technology integration. Researcher expected that the younger teachers, with less teaching experience, but probably more technological savvy, would demonstrate a greater technology integration. However, the findings revealed oppositely, where the elderly and more experienced teachers showed greater willingness to integrate technology into their instruction.

Jamieson-Proctor, Burnett, Finger, and Watson (2006) conducted a study to examine teachers' ICT integration in 38 schools in Queensland State, Australia. Analysis of the data collected from 929 teachers indicated that female teachers were significantly less confident than the male counterparts in integrating ICT into their instructional practice. When teachers' confidence to use ICT was compared based on their different years of teaching experience, a non-significant difference was found. Thus, these researchers claimed that years of teaching experience is not significantly related to teacher confidence in using ICT.

In order to analyze the computer-based technology usage in Taiwanese secondary schools, Hung and Hsu (2007) conducted a survey to investigate teachers' attitudes towards computer and their computer-based technology application in instruction. Based on the data collected from randomly selected 70 secondary school science teachers, the researchers found that there was a significant difference in the attitude toward computer with regard to age and seniority. The older and more senior teachers held less positive attitudes toward computers. As for the application of computer-based technology in classroom instruction, the findings showed that gender contributed significantly to the application of technology in instruction with male teachers used more computer-based technology in their instructional practices compared to the female teachers. However, the ANOVA analysis showed that teaching seniority had no significant impact on the application of technology in instruction. Besides, the results indicated that the middle-aged and more experienced teachers tended to integrate more computer-based technology into their instruction compared to the younger and novice teachers.

Another study was conducted by Jeffrey (2007) to investigate factors influencing actual usage of computer among 318 Mathematics, Science and English Language teachers from 65 secondary schools in the district of Petaling, Selangor. Based on the independent sample t-test analysis, the result showed that there was no significant difference in the mean scores of actual usage of computer between male and female secondary school teachers. Furthermore, the results of the ANOVA test indicated that there were no significant differences in the mean scores of actual usage of computer among Mathematics, Science and English Language teachers in relation to age and teaching experience (Kumar, Rose, & D'Silva, 2008).

A similar result was obtained in another local study conducted by Ting (2007) to investigate the level of ICT usage among teachers in four secondary schools in the district of Sarikei, Sarawak. The t-test analysis showed that there is no significant difference in term of teachers' gender on the level of teachers' ICT application.

E. M. L. Wong and Li (2008) noted that ICT was able to act as a catalyst to bring changes in student learning. Hence, they conducted a study to develop multilevel models that examine ICT implementation within a context of managing change in schools. The results showed that teachers-level variables in term of gender and teaching experience were not significantly related to teachers' perceived change in student learning with the implementation of ICT. While age was significant but related negatively to teachers' perceived change in student learning with the implementation of ICT. This finding revealed that elderly teachers perceived negatively in students learning with the implementation of ICT.

Another quantitative study was conducted by Cassim and Obono (2011) to examine factors affecting teachers' adoption of ICT for the teaching grounded on TAM as the theoretical framework. The data were gathered from 102 primary school teachers. The results showed that gender, age, and educational level have no significant effect on teachers' perception regarding the adoption of ICT for teaching. However, teachers' teaching experience was found to have a significant effect on teachers' perception regarding the adoption of ICT for teaching.

There is another study conducted on 35 secondary school principals to examine the effect of various demographic variables on their ICT usage (Seyal, 2012). The results showed that gender, age, and computer expertise significantly affect principals' ICT usage while age is negatively associated with the ICT usage. This indicated that the elderly principals demonstrated lower ICT usage if compared with the younger principals. However, the findings revealed that experience as school leaders and educational level have no significant effect on principals' ICT usage. Another similar study was conducted on 230 kindergarten principals from 12 Greek regions also revealed the similar findings (Prokopiadou, 2012). Prokopiadou (2012) wrote about the utilization of ICT in school management have found that male and younger educators are more likely to be familiar with the ICT usage.

Based on another quantitative study conducted by Nagamani and Muthuswamy (2013) to investigate the ability of 157 secondary school teachers ICT usage in Tamil Nadu, India, the result of the study revealed that there is no significant difference in the ICT usage according to gender. But the result of ANOVA analysis indicated that there was a significant difference in the ICT usage between age groups. The Turkey test revealed that the young group teachers who are below 30 years old showed a higher mean in term of ICT usage than the other age groups. Besides, the result also indicated that greatest difference in mean exists between this young group of teachers with those teachers who are 51 years old and above. The researchers felt that the young group teachers might have a lot of opportunities to practice and frequency of using ICT during their pre-service training. Hence, they do not face any difficulties in using ICT in their profession. Teachers, who belong to the age group 51 years old and above, may have completed their studies 25 years ago and during that time, ICT was just implemented. Although these teachers are academically very experienced but they have not received any formal training to integrate ICT into their teaching profession and they also did not have much opportunity to use ICT. This may be the reason why the senior teachers have shown less ICT usage in their profession.

In term of technology integration and usage, few studies (Cassim & Obono, 2011; Jeffrey, 2007; Nagamani & Muthuswamy, 2013; Ting, 2007; E. M. L. Wong & Li, 2008) showed that gender has no effect on teachers technology integration and usage. Only in Adams's finding (2003), female teachers reported having a higher concern about technology integration than the male teachers. The other studies (Hernandez-Ramos, 2005; Hung & Hsu, 2007; Jamieson-Proctor et al., 2006; Prokopiadou, 2012; Seyal, 2012; van Braak et al., 2004) all reported that the male teachers showed higher technology integration and usage than the female teachers. These research studies revealed that male teachers used more ICT in their instructional or management processes than their female counterparts.

On the other hand, Albirini (2006), who conducted a study to examine English as a Foreign Language (EFL) of the Syrian teachers' attitudes toward ICT, found that the Spearman rank correlations analysis yielded no significant relationships between teachers' attitudes and any of the demographic variables like gender, age, teaching experience and education level with the exception of computer training background.

In another research conducted by Kay (2006), he found that male teachers had relatively higher levels of computer attitude and ability before the implementation of the laptop program, but there was no significant difference between males and females regarding computer attitude and ability after the implementation of the laptop program. The researcher claimed that the ubiquitous and integrated approach to using technology in pre-service education had a significant and positive impact on both male and female computer attitudes and ability. Furthermore, the gender equalization effect observed in this study could have an effect on the future teachers training program which helps to lessen gender inequalities in promoting the instructional technology usage.

A quantitative study on gender difference in attitudes towards the information technology related tools usage and applications was conducted by S. L. Wong and Hanafi (2007). Data were collected from 102 pre-service teachers in the Faculty of Educational Studies, University Putra Malaysia. The respondents' attitudes in term of usefulness, confidence, and aversion toward information technology before and after undergoing an information technology course were measured. The independent t-test analysis did not yield any significant difference between the mean score of female and male in respect of their prior computer experience. This suggested that both genders had almost equal computer experience before enrolling in the course. There were no significant differences between female and male pre-service teachers when the pre and post-test mean scores were compared. This finding revealed that both genders exhibited the same levels of attitudes before and after undergoing the mentioned course. This suggested that the exposure to the information technology course did not contribute to any significant gender differences. Next, the paired sample t-test analysis results showed significant differences in the three dimensions of attitudes toward information technology for female pre-service teachers but only in two dimensions for male pre-service teachers. Both female and male pre-service teachers expressed enhanced positive attitudes and less negative attitudes towards information technology usage. The biggest difference for both female and male pre-service teachers was in the aversion dimension which showed that the magnitude of their strong dislike toward information technology was greatly reduced at the end of the course. However, only female pre-service teachers exhibited significantly more confidence in information technology at the end of the course. The mean scores on pre and post-test for confidence showed no statistical differences in male pre-service teachers. The researchers claimed that information technology experience gained from undergoing a course can improve the attitudes of both genders towards computer usage. Hence, this finding supported the view that computer experience is gender-based as the increase in confidence over time assumed different patterns for female and male pre-service teachers.

Another study was reported by Teo (2008) regarding pre-service teachers' attitudes towards computer usage in Singapore also showed no gender or age differences among pre-service teachers on computer attitudes.

A quantitative study was conducted by Alazzam, Bakar, Hamzah, and Asimiran (2012) to determine ICT readiness and the effects of demographic characteristics (gender, age, and years of teaching experience), educational background (level of qualification, type of ICT training), and support factors (administrative support, ICT availability) that affect the ICT readiness in terms of knowledge, skills and attitudes of vocational and technical teachers in Malaysia. Data were gathered from 329 vocational and technical teachers who are teaching engineering subjects in Malaysian vocational and technical schools. The results indicated that there were no significant age and teaching experience effects on teachers' overall ICT readiness. However, there was a significant effect of gender on teachers' overall ICT readiness. The findings revealed that male teachers have higher ICT skills than the female teachers. Besides, the results also showed that there were no significant effects of educational background and support factors effect on teachers' overall ICT readiness.

A cross-cultural comparison study was conducted by Kusano et al. (2013) to examine the effects of teachers' demographic variables on their attitude toward technology integration in Japanese and U.S. primary schools. The results of the multiple regression analysis indicated that gender is a significant predictor of Japanese teachers' attitude towards technology integration, where the male Japanese teachers have a more positive attitude than the female Japanese teachers. However, age and teaching experience were not significant predictors of the Japanese teachers' attitude towards technology integration. But gender, age, and teaching experience were not a significant predictor of U.S. teachers' attitude towards technology integration.

Gender differences in term of attitudes towards ICT usage have been reported in several studies. Few studies among these studies (Alazzam et al., 2012; Kay, 2006; Kusano et al., 2013) have cited that female teachers showed a lower level of computer attitudes and confident in ICT usage due to their limited technology knowledge, skills, and interests. However, some studies revealed that gender was not a predictor of teachers' attitude towards ICT integration (Albirini, 2006; Hung & Hsu, 2007; Teo, 2008; S. L. Wong & Hanafi, 2007). In a research conducted by Kay (2006), he found that male teachers had relatively higher level of computer attitude and ability before the implementation of computer course, but there was no difference between male and female teachers' attitude and ability after the implementation of the computer course. He claimed that quality training program on technology integration could help to lessen the gender inequalities. This finding was confirmed and reported by Yukselturk and Bulut (2009), who found that gender gap has reduced over the past years. Besides, a greater number of females than males have used internet and web 2.0 technologies, indicating gender differences are gradually dissipating.

Literature showed that the impact of gender on information technology acceptance and use has been actively documented. Although these studies may not provide conclusive evidence regarding the specific gender disparity, however, all the above mention studies, which was carried out among teachers, indicated that gender disparity in the education information technology usage existed to a certain extent. This is definitely a cause for concern as educational information technology is considered a crucial tool for the effective and efficient running of a school.

According to Norhayati (2000), teacher demographic variables (age, teaching experience, experience in using ICT, and ICT training attended) are found to be among the teacher-related factors that influence the level of instructional technology integration. She found that teachers with ICT training are more prepared to use technology than teachers with little or have never received any ICT training. Besides, experience in using ICT is no doubt another factor that also influences the readiness of teachers in integrating ICT into their teaching. Their experience in using ICT also influences the frequency of ICT usage and the level of its integration in the classroom. It is obvious that the longer teachers are exposed to ICT, they become more skillful and can easily adapt to new technology usage. Another factor that influences the level of teachers' ICT usage in instruction is their age. It seems that new teachers are more skilled in the use of ICT if compared to the previous generation of teachers with longer experience in teaching.

In a study to explore the extent of ICT adoption among 212 Malaysian secondary school teachers, B. T. Lau and Sim (2008) found that elderly teachers were more desirous to adopt information system usage in schools. Their findings revealed that elderly teachers frequently use ICT in the classrooms instruction more than the younger teachers. They claimed that this finding was considered different from other research findings in literature which indicate that younger teachers have more a positive perception of ICT acceptance and use.

Inan and Lowther (2010) conducted a path analysis research to examine the effects of teachers' individual characteristics and perceptions of environmental factors that influence their technology integration in the classroom. Based on the data collected from 1,382 Tennessee public school teachers, the results showed that both teaching experience and age do not have significantly direct effect on teachers' technology integration. However, these two variables showed an indirect effect on technology integration with negative impact. These indicated that veteran and elderly teachers' technology integration were lower in comparison to the novice and younger teachers. The total effects originated from teacher demographic factors were somehow limited. Of the two variables that represented teacher demographic characteristics, only teaching experience, but not age, had a significant total impact on technology integration.

However, based on data collected from 231 teachers from fourteen public second-cycle schools in Ghana (Buabeng-Andoh, 2012a), the result showed a moderate positive relationship between computer experience and ICT usage ($r=.49$, $p<.01$). Besides, the results also indicated that there were an inverse correlation between teachers' ICT use with age ($r=-.23$, $p<.01$) and teaching experience ($r=-.31$, $p<.01$). These findings indicated that the younger and novice teachers have a higher ICT usage.

Besides gender, few studies have claimed that age is another significant determinant of teachers' attitude toward technology integration and usage. Among these studies, most of the studies (Adams, 2003; Buabeng-Andoh, 2012b; Hung & Hsu, 2007; Nagamani & Muthuswamy, 2013; Norhayati, 2000; Prokopiadou, 2012; Seyal, 2012; E. M. L. Wong & Li, 2008) found that younger teachers tend to have more positive attitude regarding to the technology integration and usage. The reasons researchers cited for these findings are the younger teachers are more knowledgeable and skillful in the ICT usage most probably more technological savvy and they have received ICT training during their teacher training, hence, they are more confident in dealing with technology integration. On contrary, Hernandez-Ramos (2005) and B. T. Lau and Sim (2008) findings revealed that the elderly teachers demonstrated more positive attitude towards the technology integration and usage. According to B. T. Lau and Sim (2008), the main reason for this phenomenon is that the elderly teachers have richer teaching experience, classroom management skills and good content knowledge about their teaching subject than the younger teachers, hence, they can easily integrate ICT into their teaching practice. However, there are some studies (Alazzam et al., 2012; Albirini, 2006; Alston et al., 2003; Cassim & Obono, 2011; Gorder, 2008; Jeffrey, 2007; Kusano et al., 2013; Maseli, 2005; Teo, 2008; van Braak et al., 2004) reported that age was not a predictor of teachers' attitude towards technology integration and usage.

In term of teachers' teaching experience, Russell, Bebell, O'Dwyer, & O'Connor, (2003) and Bebell, Russell, and O'Dwyer (2004) found that novice teachers who had higher level of knowledge and skilled in using ICT practice than the veteran teachers did not incorporate ICT into their professional practices. Based on the same set of data collected, Russell, O'Dwyer, Bebell, and Tao (2007) argued that the quality of ICT integration was related to the number of years teachers in the teaching profession.

Another study was conducted by Granger, Morbey, Lotherington, Owston, and Wideman (2002) to examine the factors contributing to teachers' successful ICT implementation in Canada. Based on the analysis focuses on four schools that were chosen for the overall discursive and conceptual richness of data, their findings showed that there were no significant relationships between teachers' teaching experience and experience in the ICT usage related to teachers' successful ICT implementation. These showed that teachers' successful ICT implementation is a complex process and ICT experience or teaching experience is not a clear predictor of successful ICT integration.

In order to understand teachers' perspectives regarding instructional technology integration, Mueller, Wood, Willoughby, Ross, and Specht (2008) conducted a study to identify differences in teachers characteristics and variables that best discriminate between teachers instructional technology usage. Based on the data collected from 185 primary and 204 secondary teachers, the researchers found that there was no significant impact of years of teaching experience on teacher instructional technology usage. This outcome suggests that teachers at all stages of their career were equally able to integrate computer technology.

Another related study was conducted by Baek, Jung, and Kim (2008) to examine the degree to which teaching experience affects teachers' decision about instructional technology usage. Their findings revealed that although majority of the teachers intent to use technology to support their instruction, experienced teachers generally decide to use technology in the mandatory situation while junior teachers with little teaching experience are more likely to use it on their own will. A similar finding was reported by Afshari, Kamariah, et al. (2009a), who also found the novice teachers were more likely to use ICT when compared with the senior teachers.

Although most of the studies (Alazzam et al., 2012; Albirini, 2006; Alston et al., 2003; Gorder, 2008; Granger et al., 2002; Jamieson-Proctor et al., 2006; Jeffrey, 2007; Kusano et al., 2013; Maseli, 2005; Mueller et al., 2008; Niederhauser & Stoddart, 2001; E. M. L. Wong & Li, 2008; Wozney et al., 2006) reported that teachers' teaching experience did not influence their instructional technology usage, however, some studies showed that teachers' teaching experience influences the successful use of ICT in classrooms. Among these studies, there are only two studies (Hernandez-Ramos, 2005; B. T. Lau & Sim, 2008) reported that the senior teachers demonstrated a higher level of technology integration compared to the novice teachers. According to B. T. Lau and Sim (2008), the main reason for this phenomenon is that the elderly teachers have richer teaching experience, classroom management skills and good content knowledge about their teaching subject than the younger teachers, hence, they can easily integrate ICT into their teaching practice.

Surprisingly, there are few studies (Bebell et al., 2004; Russell, Bebell, O'Dwyer, & O'Connor, 2003; Russell et al., 2007) reported that the middle group teaching experience teachers showed highest technology integration among the three group of teachers (novice, middle, senior). Russell et al. (2003) explained this phenomenon for two reasons: First, novice teachers have not been exposed to the applications of technology in the real classroom setting, their teacher training program mainly focuses on how to use ICT instead of how to incorporate ICT into their teaching. Secondly, new teachers could experience some challenges in their first few years of teaching and they need to spend most of their time in familiarizing themselves with school's culture, curriculum, assessment systems and classroom management, thus, they do not have time to explore ways to integrate the technology available to them. Hence, the middle group teachers' who might be exposed to some experience in ICT and also have mastered their content knowledge demonstrated the highest technology integration into their instructional practices. However, majority of the studies (Adams, 2003; Afshari, Kamariah, et al., 2009a; Buabeng-Andoh, 2012b; Hung & Hsu, 2007; Inan & Lowther, 2010; Norhayati, 2000) reported that the novice teachers who have lesser teaching experience demonstrated a higher level of instructional technology usage. According to Afshari, Kamariah, et al. (2009a), this phenomenon might be due to the novice teachers have been exposed to more ICT training in their teaching college compared to the senior teachers and therefore, the novice teachers have more experience in using this ICT tools. These findings indicated that teachers' teaching experience might be another important variable to be considered in this study.

In term of teachers' educational level, majority of the studies (Alazzam et al., 2012; Albirini, 2006; Alston et al., 2003; Cassim & Obono, 2011; Gorder, 2008; Seyal, 2012) reported that teachers' educational level did not influence their technology integration and usage. However, in Maseli's (2005) study, there was a significant different in teachers' educational level with teachers' ICT application in instructional management, which the non-graduate teachers demonstrated a higher level of ICT application than the graduate teachers.

Based on a study conducted by Ranjit Singh and Chan (2014) to investigate the knowledge level, attitude towards the ICT usage in instruction and obstacles faced by the in-service teachers in a secondary school. Researchers found that the teachers' attitudes toward the use of ICT in instruction vary with their years of experience in using ICT for instruction.

There is only one study (Granger et al., 2002) reported that teachers' experience in using computer did not influence teachers' attitudes and technology integration. Besides Ranjit Singh and Chan's (2014) study, few studies (Buabeng-Andoh, 2012b; Mueller et al., 2008; Norhayati, 2000; van Braak et al., 2004; S. L. Wong & Hanafi, 2007) also reported that teachers' experience in using computer relates positively to their computer attitudes and technology integration. These studies revealed that those teachers with more experience with computer in term of years, more likely, they will demonstrate positive attitudes towards computer and higher technology integration. Hence, teachers' experience in using computer is another variable need to be considered in this study.

Overall, the researcher found that not all studies related to teacher demographic variables reported consistent results. However, the researcher concluded that there are five teacher demographic variables which are gender, age, teaching experience, educational level, and experience in using ICT do have some effect on teachers' technology integration and usage. Hence, researcher proposed that these five variables would have influenced on the relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. In other words, these five teacher demographic variables were proposed as the moderating variable in this study.

2.4 Literature on Relationship between Variables

After the construction of the measurement models for each of the latent variables from the above literature, this section focused on the related literature reviews and empirical studies pertaining to understand the relationship exist between these latent variables. This study investigates teacher acceptance and use of SMS as the endogenous (dependent) variable in relation to principal technology leadership practices as the exogenous (independent) variable and teacher ICT competency as mediating variable with teacher demographic variables as the moderating variable. The relationships that exist between each of these variables were used to construct the structural model or conceptual framework proposed for this study at the end of chapter two.

2.4.1 Relationship between Principal Technology Leadership Practices and Teacher Acceptance and Use of SMS

The incorporation of ICT in education is increasingly recognized as a priority for schools improvement all over the world. In some countries, teachers are expected to undertake formal training to ensure they are proficient in the use of ICT and are able to use it effectively within the classroom setting. However, school leaders have a crucial role in ensuring and leading school reform and improvements (Han, 2002). Han (2002) noted that principal has the capacity to influence and inspire teachers, encourage better performance, and encourage innovative changes in teaching and learning. Based on the result of factor analysis, Franklin (2007) also found that principals' technology leadership is one of the factors that influence teachers' instructional technology usage.

Norizan (2003), noted that factors such as equipment facilities, computer software, internet access, and multimedia provided by the school principals could increase and encourage teachers' technology usage for teaching. This is because, without facilities and access, the usability of technology for instructional purposes is significantly limited (Franklin & Bolick, 2007). This was further supported by a study conducted by Ting (2007) who found that there is a moderate significant positive correlation ($r=.33$, $p<.01$) between principal's support with teacher's level of ICT usage.

Based on the data gathered from interviewing 74 Turkish computer teachers to examine their experiences with school administration, Deryakulu and Olkun (2009) found that the computer teachers thought that the administrators lacked basic knowledge and skills with technology and were not helping to promote the frequent use in schools. They argued that when the school administrators are comfortable with computer technology and are supportive, the computer teachers' perception and feeling about teaching and school life are positive as well. Undoubtedly, such positive perceptions and feelings can increase the teachers' commitment to teaching. As teachers' commitment is central to maintaining and improving educational quality, administrators should be aware that they are also responsible for producing this quality by providing good leadership. This was further supported by Balakrishnan, Rossafri, and Ahmad Moghni (2009), who stated that leader and administrator play the most important role in determining the acceptance and integration of technology in their respective institutions.

Anderson and Dexter (2005), found that technology leadership, compared to infrastructure factors, was a stronger predictor for three different dependent measures on technology outcomes: frequency of use of Internet by students and teachers, frequency of integration of ICT into lessons, and extent to which students use ICT for academic works in the school. The result indicated that technology leadership had a significant and positive correlation with all technology-related outcomes. This means that when school leaders are comfortable with technology, they foster technology acceptance and use in their schools. The most important finding from their analysis was that technology leadership has greater leverage on desired outcomes than technology infrastructure and expenditures.

Sanders (2006) claimed that innovations in schools often do not have the intended impact leaders hope to see when implementation occurs. Based on an action research to determine the impact of leadership on the implementation of an online curriculum management system, Sanders (2006) found that leadership characteristics could be the determinant to the successful implementation of the online curriculum management system.

Hadjithoma-Garstka (2011), wrote about the principal's role in the ICT policy implementation process based on case studies involving four Cyprus primary schools which reported as showing a high level of ICT usage. The finding indicated that the level of ICT implementation was related to the interconnected factors of school climate, the school technology implementation committee, the technology coordinator's role and the principal's leadership practices. She found even though the government does not impose the ICT usage in school, but all principals promote the ICT usage in their schools in a very different manners. These were mainly on empowering and supporting teachers in ICT usage, having a school vision for promoting the ICT usage, and modeling the effective use of ICT.

Schepers et al. (2005) noted that management support and training have been shown to positively influence technology acceptance but less attention has been given to the influence of the overall leadership style in an organization. Hence, they carried out a study to determine the impact of leadership styles on technology acceptance model

(TAM) factors within a service organization. They found that transformational leadership style positively influences perceived usefulness but did not have a significant effect on perceived ease of use (technology usage) of the new technologies. Based on a grounded theory approach to derive key findings from 12 empirical studies on technology leadership, Tan (2010) found that school technology leadership is a strong predictor of the level of technology use in schools.

Hatlevik and Arnseth (2012) conducted a study to explore the relationship between teachers' experience with ICT-supportive school leaders, perceived usefulness of computers, perceived students' learning outcomes and teachers' instructional technology usage. Based on the data collected from nationwide secondary school teachers (N=386), the correlation analysis revealed that teachers with a higher level of ICT-supportive leader reported a higher level of perceived usefulness of computers, and perceived students' learning outcome, and more frequent use of instructional technology.

A study that empirically investigated teachers' perception of elementary schools principals' technology leadership practice in seven cities in Taiwan for understanding the implementation of technology leadership identified that principals' technology leadership is strongly correlated with teachers' integration of educational technology and technology leadership is necessary for effective utilization of technology in schooling. The results suggested that principals who embrace technology will effectively lead their schools to acquire educational resources to enhance student engagement and learning (Chang et al., 2008).

C.-h. Wang (2010), also identified that the principal's leadership practices had an impact on the technology integration process through technology coordinator perspective. They wrote on how the principal's technology leadership practices impeded the process of technology integration in a Taiwanese Elementary school. They found three practices of the principal which hindered the effective implementation of school-wide technology integration: first, the principal did not have a vision of technology integration for their school; second, the principal did not take up responsibility for managing resources for technology implementation, and third, the principal did not empower the technology coordinator for technology integration. These findings clearly reflected that the lack of commitment and strong technology leadership by the principal negatively influenced technology-integration; the lack of support and recognition from the principal negatively affected the morale of technology coordinator and his team members, who were highly motivated regarding technology integration; and the coordinator and his team could not become effective change agents in the school because of the lack of principal's empowerment. This finding was in line with K. W. Lai and Pratt (2004), who revealed how technology coordinators perceived their school principals as the impediment to their works by not providing sufficient time for planning, not providing professional development and not giving recognition to the coordinators.

Beside, Afshari, Kamariah, et al. (2009b) found a significant correlation between the principal's computer competency level and transformational leadership practices which could help to improve the use of technology for teaching and learning. Principals' awareness, understanding, and use of ICT are essential for effective use of computers in the school (Afshari et al., 2008). At the same time, school leaders should use technology themselves, developing an awareness of how technology can be used and modelling the practice to the school staff. In other word, principals must embrace the movement and utilize technology themselves if they expect the staff to adapt and use technology without resistance (Afshari et al., 2010). This will make the teachers feel more comfortable knowing that the principal is competent and willing to utilize technology him or herself. Therefore, necessary training and resources should be provided for principals to effectively use technologies in the performance of their work responsibilities.

The cultural and contextual characteristics of schools could affect educational change in term of the level of teachers' ICT usage in classrooms. J. Tondeur et al. (2009), conducted a quantitative survey of 527 teachers from 68 primary schools in Flanders, Belgium to investigate teachers' perception about their ICT usage in the classroom based on two clusters of school-level characteristics which are cultural and contextual characteristics. They found that schools (N=41) which are strong in cultural characteristics (i.e. leadership, innovativeness, goal-orientedness) and structural characteristics (i.e. ICT planning, infrastructure and ICT-related support) have a significant higher mean level of computer use in the classroom compared with schools (N=27) that are weak in these two measures. This result indicated that the school's contextual and cultural characteristics are relevant catalysts for ICT integration in the classroom.

Despite the importance of technology, Jackson (2009) noted that many principals ignore technology integration within their schools especially in the areas of instructional technology. Thus, Jackson (2009) conducted a study to investigate whether principals' technology leadership influence the instructional technology integration within their schools. Based on a qualitative inquiry approach by interviewing the principals, media specialist, and seven to nine teachers from each of the two middle schools within a Central Savannah River Area school district. The findings provided evidence that the principals' technology leadership enhanced the utilization of instructional technology within the school. In other words, principals' technology leadership has a direct relationship with their schools' instructional technology usage. This finding was in line with Dawson and Rakes (2003), who conducted a study to investigate whether technology training received by principals influences the integration of technology into the classroom.

The first local study to examine the relationship between principal's technology leadership and teacher ICT application was conducted by Leong (2010). Based on the data collected from 92 teachers from a Secondary Day School located in the District of Seremban, Negeri Sembilan, the Spearman-Rho correlation indicated that there was a moderate but significant positive correlation between principal's technology leadership and teacher ICT application ($r=.437$, $p<.01$). Next, stepwise multiple regression analysis was conducted to determine which of the principal's technology leadership dimensions significantly predict teacher ICT applications. The regression results indicated that productivity and professional practice, and social, legal, and ethical issues are the two significant predictors of teacher ICT applications. Productivity and professional practice dimension alone contributed a variance of 15.2% on teacher ICT applications while the social, legal, and ethical issues dimension contributed another 4.5% variance on teacher ICT application.

A similar study was conducted by Mohd Jamil (2011), based on the data collected from 54 teachers in a Smart School located at Kota Tinggi, Johor, the researcher found that there was also a moderate but significant positive correlation between principal's technology leadership and teacher ICT application ($r=.50$, $p<.01$). The stepwise multiple regression indicated that leadership and vision, productivity and professional practice and social, legal, and ethical issues are the three principal's technology leadership dimensions that significantly predict on teacher ICT applications. Leadership and vision dimension contributed 31.8% of the variance on teacher ICT applications while the social, legal, and ethical issues contributed another 13.7% of the variance on the teacher ICT application. The third dimension, Productivity and Professional Practice, also contributed 3.4% of the variance on teacher ICT application.

Page-Jones (2008) conducted a study to investigate the influence of the principals' technology leadership behavior in term of NETS.A (2002) on technology usage in schools. The population composed of principals and teachers from public schools in Collier County, Florida. According to the NETS.A standards, 25 principals completed the PTLA to establish their leadership behavior while 339 teachers completed the School Technology Outcomes survey to identify their technology usage in schools. The researcher found that these principals showed superior leadership in five out of the six of the NETS.A constructs, with high mean scale for all constructs except assessment and evaluation, which produced a moderate mean scale. Thus, these can be concluded that principals' have strong principals' technology leadership behaviors. The results also indicated that teachers showed a high level of technology usage in schools. However, the findings indicated that there was no significant relationship between the principals' technology leadership behavior and the technology usage by their teachers for organizational, instructional, and educational purposes. Besides, the findings also showed that technology leadership behavior measured in the PTLA score of principals was not found to be a good predictor school technology usage. Through multiple linear regression, the results revealed that only 8% (R^2=.077) of the variation in school technology usage was accounted by the linear relationship with principal leadership technology behavior.

However, Watts (2009) claimed that principals' leadership failing to acknowledge technology's impact on the educational setting may miss the opportunity to fully implement technology in the classrooms. Hence, she conducted a similar study to examine the relationship between principals' technology leadership (NETS.A, 2002) and school climate to the extent of teachers' technology integration. Data were collected from 968 teachers and 44 administrators in 32 schools in Clayton County Public School in Clayton County, Georgia. The NETS.A survey collected information from school level leaders (principals and assistant principals) about K-12 technology leadership. Also, data were collected using the Organizational Climate Index (OCI) survey measuring school climate from the teachers of the same K-12 schools. Then the data from the NETS.A and the OCI were correlated with "*Taking A Good Look at Instructional Technology, TAGLIT*" survey data about technology integration and again collected from teachers at the corresponding K-12 schools. Her finding was similar to Page-Jones's study (2008), which showed that administrators' technology leadership was not a predictor of teachers' use of technology.

A correlation research design was employed by Smith (2011) to examine the relationship between principal's instructional technology leadership ability (knowledge and skills, and support actions) and the effective use of instructional technology. Data were collected using parallel online surveys for teachers and school principals. The results also indicated that principal's instructional technology leadership for middle and high school principals was not a predictor of effective use of instructional technology.

Another similar study was conducted by Lafont (2011) to examine the relationship between principals' technology leadership and the level of teachers' technology usage. Data were collected from 561 teachers in all 28 Lafourche Parish Public Schools with two set of questionnaire – Stages of Adoption of Technology survey was used to measure teachers' technology integration in the classroom and Technology Leadership survey was used to measure the principals' technology leadership. The bivariate correlation analysis revealed that there was no significant relationship between teachers' level of technology adoption and principals' technology leadership. Besides, the multiple regression analysis indicated that none of the predictor variables contributed to the predictive process at a significant level. Hence, the researcher concluded that the teachers' level of technology adoption cannot be predicted by teachers' perception of principals' technology leadership.

In a similar local study, Raman, Yahya Don, and Kasim (2014) also conducted a survey of 118 public schools principals in Kedah to investigate the influence of principals' technology leadership on teachers' technology usage in Malaysian Secondary Schools. In this study, the principals' technology leadership behavior was measured according to NETS.A (2009). Two sets of questionnaires were used in this study; the PTLA was used to measure the principals' technology leadership behavior (dependent variable) while the Teachers Technology Use (TTU) instrument was used to measure teachers' technology usage in the classroom (independent variable). Thus, the independent variable responses (PTLA) were obtained from the principals while the dependent variable responses (TTU) were obtained from the teachers. A random sampling method was used to select 118 principals and 234 teachers from the population of 183 public secondary schools principals and 520 teachers in the state of

Kedah, Malaysia. The result indicated that principals' technology leadership is not a good predictor of the school technology usage, and principals' technology behavior only accounted for 12.1 % of the variance on teachers' technology usage in the instruction.

The researcher found that Page-Jones (2008), Raman, Yahya Don, and Kasim (2014), Smith (2011) and Watts (2009) findings are very different from Mohd. Jamil's (2011) finding which indicated that principal technology leadership accounted for nearly half (48.9%) of the variance in teacher ICT application. The researcher found that this occurs most probably because the earlier studies try to correlate two responses from different people – the principals and the teachers. As what researcher understood from the theory and literature (Luo, 2004; Sharma, 2011; Sharma et al., 2012), the influence of a leader towards his/her followers should be measured from the perceptions of the follower towards the leader leadership behavior, because how the followers perceive their leader leadership behavior will directly influence them in term of behavior and attitudes in the usage of technology and this is more accurate to be correlated.

On the contrary, Fisher (2013) noted that technology leadership demonstrated by school administrators is crucial for the effective instructional technology integration. Hence, she conducted a survey to examine the relationship between principals' instructional-technology leadership and the effective use of instructional technology. The results showed that principals' instructional-technology leadership proficiencies yielded significant positive correlations with teachers' abilities to integrate instructional technology. This finding was in line with Chang et al. (2008), Hatlevik and Arnseth (2012), Jackson (2009), Leong (2010), Mohd Jamil (2011), and Ting (2007) empirical studies, which also indicated that there were significant relationship between principal's technology leadership and the level of ICT application of teachers. Thus, in this study, researcher expects that principal technology leadership practices would affect teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

2.4.2 Relationship between Principal Technology Leadership Practices and Teacher ICT Competency

Creighton (2003) pointed out that only if school leaders realized their leadership and vision for technology, they can inspire their teachers in the quest for more knowledge and skills and be able to ensure completed and sustained implementation of the vision. For this to happen, principals must be aware of their role as technology leaders. And it is highly impossible to talk about real technology leadership if the principals do not show high competence in the leadership and vision dimension (Banoglu, 2011).

Based on a study conducted by Harin Hafian (2011) to examine the relationship between principal's transformation leadership with teacher ICT competency in a vocational secondary school located in Shah Alam, Selangor. The Spearman-rho analysis revealed that there was a significant weak positive correlation ($r=.28$, $p<.05$) between principal's transformation leadership with teacher ICT competency.

Another study was conducted by Moktar (2011) to investigate the relationship between principal technology leadership and the teacher ICT competency in a religious secondary school in Kuching District, Sarawak. Based on data collected from 55 teachers, Pearson correlation analysis indicated that there was a significant strong positive relationship (r=.747) between principal technology leadership and teacher ICT competency. However, this result cannot be generalized to a bigger population because it only involved 55 teachers and one principal. Besides, teacher ICT competency measured in his study does not base on any standard and only basic computer operation skills and knowledge are measured. In the current study, teacher ICT competency was measured based on ISTE Standard•T (2008) which includes basic and advanced skill that teachers need to carry out their daily routine work as teachers and probability sampling technique is used to collect data from Negeri Sembilan secondary schools which is more representative and can be generalized to the population of teachers in Negeri Sembilan.

Based on the above literature, it was found that principal technology leadership practices do have some impact on teacher ICT competency but there is still lack of empirical results to show how strong the relationship is. Thus, in this study, the researcher would like to identify what is the relationship between principal technology leadership practices and teacher ICT competency in Negeri Sembilan secondary schools.

2.4.3 Relationship between Teacher ICT Competency and Teacher Acceptance and Use of SMS

Teacher ICT competency has been viewed as a prerequisite for the acceptance and use of ICT in schools' systems (Archibong et al., 2010). According to Rogers (2003), individuals' decision to accept and use a new technology is related to the skills and knowledge one has regarding how to operate that technology (information system) appropriately. Based on Jegede, Dibu-Orjerinde, and Illori (2007) empirical study, the finding indicated that there was a significant positive relationship ($r=.663$, $p<.05$) between ICT competence and the general computer attitudes and practices of an individual.

In line with Jegede et al.'s (2007) study, the results of Sa'ari et al. (2005a) study also revealed that teachers who demonstrated a high level of competent in using computers find information system to be more useful. These teachers approached the information system with greater confidence and displayed a lower level of anxiety and aversion towards using it. Besides, the results showed that there was a weak positive correlation ($r=.127$, $p<.05$) between teachers' attitudes and their perceived competence toward computer usage (Sa'ari et al., 2005b). Therefore, the researchers argued that being competent in using computers is also an important asset rather than only having positive attitudes toward information system usage. This showed that both attitudes and ICT competency played a significant part to establish the concrete development of teacher acceptance and use of information system. In other words, to enhance teacher acceptance and use of information system, there is an urgent need for the teachers to acquire the right attitude with a higher competency level for the betterment of the information system application in the education system.

Based on another study conducted by Ting (2007) to investigate the level of ICT usage among 181 teachers from four secondary schools in the district of Sarekei, Sarawak. The researcher found that there is a moderate significant positive correlation ($r=.42$, $p<.01$) between teacher ICT competency with teacher's level of ICT usage. This positive relationship revealed that teachers with a higher level of ICT competency will demonstrate a higher level of ICT application.

Next, another study conducted by B. T. Lau and Sim (2008) further clarified that teachers who are more competent in using ICT have reported more favourable perception towards the acceptance and use of ICT in Malaysian secondary schools. Hence, they suggested that in order to change teachers' perception and increase their ICT usage, it is important to develop their ICT competency. This result is consistent with the findings of the previous study which concluded that teachers who are more competent in using computers have also more favourable attitudes towards computer (Jegede et al., 2007; Sa'ari et al., 2005b; Varol, 2013).

Afshari, Kamariah, Wong, Foo, et al. (2009) took the final data of 320 Iranian secondary school principals to examine the extent to which the principals used computers, their perceive computer competency and leadership styles. The study findings showed that principals' computer competence and transformational leadership contributed significantly to the level of computer use by principals. The Pearson product-moment correlation coefficient showed a significant positive strong relationship between the level of computer use with their computer competency ($r=.74$, $p<.05$). This finding implies that level of computer use would be improved when competencies in computer were enhanced. In other words, the higher level of computer use is often caused by an increase in computer competence. Furthermore, the strong, positive relationship between computer use and computer competence suggests that establishing regular programs for the improvement of principals' competence would help to improve their level of computer use for instructional and administrative purposes. Computer competence explained for 54% of the variance in the level of computer use. This finding made computer competence an important factor that can be taken into consideration when examining the level of computer use.

Integration of ICT into classroom instruction for meaningful learning has been a challenging task all over the world (Chai, 2010). Chai (2010) conducted a study to investigate the relationships among Singaporean pre-service teachers' ICT competencies, pedagogical beliefs, and their beliefs on the acceptance and use of ICT. The data were collected from 1,230 pre-service teachers who enrolled in teacher preparation programs at the National Institute of Education, which is the sole teacher education institute in Singapore. The findings affirmed that the pre-service teachers' ICT competencies and their pedagogical beliefs are significantly related to their acceptance and use of ICT. These findings suggested that basic ICT competencies from the foundation of teachers' use of ICT in their instruction. However, based on the path analysis, pedagogy-oriented ICT competency does not yield any significant paths towards the use of ICT. The researcher found that this might be due to the fact that the construct is targeted towards general pedagogy such as classroom management and the adaptation of existing electronic resources for teaching. Hence, he suggested that a more specific survey related to a clear theoretical orientation should be further explored.

Based on the NETS.T (2000) performance indicators prescribed by ISTE, Hsu (2010) developed two scales to measure teachers' self-perceived technology integration competency and usage. The data were collected from 3,729 Taiwanese teachers. The results of Pearson correlation showed that there was a significant moderate positive correlation ($r=.56$, $p<.001$) between teachers' technology integration competency and usage. This finding suggested that teachers with high competency in technology integration generally show higher usage of technology integration in their daily works.

Based on a survey conducted by Buabeng-Andoh (2012a) to examine teachers' competency, perceptions, and practices toward ICT usage in second-cycle institutions in Ghana, the correlation analysis showed a positive significant correlation ($r=.68$, $p<.01$) between teachers' ICT use and teachers' ICT competence. This result is consistent with Sorgo, Verckovnik, and Kocijancic (2010), who found a high correlation between teacher ICT competency with the frequency of use of ICT and perceived importance of ICT among Biology teachers. They concluded that teacher ICT competency and confidence were predictors of ICT usage in teaching.

In contrast to the above findings, Drent and Meelissen (2008) found that teachers' ICT competence has no direct influence on their innovative ICT usage. However, the researcher found that the teachers' ICT competence defined by these researchers is only the basic computer skills and knowledge regarding how to operate the computer and software. The researcher found that it was more appropriate to focus on the end-user ability to apply ICT in carrying out their routine task. Hence, in this study, the researcher aims to study teacher ICT competency in term of their skill and knowledge as an educator in teaching, working, and learning processes based on the ISTE Standard•T (2008).

Based on the above literatures, researcher found that majority of the studies reported that there were significant relationship between teacher ICT competency with teachers' application or acceptance and use of ICT (Buabeng-Andoh, 2012b; Chai, 2010; Hsu, 2010; B. T. Lau & Sim, 2008; Sorgo et al., 2010; Ting, 2007) and teachers attitude towards computers (Jegede et al., 2007). Although teacher ICT competency has been viewed as a prerequisite for the acceptance and use of ICT in schools' systems (Archibong et al., 2010), not many empirical studies reported on the relationship between teacher ICT competency and teacher acceptance and use of SMS. Hence, in this study, researcher expects that teacher ICT competency would influence teacher acceptance and use of SMS. In other words, the researcher would like to examine the relationship between teacher ICT competency and teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

2.4.4 Relationship between Principal Technology Leadership Practices, Teacher ICT Competency, and Teacher Acceptance and Use (Teaching Effectiveness)

Based on a survey conducted on a targeted population of 1,000 teachers randomly selected from 100 Taiwanese primary schools from the six metropolitan cities in Taiwan to examine the relationship between principals' technological leadership, teachers' technological literacy, and teaching effectiveness, Chang (2012), found that principals' technological leadership significantly improved teachers' technological literacy and directly encourages teachers to integrate technology into their teaching. Based on these findings, the author suggested that schools should develop a technology plan in line with the schools' vision; support teachers with the necessary professional development to develop their technological competency, and provide sufficient technological infrastructure and equal opportunities for the technological usage. Moreover, the findings also indicated that teachers' technological literacy directly affects their teaching effectiveness. Hence, the author concluded that principals' technological leadership, as mediated by teachers' technological literacy, can affect teaching effectiveness. Besides, structural equation modelling was used to analyze how well the proposed model captured the relationships between these variables from the collected data. The common fit indices (absolute fit indices, comparative fit indices, and parsimonious fit indices) result clearly indicated that the proposed model fits with the collected data quite well. The author expressed that educators must realize that only technology usage itself couldn't effectively enhance the learning process, in order to change the mindsets of teachers and to create a new instructional model, the principals' technological leadership practices must be able to construct a suitable educational technological environment in schools to enhance the teaching efficiency of teachers and the learning effectiveness of students. In other words, when the principal is competent with the technological leadership and able to construct a technological learning environment, teaching effectiveness will enhance and this, in turn, will improve student performance.

Based on the above finding, it is expected that when principal technology leadership practices able to enhance teacher ICT competency, indirectly teacher acceptance and use of SMS will be increase. Thus, teacher ICT competency is proposed as the mediator in the relationship between principal technology leadership practices and teacher acceptance and use of SMS in this study.

2.4.5 Effect of Teacher demographic Variables on the Relationship between Principal technology leadership practices and Teacher acceptance and use of SMS

Chang et al. (2008) reported on teachers' perception of the principals' technology leadership in Taiwanese Elementary Schools, found that there were significant differences in teachers' perception of all principals' technology leadership dimensions (vision, staff development, infrastructure support, evaluation, and research) according to age, teaching experience and position held by the teachers.

Another similar local quantitative study was conducted by Mohd Tahir, Abd Rahman, Yassin, and Phoon (2010) to evaluate the role of primary school principals' technology leadership. Based on 238 primary school teachers perception on the role of principals' technology leadership in term of providing sufficient ICT infrastructure in school; encouraging teachers ICT usage; implementing ICT usage for school management; and implementing instructional ICT usage, the researchers found that there were significant differences based on teachers demographic variables such as gender, age, and teaching experiences in their assessment towards principals' technology leadership role. However, there was no significant difference based on teachers' academic qualifications in their assessment towards principals' technology leadership role.

Since there is not much literature reported on the effects of gender, age, teaching experience, educational level and experience in using computer as the moderator on the relationship between principal technology leadership practices and teacher acceptance and use of SMS. Hence, this study was carried out to assess the moderating effects of these demographic variables on the relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

2.5 Conceptual Framework

Based on the above theories and evidence of the relationships that exist between the variables in literature review presented in the earlier section, the framework of this study is developed (see Figure 2.8). In the framework, there are four main variables which are (i) teacher acceptance and use of SMS; (ii) principal technology leadership practices; (iii) teacher ICT competency; and (iv) teacher demographic variables.

The first variable, teacher acceptance and use of SMS was based on UTAUT2 Model (Venkatesh et al., 2012), which comprised six dimensions; (i) Performance Expectancy; (ii) Effort Expectancy; (iii) Social Influence; (iv) Facilitating Condition; (v) Hedonic Motivation; and (iv) Habit.

Principal technology leadership practices comprised five dimensions according to the ISTE Standards•A (2009), these dimensions are: (i) Visionary leadership; (ii) Digital age learning culture; (iii) Excellence in professional practice; (iv) Systemic improvement; and (v) Digital citizenship.

While teacher ICT competency comprised five dimensions according to ISTE Standards•T (2008), these dimensions are (i) Smart Pedagogy; (ii) Digital age learning experiences and assessments; (iii) Digital age work and learning; (iv) Digital citizenship and responsibility; and (v) Professional growth and leadership.

Finally, the researcher aims to investigate the moderating effect of the teacher demographic variables on the relationship between principal technology leadership practices and teacher acceptance and use of SMS. Teacher demographic variables include gender, age, teaching experience, educational level and experience in using computer.

In this framework, teacher acceptance and use of SMS is the endogenous (dependent) variable in relationship with principal technology leadership practices as the exogenous (independent) variable and teacher ICT competency as mediating variable while teacher demographic variables as the moderating variable. Figure 2.8 is the conceptual framework proposed for this study.

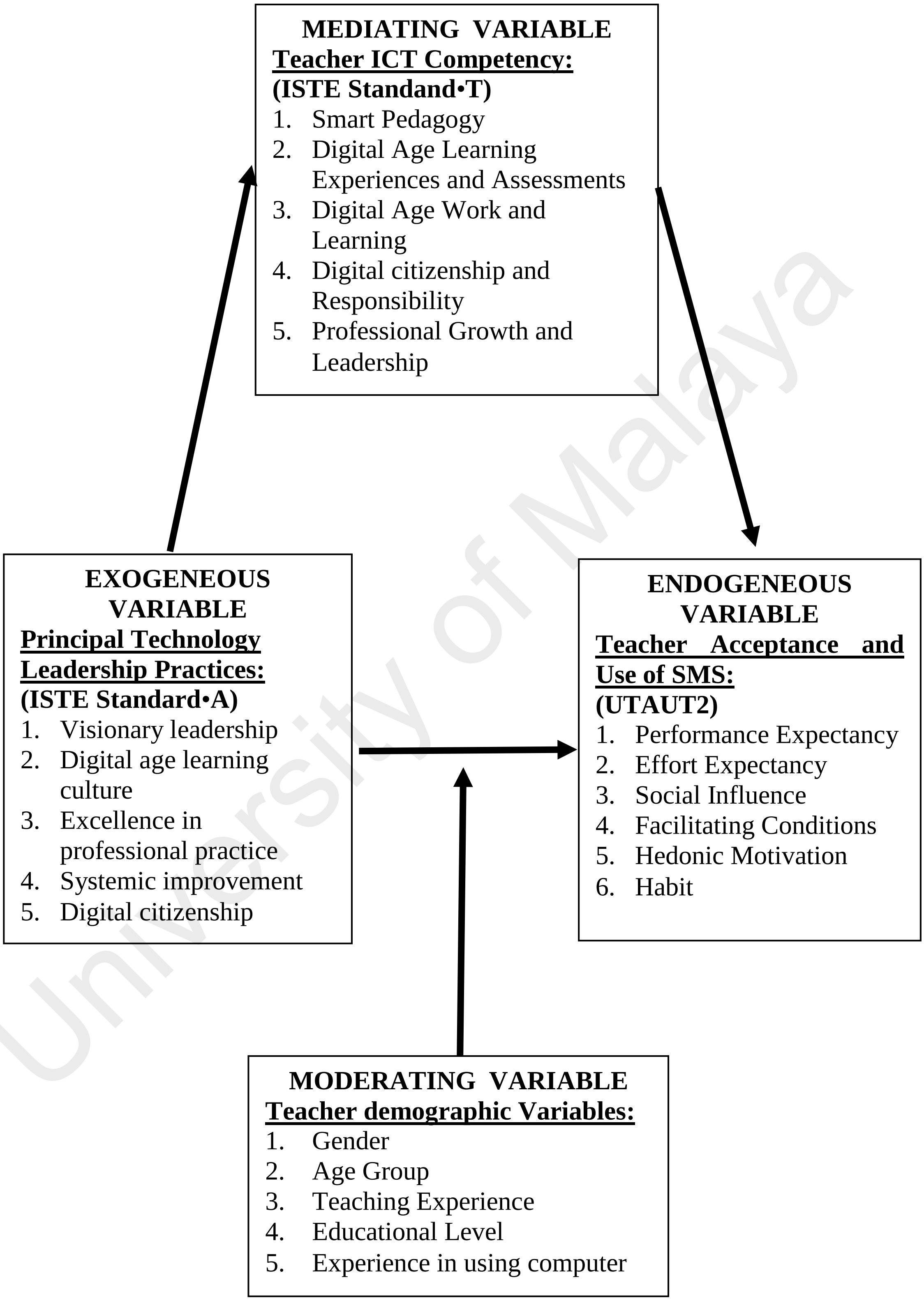


Figure 2.8: The conceptual framework of the study

2.6 Summary

This chapter provided an overview of literature relevant to the study. The flow of this chapter starts with relevant theories and models related to organizational behavior, leadership and technology acceptance and use. Next, the current studies on teacher acceptance and use of technology, principal technology leadership practices, teacher ICT competency and teacher demographic variables are identified and discussed in detail. Each of these four main variables is reviewed critically to give a clearer picture to the readers about what are the related constructs or dimensions should be included in each of these latent variables before the construction of the measurement models for the dimensions which explain on these four latent variables. Similarly, the contemporary studies related to the relationship between principal technology leadership practices with teacher acceptance and use of SMS and teacher ICT competency are also presented. Besides, the effects of teacher demographic variables on the relationship between principal technology leadership practices and teacher acceptance and use of SMS are assessed. Finally, all the findings are compared, contrasted and reviewed critically. The convergence of these empirical studies, the theoretical framework and the relevant theories that are reviewed, leads to the chapter conclusion with an overview of the conceptual framework proposed for this study.

Besides guiding the researcher to formulate the conceptual framework, the contents of literature were used as the reference in designing the present study, as well as developing the research methods and data analysis. Next chapter, Chapter 3 provides the design and methodology of the study.

CHAPTER 3: METHODOLOGY

3.1 Introduction

The purpose of this chapter is to describe in greater detail about the methodology used for the study. This includes the research design of the study, description of population and sampling procedures, the development of the research instruments, the reliability and validity of the developed instrument, data collection procedures and data analysis according to the research questions.

3.2 Research Design

This study aims to examine the relationship between teacher acceptance and use of SMS as the endogenous (dependent) variable with principal technology leadership practices as the exogenous (independent) variable and teacher ICT competency as mediating variable with teacher demographic variables as the moderating variable. Based on Orlikowski and Baroudi (1991), "*positivist studies are premised on the existence of a priori fixed relationships within phenomena which are typically investigated with structured instrumentation*" (p. 5). They also noted that positivist studies are "*evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from the sample to a stated population*" (p. 5). The philosophical perspectives (i.e., epistemology) describe the underlying research assumptions regarding the nature of the phenomena being studied. They found that positivism was the dominant epistemology, accounting for 96.8% of the studies on information system implementation and adoption. Meanwhile, their findings also indicated that survey method and cross-sectional design are the predominant forms of information systems research. Fraenkel, Wallen, and Hyun (2011) noted that the quantitative approach is associated with the philosophy of positivism, which emerged in the nineteenth century. According to Muijs (2011), quantitative approach is described as being ‘realist’ or ‘positivist’ where the world works according to fixed laws of cause and effect. Scientific thinking or research is carried out to test theories about these laws. This was further supported by Creswell (2009), who state that in the scientific method, the accepted approach to research by post-positivists is when researcher begins with a theory, then data were collected to verify the theory or to relate variables in research questions. The knowledge that develops through a post-positivist lens is based on careful observation and measurement of the objective reality that exists in the world. Thus, developing numeric measures of observations and studying the behavior of individuals become paramount for a post-positivist. Hence, this study applies post-positivism philosophical paradigm with the support of the organizational behavior theory, leadership theories, and technology acceptance and use theory as the theoretical framework. Meanwhile, post-positivism philosophy also helps to define the elusiveness of leadership by suggesting the teacher’s realities are based on their personal experiences (Mackenzie & Knipe, 2006).

Since this study is to explain the relationship between and among variables, it has an explanatory nature. Thus, quantitative research method is applied to explain how one variable affects another (Creswell, 2014) or to establish the relationship between variables (Fraenkel et al., 2011). According to Creswell (2009), the quantitative approach is the one in which researcher primarily uses post-positivist claims for knowledge, then employs strategies of inquiry such as survey in an unbiased and objective manner (Creswell, 2014), and collects quantifiable data on predetermined instruments that yield statistical data. Thus, quantitative method is based on post-positivism epistemology and numerical data (McMillan & Schumacher, 2010). This study employed the quantitative design, which means that this study relies on numerical data and accuracy (Chua, 2012; Mertler & Charles, 2008). According to Gay, Mills, and Airasian (2012), quantitative research is the collection and analysis of numerical data (Johnson & Christensen, 2008) to describe, explain, predict or control phenomena of interest. Furthermore, quantitative research approaches are applied to describe current conditions and investigate relations among variables (Gay et al., 2012). Quantitative researchers are concerned with the development and testing of hypotheses, and the generation of models and theories that explain behavior. Measurement and statistics are central to quantitative research because they are the connection between empirical observation and mathematical expressions of relations (Hoy, 2010). According to Muijs (2011), quantitative research is about explaining phenomena by collecting quantitative data, which are analyzed by mathematically based methods.

This is a non-experimental quantitative research using survey technique through the administration of questionnaire that was developed for data collection. According to Hoy (2010), non-experimental research is a systematic empirical inquiry in which the researcher does not have direct control of the independent variable because the change in the independent variable has already occurred. Hence, there is no manipulation of an independent variable in non-experimental research (Johnson & Christensen, 2008; McMillan, 2012; Tabachnick & Fidell, 2012) and it is used to depict people, events, situations, conditions, and relationships as currently exist (Mertler & Charles, 2008), thus, a cross-sectional research design is suitable for this study.

Survey research is one of the most popular non-experimental research methods in various fields of study, especially in social sciences (Chua, 2012; Muijs, 2011) and educational research (McMillan, 2012). According to Gay et al. (2012), survey research involves assessing the perceptions, attitudes, beliefs, practices, concerns, interests or other traits of a group of people (Creswell, 2009, 2014; McMillan, 2012). The survey design is selected for this study based on its ability to provide a quantifiable or numeric description of the principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Besides, this design was economical and could provide quick, inexpensive, and accurate means of assessing information about the population (Zikmund, Babin, Carr, & Griffin, 2010). Furthermore, survey research is well suited to descriptive studies, or where researcher wants to look at relationships between variables occurring, in particular, real-life contexts (Muijs, 2011).

A cross-sectional and self-administered questionnaire was the data collection tool for this research design. Cross-sectional survey design is the most popular form of survey design used in education setting, where the researcher collects data at one point in time (Babbie, 2014; Creswell, 2014; Fraenkel et al., 2011; Gay et al., 2012). According to L. Cohen, Manion, and Morrison (2011), a cross-sectional study is one that produces a 'snap-shot' of the current behaviors, attitudes, and beliefs in a population (Gay et al., 2012). This design has the advantage of measuring current attitudes, beliefs, opinions, or practices (Creswell, 2014) and providing data relatively quickly (Gay et al., 2012). The purpose of researcher self-administered the questionnaire is to increase the response rate within a short period of time (L. Cohen et al., 2011; Sekaran, 2003) because a high response rate creates a stronger claim in generalizing results from the sample to the population (Creswell, 2014). Meanwhile, any doubts, queries or uncertainties that the respondents might have on the questionnaire could be clarified on the spot (Sekaran, 2003) or addressed immediately (L. Cohen et al., 2011).

3.3 Population and Sample of the Study

Population refers to the entire group of people, events, or things of interest that the researcher wishes to investigate (Chua, 2012; Sekaran, 2003) and a population contains all the individuals within certain descriptive parameters (Mertler & Charles, 2008). According to Creswell (2014), population is a group of individuals who have the same characteristics and a target population is a group of individuals with some common defining characteristic that researcher can identify, study and would like to generalize (Fraenkel et al., 2011; McMillan, 2012). The targeted population for this study comprised all public secondary day school teachers in Negeri Sembilan, Malaysia. There are 6499 teachers within 89 schools located in six different districts in Negeri Sembilan. Since, this study aims to investigate teachers' perception on the level of principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS, hence, whom being studied or unit of analysis (Babbie, 2014) in this study is the individual teacher. Table 3.1 shows the distribution of schools and teachers in Negeri Sembilan according to districts.

Table 3.1: Number of Public Secondary Day Schools and Teachers in Each of the District, Negeri Sembilan

District	Number of Schools	Number of Teachers
Seremban	35	3085
Jempol Jelebu	19	1159
Kuala Pilah	11	530
Tampin	10	666
Port Dickson	9	735
Rembau	5	324
Total	**89**	**6499**

Based on the total number of teachers in Negeri Sembilan secondary schools (Table 3.1), the minimum number of respondents needed for this study at the significance level of p=.05 is 362 teachers (Krejcie & Morgan, 1970). According to Hair, Black, Babin, and Anderson (2010), the statistical power is determined by three factors which are effects size, alpha, and sample size. They emphasized that researcher must always be aware that sample size can affect the statistical test either by making it insensitive (at small sample sizes) or overly sensitive (at very large sample size), hence, they recommended a sample size between 100 to 400 is the most sufficient (Gay et al., 2012).

Sampling is the process of selecting a sufficient number of elements from the population (Chua, 2012; Johnson & Christensen, 2008), so that a study of the sample and an understanding of its properties or characteristics would make it possible for the researcher to generalize such properties or characteristics to the population (Johnson & Christensen, 2008; Sekaran, 2003). According to Mertler and Charles (2008), a sample is comprised of a small group drawn from a population. Hence, a sample is a subgroup or subset of the targeted population that the researcher plans to study for generalizing about the targeted population (Creswell, 2014) or any part of a population of individuals from whom information is obtained (Fraenkel et al., 2011). In other words, some individuals selected through the sampling procedure to represent the population under study is called as sample (L. Cohen et al., 2011). Since probability sampling is frequently used in non-experimental survey research (Johnson & Christensen, 2008), the selection of samples for this study was conducted in several stages by probability sampling procedure (McMillan & Schumacher, 2010).

In the first stage, proportional stratified random sampling procedure is employed to select the number of teachers needed as samples from each district in Negeri Sembilan. Mertler and Charles (2008) noted that proportional stratified sampling may be used when researcher wants to ensure that the subgroups of the population are represented proportionally in the sample (Gay et al., 2012). Proportional stratified random sampling is a process in which certain subgroups, or strata, are selected for the sample in the same proportion as they exist in the population (Fraenkel et al., 2011; McMillan, 2012). Thus, the six districts exist in the State of Negeri Sembilan are applied as the strata for this study. First, all public secondary day school teachers in Negeri Sembilan are divided into six groups according to the six districts. Then the minimum number of teachers needed from each of the districts was calculated based on the proportion of number of teachers in such district to the total number of teachers multiplied by the number of samples needed. In this study, the number of samples needed is 362 teachers. Figure 3.1 shows the mathematical expression to determine the samples needed from each district and Figure 3.2 is an example of calculation for the Kuala Pilah district. The minimum number of teachers needed from each district is calculated and shown in Table 3.2.

$$\boxed{\text{Number of Teachers needed from each District} = \frac{\text{Number of teachers in such district}}{} \times 362}$$

Total number of teachers

Figure 3.1: Mathematical expression to determine the samples needed

$$\text{Number of Teachers needed from Kuala Pilah District} = \frac{530}{6499} \times 362 = 30 \text{ teachers}$$

Figure 3.2: Example of calculation for the Kuala Pilah district

Table 3.2: Minimum Number of Teachers Needed as Samples from Each of the District

District	Number of Schools	Number of Teachers	Minimum Number of Teachers Needed
Seremban	35	3085	172
Jempol Jelebu	19	1159	65
Kuala Pilah	11	530	30
Tampin	10	666	37
Port Dickson	9	735	41
Rembau	5	324	18
Total	**89**	**6499**	**362**

A. F. Brown (1967) and Hoo (2007) noted that a random selection of between 4 to 10 teachers in a school was adequate to represent the feelings and perceptions of the entire school. Based on this justification, the researcher decided to choose 10 teachers from each school as samples in this study. Hence, the number of schools needed from each district can be calculated based on the minimum number of teachers needed from each district as shown in Table 3.2. The mathematical expression is by dividing the minimum number of teachers required with 10 and the answer was written as the highest whole number. For example, the minimum number of teachers required for the Jempol Jelebu district is 65, hence, 65 divided with 10 is equal to 6.5. Thus, the highest whole number is equal to seven. This meant that the minimum number of schools needed from Jempol Jelebu district is seven. However, the number of teachers shown in Table 3.2 is the minimum number of teachers required from each district, in order to avoid the situation where the response rate achieved always less than 100% and some of the void responses (not completely or wrongly filled) might be obtained, thus, to ensure the data is adequate, the researcher choose an additional school from each district as reserve. Thus, the number of schools needed from the Jempol Jelebu district equal to seven plus one which is equal to eight schools. The actual number of teachers selected is equal to the number of schools required multiply by 10. Hence, the actual numbers of teachers selected as sample from the Jempol Jelebu district are 80 teachers. Table 3.3 shows the number of schools required from each district and the actual number of teachers selected as sample for this study.

Table 3.3: Number of Schools Required from Each of the District and The Actual Number of Teachers Selected as Sample.

District	**Number of Schools**	**Number of Teachers**	**Minimum Number of Teachers Needed**	**Number of Schools Required**	**Actual Number of Teachers Selected**
Seremban	35	3085	172	18 + 1 =19	190
Jempol Jelebu	19	1159	65	7 + 1 = 8	80
Kuala Pilah	11	530	30	3 + 1 = 4	40
Tampin	10	666	37	4 + 1 = 5	50
Port Dickson	9	735	41	5 + 1 = 6	60
Rembau	5	324	18	2 + 1 = 3	30
Total	**89**	**6499**	**362**	**45**	**450**

In the second stage, a simple random sampling technique was used to select number of schools required from each district. In simple random sampling, the researcher selects schools as sample so that every school has an equal probability and independent chance of being selected from the population (Chua, 2012; L. Cohen et al., 2011; Fraenkel et al., 2011; Gay et al., 2012; McMillan, 2012; Mertler & Charles, 2008). The intent of simple random sampling is to choose schools to be sampled which will be representative of the population (Creswell, 2014). The procedure used in simple random sampling is to assign a number to each school according to each respective district. For example, Kuala Pilah district has 11 schools, the researcher prepared 11 pieces of small paper label with one number in each piece of the paper from number one to 11, and these 11 pieces of numbers were put into a box. Then a number was drawn randomly from the box containing these 11 numbers as sample number one, without returning the first number back to the box, the second number was drawn from the box and the chosen number was labeled as sample number two and this process was repeated until the numbers of schools required for that respective district is selected (Refer Table 3.3). After that, the same procedure was repeated for another district.

In the final stage, a systematic random sampling was used to select teachers as respondents for this study from each of the selected schools. A systematic random sample of 10 subjects were selected from each school to participate in the study. According to Mertler and Charles (2008), systematic random sampling is often done when all teachers in the school are named on a master staff list and the sample can be drawn directly from that list. Hence, the systematic random sampling procedure started by getting the school's staff list and then the total number of teachers in that school is divided by 10 which are the samples needed from each school to obtain a lowest whole number (*n*). Number *n* is the sampling interval which is the distance in the list between each of the individuals selected as sample (Babbie, 2014; Johnson & Christensen, 2008; Zikmund et al., 2010). Next, a number is chosen randomly by drawing a number from the first *n* numbers as the randomly start first sample. The successive samples were chosen based on every *n*th person until ten teachers are selected as samples from each school. For example, if a school containing 63 teachers, the number *n* is obtained by dividing 63 by 10 which equal to 6.3 and the lowest whole number for 6.3 is six.

Thus, *n* is equal to six. Then, researcher chooses a number randomly from number one to six by drawing a number from a box containing these six number, let say the number chosen is three, hence, the first sample was person number three in the staff list. Next, to get the second sample, researcher add six (*n*) to number three which is equal to nine, this means that the second sample was person number nine in the staff list. By adding six (*n*) to number nine, the third sample was person number 15 in the staff list and so on until researcher got the tenth sample. After that, the same procedure was repeated for another school.

This multistage probability sampling procedure which involved proportional stratified random sampling, simple random sampling and systematic random sampling as mentioned above yield a total number of 450 teachers to be chosen as the samples in this study (Refer Table 3.3).

3.4 Instrumentation

Since this is a quantitative study, a questionnaire was developed by the researcher as an instrument to obtain the information needed for the study. According to Creswell (2014), an instrument is a tool for measuring, observing, or documenting quantitative data that contains specific questions and response possibilities that are established or developed by the researcher in advance of the study.

The instrument (Appendix D) used in this study consists four sections that corresponding to the four main variables in this study. These four variables are teacher demographic variables, principal technology leadership practices, teacher acceptance and use of SMS, and teacher ICT competency. The development of this questionnaire is guided by an extensive review of literature and scale used in the different educational background. Each of the sections is discussed as follows.

3.4.1 Teacher demographic Variable

Based on the extensive review of the literature, the researcher found that there are five teacher demographic variables that have some effect on teachers' technology integration and usage. Hence, the researcher expects these five variables may influence on teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Thus, the following data on teacher demographic variables were collected in this study:

1. Gender
2. Age Group
3. Teaching Experience
4. Highest Educational Level
5. Experience in Using Computer

These variables are listed in Section A of the instrument. Information on subjects' demographic variables are collected in the form of nominal data with two or more unordered categories (Morgan, Leech, Gloeckner, & Barrett, 2004). The number assigned to the objects have no quantitative meaning or no intrinsic value (Sekaran, 2003) beyond indicating the presence or absence of the attribute or characteristic under the investigation. Therefore, the use of nominal data allowed the researcher to examine the various categories of demographic variables using descriptive statistics such as frequency distribution and percentage (Hair et al., 2010).

3.4.2 Principal Technology Leadership Practices

Principal technology leadership practices were measured based on the five composite dimensions of ISTE Standards•A (2009). These dimensions are: (i) Visionary leadership; (ii) Digital age learning culture; (iii) Excellence in professional practice; (iv) Systemic improvement and (v) Digital citizenship. However, through a thorough review of the literature, the researcher had found that there is no assessment instrument has been created to measure the administrators' progress towards meeting this standard. Since there is no existing survey instrument that measures principal technology leadership practices using the updated version of ISTE Standards•A (2009) which contained five dimensions of technology leadership, the researcher developed the instrument based on the elements in the ISTE Standards•A (2009) as guideline together with the adaptation of some High Impact Malaysian School Leaders Competencies Standard elements related to technology leadership from an instrument named "*Instrumen Kompetensi Pemimpin Sekolah*" (KOMPAS) which was developed by The National Institute of Educational Leadership and Management, Institute Aminuddin Baki (Senin, Manaf, Abd. Halim, & Abd. Hamid, 2011).

Each of the five dimensions has different number of items. The item pool for principal technology leadership practices consists of 32 items with five dimensions (Section B of the questionnaire). Each of the five dimensions has five to eight items as observed variables. Table 3.4 shows the summary of the breakdown of the principal technology leadership practices items according to each dimension.

Table 3.4: Summary of the Breakdown of Principal Technology Leadership Practices - Dimensions and Items

Dimension	Items	No of Items
Visionary Leadership	B1 to B5	5
Digital Age Learning Culture	B6 to B11	6
Excellence in Professional Practice	B12 to B18	7
Systemic Improvement	B19 to B24	6
Digital Citizenship	B25 to B32	8
Total		**32**

Teacher's perceptions on principal technology leadership practices on the five dimensions are measured according to a numerical rating scale. A numerical rating scale consists of a set of numbers and "*anchored*" endpoints and researcher normally labels the anchor with a written descriptor (Johnson & Christensen, 2008). The numerical rating scale from number 0 to 10 is used to measure teachers' perception on principal technology leadership practices, where the first endpoint "*0*" is anchored by the words "*never practice at all*". The other endpoint "*10*" is anchored by the words "*most frequent practice*". The researcher chooses this numerical rating scale because it provides the highest level of measurement precision and permitting all mathematical operation to be performed (Hair et al., 2010).

According to Zainudin Awang (2014), the ideal measurement scale to run the SEM should be in the interval form from one (1) to ten (10) so that the data is more independent and meet the requirement for parametric analysis. This is further explained by L. Cohen et al. (2011) who stated that if a researcher wishes to calculate more sophisticated level of statistics such as regressions, factor analysis, and structural equation modelling, then a ratio scale must have a true zero ('0') and equal intervals, thus many rating scales use an 11-point scale that runs from 0 to 10, with 0 being '*not at all*' (or something equivalent to this, depending on the item) and 10 being the highest score that meets the minimum requirements for ratio measures.

3.4.3 Teacher Acceptance and Use of School Management System (SMS)

Teacher acceptance and use of SMS was self-rated by the teachers based on the UTAUT2 Model (Venkatesh et al., 2012), which comprised six dimensions: (i) Performance Expectancy; (ii) Effort Expectancy; (iii) Social Influence; (iv) Facilitating Condition; (v) Hedonic Motivation; and (iv) Habit. The Researcher adapted this scale because based on literature review, this model showed the highest predictive power to explain the user's acceptance and use of technology.

Each of the six dimensions has five items as observed variables and the total number of items in the item pool for teacher acceptance and use of SMS consists of 30 items (Section C of the questionnaire). Table 3.5 shows the summary of the breakdown of the teacher acceptance and use of SMS items according to each dimension.

Table 3.5: Summary of the Breakdown of Teacher Acceptance and Use of SMS - Dimensions and Items

Dimension	**Items**	**No of Items**
Performance Expectancy	C1 to C5	5
Effort Expectancy	C6 to C10	5
Social Influence	C11 to C15	5
Facilitating Conditions	C16 to C20	5
Hedonic Motivation	C21 to C25	5
Habit	C26 to C30	5
Total		**30**

The numerical rating scale run from number 0 to 10 is used to measure teachers' level of agreement about the acceptance and use of SMS. The first endpoint "*0*" is anchored by the words "*not agree at all*" and the other endpoint "*10*" is anchored by the words "*highest agreement*".

3.4.4 Teacher ICT Competency

Teacher ICT competency was self-rated by the teachers based on ISTE Standards•T (2008). These standards consisted five dimensions which are: (i) Smart Pedagogy; (ii) Digital age learning experiences and assessments; (iii) Digital age work and learning; (iv) Digital citizenship and responsibility; and (v) Professional growth and leadership.

However, through the thorough review of the literature, the researcher had found that there is no assessment instrument has been created to measure teacher ICT competency towards meeting this standard. Since there is no existing survey instrument to measure teacher ICT competency using the updated version of ISTE Standards•T (2008) which contained five dimensions, the researcher developed the instrument based on the elements in the ISTE Standards•T (2008) as the guideline. Besides, the researcher also adapted some of the ICT competency standards for Malaysian Science and Mathematics teachers developed by a group of researchers using Delphi technique (Fong et al., 2013).

Each of the five dimensions has different number of items. There are 31 items (Section D of the questionnaire) in the item pool for teacher ICT competency. Each of the five dimensions has five to nine items as observed variables. Table 3.6 shows the summary of the breakdown of the teacher ICT competency items according to each dimension.

Table 3.6: Summary of the Breakdown of Teacher ICT Competency - Dimensions and Items

Dimension	Items	No of Items
Smart Pedagogy	D1 to D6	6
Digital Age Learning Experience and Assessments	D7 to D12	6
Digital Age Work and Learning	D13 to D17	5
Digital Citizenship and Responsibility	D18 to D22	5
Professional Growth and Leadership	D23 to D31	9
Total		**31**

The numerical rating scale from number 0 to 10 is used to measure on teachers' level of competence. The first endpoint "*0*" is anchored by the words "not competence at all" and the other endpoint "*10*" is anchored by the words "*most competence*".

3.5 Reliability and Validity of the Developed Instrument (Pilot Study)

The instrument used in this study is developed by the researcher based on the review of related literature and previous studies, especially the work by Venkatesh et al. (2012) and Fong et al. (2013). Prior to the construction of the instrument, the researcher was given permission to adapt their scale (Appendix E and F) and permission from ISTE to adapt some of the elements in the ISTE Standards•A (2009) and ISTE Standards•T (2008) (Appendix G).

The instrument consisted of bilingual items both in English and Malay languages. The English items were translated by two language experts who were bilingual. The consistency of items in both languages was maintained through a double back translation technique (Zikmund et al., 2010).

After the development of the instrument, the researcher needs to be reasonably sure that the instrument used in this research does indeed measure the variables they are supposed to, and that they measure them accurately. Hence, the researcher needs to assess the "*goodness*" of the instrument developed by establishing the validity and reliability of the instrument (Sekaran, 2003).

3.5.1 Validity

Validity is the capability of a measurement or a set of instrument to measure correctly the concept of study (Babbie, 2014; Chua, 2012; Hair et al., 2010; Sekaran, 2003). According to Fraenkel et al. (2011), validity refers to the appropriateness, meaningfulness, correctness, and usefulness of the inferences a researcher makes from the test scores (Johnson & Christensen, 2008). Hence, in this study, two types of validity were discussed in detail which includes the content validity and the construct validity of the developed instrument.

3.5.1.1 Content Validity

Content validity is to ensure that the measure includes an adequate and representative set of items that measure the concept or how well the dimensions of a concept have been delineated (Sekaran, 2003). According to Muijs (2011), content validity refers to whether the content of the manifest variables is right to measure the latent concept that the researcher intended to measure. In other words, content validity is the extent to which the items in the instrument and the scores from these questions are representative of all the possible questions that a researcher could ask about the content or skills (Gay et al., 2012). Typically researchers go to a panel of judges or experts and have them identify whether the questions are valid (Blunch, 2013; Creswell, 2014; Gay et al., 2012). Thus, the instrument was evaluated by a panel of experts for content and face validity (Appendix H). Feedback from the panel of experts was used mainly to ensure that the three scales measure the content areas of investigation and are culturally and technically appropriate for the context of this study. Then, based on the experts' suggestions, the items were revised for consistency of terminology, specificity of questions and responses, and additional items that should be included before the instrument was administered to the respondent. Table 3.7 below shows some examples of the amended items based on the experts' comments.

Table 3.7: Examples of the Amended Items Based on the Experts' Comments

Expert	Item	Initial Item	Amended Item
No 1	B29	*Pengetua saya menggalakkan kebertanggungjawaban interaksi sosial berkaitan dengan penggunaan ICT.*	*Pengetua saya menggalakkan rasa tanggungjawab terhadap interaksi sosial berkaitan dengan penggunaan ICT.*
	B30	*Pengetua saya menjadi teladan dalam kebertanggungjawaban interaksi sosial berkaitan dengan penggunaan ICT.*	*Pengetua saya menjadi teladan dalam interaksi sosial yang bertanggungjawab berkaitan dengan penggunaan ICT.*
	B31	*Pengetua saya menjadi teladan dalam perkongsian perkembangan pemahaman budaya melalui penggunaan ICT.*	*Pengetua saya menjadi teladan dalam kesefahaman budaya melalui penggunaan ICT.*
	B32	*Pengetua saya memudahcarakan perkongsian perkembangan pemahaman buday melalui penggunaan ICT.*	*Pengetua saya memudahcarakan perkembangan kesefahaman budaya melalui penggunaan ICT.*
No 2	B1	*Pengetua saya membimbing pembangunan satu visi bersama ke arah memaksimumkan penggunaan ICT.*	*Pengetua saya memimpin pembangunan satu visi bersama ke arah memaksimumkan penggunaan ICT.*
	B7	*Pengetua saya menggalakkan penggunaan ICT yang berkesan untuk pembelajaran.*	*Pengetua saya menggalakkan penggunaan ICT yang berkesan dalam pembelajaan.*
No 3	C24	The challenge of using SMS is exciting for me.	The challenge of using SMS is interesting for me.
No 5	B1	*Pengetua saya membimbing pembangunan satu visi bersama ke arah memaksimumkan penggunaan ICT.*	*Pengetua saya memimpin pembangunan visi bersama ke arah memaksimumkan penggunaan ICT.*
	B5	*Pengetua saya mendorong aktiviti di pelbagai peringkat (tempatan, negeri atau kebangsaan) bagi menyokong implementasi pelan strategik integrasi*	*Pengetua saya mendorong pelbagai aktiviti bagi menyokong implementasi pelan strategik integrasi teknologi.*

		teknologi.	
No 6	C15	*Ibubapa pelajar saya mendapati saya harus menggunakan SPS.* (My students' parent found that I should use SMS)	*Ibubapa pelajar saya lebih suka saya menggunakan SPS.* (My students' parent prefer that I use SMS)
	C27	*Saya bergantung kepada penggunaan SPS dalam membuat keputusan.* (I become dependent upon using SMS to make decision).	*Saya membuat keputusan berdasarkan maklumat dalam SPS.* (I make decisions based on information from SMS).
	C29	I like working with SMS in my daily works.	I like using SMS in my daily work.
	D28	*Saya menggunakan ICT untuk membangunkan kemahiran teknologi orang lain.* (I use ICT to develop others people technology skills)	*Saya menggunakan ICT untuk membangunkan kemahiran teknologi guru lain.* (I use ICT to develop other teachers technology skills).

According to Muijs (2011), the way in which the questionnaire is designed and questions are worded will affect the respondents' answers. Hence, the developed questionnaire was pre-tested by distributing 10 questionnaires to the bilingual teachers as respondents. A pre-test of the questionnaire can reveal ambiguities, poorly worded questions, questions that are not understood, and unclear choices; it can also indicate whether the instructions to the respondents are clear (Fraenkel et al., 2011). In other words, pre-testing helped in identifying any potential problem with wordings or measurement and ambiguities (Sekaran, 2003), because wordings and phrasings substantially influence accuracy (Zikmund et al., 2010). After pre-testing, the questionnaire was revised according to the respondents' suggestions. Additional suggestions were made to reduce ambiguities in the wording of few statements.

3.5.1.2 Construct Validity

Construct validity is established by determining whether the scores from an instrument is significant, meaningful, useful, and have a purpose (Creswell, 2014). According to Sekaran (2003), construct validity testified how well the results obtained from the use of the measured fit with theories around which the test is designed. In other words, construct validity is related to the internal structure of an instrument and the concept it is measuring (Muijs, 2011). This construct validity could be assessed through the confirmatory factor analysis (CFA) in structural equation modelling (SEM) by using AMOS software (Kline, 2011). According to Kline (2011), the minimum number of sample required for the CFA in SEM is 100. Hence, the construct validity of the developed instrument would be assessed and reported using the real data collected from the Negeri Sembilan secondary schools (N=417) in section 4.3.4.

The validation of the instrument included an extensive search of the literature on the concept of technology leadership, ICT competency and technology acceptance and use; a professional review for content validity; a pre-testing was carried out to check for the instrument's face validity; and CFA was conducted to verified construct validity of the instrument developed. Unsatisfactory items were revised according to comments and suggestions of professional reviewers and the pre-testing respondents' comments. Following this initial inspection, the developed instrument has exhibited sufficient content validity and construct validity. In the next stage, the survey was administered to a pilot group to establish the instruments' reliability. After that, the questionnaire was administered to the targeted population.

3.5.2 Reliability

Reliability is the extent to which a variable or set of variables is consistent with what it is intended to measure (Fraenkel et al., 2011; Gay et al., 2012; Hair et al., 2010). The reliability of a measure indicates the extent to which the measurement is without bias or error free and hence ensures consistent measurement across time and across various items in the instrument. In other words, the reliability of a measure is an indication of the stability and consistency with which the instrument measures the concept and helps to assess the 'goodness' of measure (Johnson & Christensen, 2008; Sekaran, 2003). The internal consistency of measures is the indicative of the homogeneity of the items in the measure of a construct (DeVellis, 2012) or how well the items in one construct or dimension were correlated to one another. The most popular test of inter-item consistency reliability is Cronbach's Alpha coefficient (Pallant, 2013).

Cronbach's alpha, a coefficient of reliability, measures how well a set of items or variables measure a single one-dimensional latent construct was used to assess the instrument reliability. This method measures the internal consistency of the test instrument through an analysis of inter-items correlation. If the inter-item correlation value of an item is high, there is evidence that the item is reliable for measuring the underlying construct whereas items with low inter-item correlation value will have low reliability and will be removed from the instrument (Chua, 2012; L. Cohen et al., 2011).

According to Sekaran (2003), reliabilities less than .60 are considered to be poor, those in the range of .60 to .70 are acceptable, and those over .80 are good. Based on Chua (2013), Cronbach's Alpha coefficient for an instrument in the range of .65 to .95 is sufficient. Generally, reliability coefficients around .90 are considered "*excellent*", values around .80 are "*very good*", and values around .70 are "*adequate*" (Kline, 2011). Thus, it can be concluded that Cronbach's Alpha coefficient greater than .70 (Fraenkel et al., 2011; Johnson & Christensen, 2008; Muijs, 2011; Zainudin Awang, 2013) is the most preferable and acceptable.

The developed instrument was pilot tested using 57 secondary school teachers in some secondary schools located in the state of Selangor, Perak, and Johor to avoid contamination of the pilot study (Chua, 2012). Data gathered were analyzed using Statistical Package for Social Sciences (SPSS) version 22.0 for internal consistency of the instrument. The analysis yields Cronbach's Alpha coefficient as shown in Table 3.8.

Table 3.8: The Cronbach's Alpha Coefficient of The Pilot Study (N=57)

Section/ Variable	Dimension	Cronbach's Alpha
Section B: Principal Technology Leadership Practices	Visionary Leadership	.917
	Digital Age Learning Culture	.936
	Excellence in Professional Practice	.923
	Systemic Improvement	.908
	Digital Citizenship	.944
Section C: Teacher Acceptance and Use of SMS	Performance Expectancy	.862
	Effort Expectancy	.919
	Social Influence	.878
	Facilitating Conditions	.843
	Hedonic Motivation	.926
	Habit	.915
Section D: Teacher ICT Competency	Smart Pedagogy	.853
	Digital Age Learning Experience and Assessments	.929
	Digital Age Work and Learning	.807
	Digital Citizenship and Responsibility	.800
	Professional Growth and Leadership	.919

From the analysis of the pilot study data (N=57), it was found that the Cronbach Alpha for the principal technology leadership practices dimensions were between .908-.944;

teacher acceptance and use of SMS dimensions were in the range of .843-.926; and teacher ICT competency dimensions were between .800-.929. Based on the results of this reliability test, the researcher concluded that the instrument developed for this study showed a very good level of internal consistency.

3.6 Research Procedure

As soon as the pilot study was completed and the validity and reliability of the instrument were established, the first step is to get faculty's permission through approval from an institutional review board (Creswell, 2014). This is done after the successful presentation of the research proposal by the researcher. A letter of seeking permission (Appendix I) for research to be conducted in schools was issued by the Institute of Educational Leadership to the Educational Planning and Research Division (EPRD), MOE. Then the researcher obtained an approval letter from EPRD by submitting a research proposal and questionnaire together with the letter of seeking permission from the institution for research to be conducted in schools. After getting the approval letter from the EPRD (Appendix J), the researcher needs to obtain approval from Negeri Sembilan State Education Department (Appendix K) by attaching approval letter from the EPRD and a personal letter seeking permission to conduct this study in Negeri Sembilan secondary schools.

After getting all the above consents, a formal letter was sent to the related schools to obtain permission from the school's principals to enter the site and to study their setting. The information in the letter includes the purpose of the study, the amount of time researcher needed at the school for collecting data, the time and date required, numbers of teachers involved, the benefits of the study, and the provisions the researcher made of protecting the anonymity of the participant. The researcher then contacts the principals of the respective schools to make an appointment to conduct the study and to seek their cooperation for the success of the study.

The data collection is carried out through direct administration and self-collection method. On the data collection appointment date with a school, the researcher first meets with the respective school principal and have the principal's permission to get the school's staff list. Then, the respondents were selected using systematic random sampling procedure. The selected respondents were informed to gather at one location and prior to the administration of the instrument, participants were briefed on the purpose of this study, told of their rights to withdraw from the study before, during or after they had completed the questionnaire and informed that their participation was voluntary and confidentiality was assured to alleviate teacher anonymity concerns. Finally, they were told that they could ask the researcher if they have any query when filling in the questionnaire. The respondents were given 20 minutes to fill-up their respond on the provided questionnaires and immediately the questionnaires were collected by the researcher after respondents have fill-up the questionnaire completely. The same procedure was repeated to the successive schools in the six districts of Negeri Sembilan until all the 450 questionnaires disseminated, filled, and collected.

3.7 Analysis of Data

Numerical data gathered were analyzed quantitatively using Statistical Package for Social Sciences (SPSS) and Analysis of Moment Structures (AMOS) version 22.0. Both descriptive and inferential statistical methods were used to analyze the data to answer the twelve research questions proposed. The goal of descriptive statistics is to describe, summarize, or make sense of a particular set of data while the goal of inferential statistics is to go beyond the immediate data and to infer the characteristics of populations based on samples (Chua, 2013; R. Ho, 2014; Johnson & Christensen, 2008).

3.7.1 Descriptive Statistic

Descriptive statistic transforms a set of numbers into indices that summarize characteristics of a sample (McMillan, 2012). According to L. Cohen et al. (2011), descriptive statistics include frequencies, measures of central tendency (means, modes, medians), measures of dispersal (range, interquartile range, and standard deviations), cross-tabulations, and standardized scores. Hence, in this study, descriptive statistics in term of mean and standard deviation are used to answer the first three research questions.

Multiple items may capture the essence of an unobservable variable with a higher degree of precision than a single item (DeVellis, 2012) because using multiple items to measure a single concept is more likely to represent all the different aspects of the concept (Hair, Hult, Ringle, & Sarstedt, 2014). Besides, the use of multiple items designed to measure a construct is carried out to reduce the effect of measurement error in any individual indicator on the accuracy of the results (Kline, 2011) and to increase the reliability and validity of the measures. One common procedure for the measurement of an abstract construct is called a summated scale (Hair et al., 2010). A summated scale is composed of multiple items that are designed to measure the same construct (Hair et al., 2010; Johnson & Christensen, 2008). In this study, the researcher reported the summated scale in term of mean and standard deviation for each of the dimensions of principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS.

In addition to reducing measurement error by improving each of the individual variables under this study, the researcher also develops a multivariate measurement, also known as the summated scale for each variable, where several dimensions are joined in a composite measure to represent a construct. The objective is to avoid the use of only a single dimension to represent a construct and instead to use several dimensions as indicators, all representing differing facets of the construct to obtain a more well-rounded perspective. The use of multiple indicators enables the researcher to more precisely specify the desired responses. It does not place total reliance on a single response, but instead on the "average" or typical response to a set of related responses (DeVellis, 2012; Hair et al., 2010).

Next, the composite mean obtained from the summated scale was used to assess the level of principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS. These composite mean were collapsed into three levels with equal interval according to the interpretation of mean in the range as shown in Tables 3.9.

Table 3.9: Interpretation of Level According to Mean

Mean	Interpretations (Level)
0.00 – 3.33	Low
3.34 – 6.67	Medium
6.68 – 10.00	High

3.7.2 Pearson Product-Moment (Inferential Statistic)

Inferential statistic is used to answer research questions fourth to sixth. The Pearson Product-Moment correlation test was carried out to identify the relationship between two variables (McMillan, 2012) which use numerical rating scale as the measurement scale. In other words, the Pearson correlation, r estimates the degree of linear association between two continuous variables (Kline, 2011). Thus, Pearson Product-moment correlation coefficient was computed to examine the relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools (RQ4); to examine the relationship between principal technology leadership practices and teacher ICT competency in Negeri Sembilan secondary schools (RQ5); and to examine the relationship between teacher ICT competency and teacher acceptance and use of SMS in Negeri Sembilan secondary schools (RQ6). The correlation coefficient (*r*) is a value that measures the direction and strength of relationship between the two variables (McMillan, 2012). The *r* value ranges from +1.00 to -1.00. The strength of the correlation is based on Chua (2013) as shown in Table 3.10.

Table 3.10: The Strengths of Correlation Coefficient Values

Correlation Coefficient (*r*)	Strength of Correlation
.91 to 1.00 or -.91 to -1.00	Very Strong
.71 to .90 or -.71 to -.90	Strong
.51 to .70 or -.51 to -.70	Average/ Moderate
.31 to .50 or -.31 to -.50	Weak
.01 to .30 or -.01 to -.30	Very Weak

.00	No Correlation

3.7.3 Multiple Regression Analysis (Inferential Statistic)

The inferential statistic in term of multiple regression analysis which is an extension of the bivariate correlation was used to answer research questions number seven to nine. The multiple regression analysis is used to identify if change in two or more factors (independent variables) contribute to change in a dependent variable (Chua, 2013; R. Ho, 2014). Hence, in this study, multiple regression analysis was carried out to identify which dimensions of principal technology leadership practices contribute to the changes in the teacher acceptance and use of SMS (RQ7); which dimensions of principal technology leadership practices contribute to the changes in the teacher ICT competency (RQ8); which dimensions of teacher ICT competency contribute to the changes in the teacher acceptance and use of SMS (RQ9). In regression analysis, the independent variable is known as the predicting variable, while the dependent variable is known as the criterion variable (Chua, 2013).

The step-wise multiple regression method was employed in this study to determine the significant predictors among the principal technology leadership practices dimensions in explaining teacher acceptance and use of SMS in Negeri Sembilan secondary schools (RQ7); the significant predictors among the principal technology leadership practices dimensions in explaining teacher ICT competency in Negeri Sembilan secondary schools (RQ8); and the significant predictors among the teacher ICT competency dimensions in explaining teacher acceptance and use of SMS in Negeri Sembilan secondary schools (RQ9).

In regression analysis, the overall effect size of the model is based on the R^2 value. The interpretation of the model's effect size was based on Cohen's (1988) benchmark range of effect sizes as shown in Table 3.11.

Table 3.11: The Cohen's (1988) Benchmark Range of Effect Size

R^2	Strength of Effect Size
< .13	Small
.13 - .26	Medium
> .26	Large

While the effect size of the individual predictor is given by the beta weightings (L. Cohen et al., 2011) and the interpretation of the effect size of the individual predictor is based on Muijs (2011) effect size as shown in Table 3.12.

Table 3.12: The Muijs's (2011) Beta Value and Strength of Effect Size

Beta (β)	Strength of Effect Size
0 to .10	Weak Effect
.11 to .30	Modest Effect
.31 to .50	Moderate Effect
> .51	Strong Effect

3.7.4 Structural Equation Modelling (SEM)

The structural equation modelling (SEM) procedure with Analysis of Moment Structures (AMOS) version 22.0 was carried out to answer research questions ten to twelve. According to Zainudin Awang (2013), AMOS is one of the latest software that enables the researcher to model and analyze the inter-relationship among constructs having multiple indicators effectively, accurately, and efficiently. More specifically, the multiple equations of correlational and causal relationships in a model are computed simultaneously. Besides, it is also a powerful software that enables researchers to support their theories by extending standard multivariate analysis method which including regression, factor analysis, correlation, and analysis of variance.

SEM is a second generation statistical analysis technique developed for analyzing the inter-relationships among multiple variables in a model (Hair et al., 2010) and the inter-relationships among variables could be expressed in a series of single and multiple regression equations (Zainudin Awang, 2013). SEM is a type of statistical analysis that takes a confirmatory approach to the analysis of a structural theory relating to some phenomenon with two important aspects of the procedure: (1) the causal processes under study are represented by a series of structural equations; and (2) these structural relations can be modelled pictorially to enable a clearer conceptualization of the theory under study (Byrne, 2010). SEM has four significant benefits when compared to other multivariate techniques, these include (Byrne, 2010):

1. SEM takes a confirmatory approach rather than an exploratory approach to the data analysis, although SEM can also address the later approach. SEM lends itself well to the analysis of data for the purposes of inferential statistics.
2. SEM can provide explicit estimates of error variance parameters, but traditional multivariate techniques are incapable of either assessing or correcting for measurement error.
3. Data analysis using SEM procedures can incorporate both unobserved (i.e. latent) and observed variables, but the former data analysis methods are based on observed measurements only.
4. SEM methodology has many important features available which include modelling multivariate relations, or for estimating point and/or interval indirect

effects whilst there are no widely and easily applied alternative methods for these kinds of features.

Besides, Zainudin Awang (2014) listed the other advantages of SEM as follow:

1. Could run CFA to reduce measurement errors.
2. Could deal with the problem of multicollinearity among independent variables.
3. Could analyze the model with multiple independent variables as well as multiple dependent variables.
4. Could model and analyze the mediating effects of certain variable (mediator).
5. Could model and analyze the moderating effects of certain variable (moderator).
6. Could assess the fitness of the overall model as well as assessing individual construct.
7. Could model the error terms and handle the correlated errors among response items.
8. Could entertain the second order constructs in a model.

Furthermore, AMOS software could be utilized to explore statistical relationships among the measuring items of each construct (dimension) and also between constructs (Zainudin Awang, 2013). Because of this outstanding feature, SEM was used to determine the construct validity of the developed instrument through convergent validity with CFA and discriminant validity to assess whether the multicollinearity problem exists in the developed instrument. Additionally, the SEM was also used to validate the measurement models and structural model in the preliminary data analysis section.

Subsequently, SEM was used to answer research questions ten to twelve in term of mediating effect (RQ10: Is teacher ICT competency a mediator for the relationship between principal technology leadership practices and teacher acceptance and use of SMS?), moderating effect (RQ11: Do teacher demographic variables moderate the relationship between principal technology leadership practices and teacher acceptance and use of SMS?) and model fit (RQ12: Does the proposed model of principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS fit with the data collected from Negeri Sembilan secondary school teachers?).

According to Zainudin Awang (2013), AMOS is the software developed specifically meant for analyzing the SEM. Using AMOS, the researcher can specify, estimate, assess, and present the model in a causal path diagram to show the hypothesized relationships among constructs of interest and the empirical model can be tested against the hypothesized model for goodness of fit.

The evaluation of the model fit is determined from the model-data fit indexes. There are a series of goodness-of-fit indexes that reflect on the fitness of the model to the data collected. However, there is no agreement among researchers which fitness indexes should be reported (Zainudin Awang, 2014). Thus, Hair et al. (2010) recommended the use of at least three fit indexes by including at least one index from each category of model fit. The three fitness categories are absolute fit, incremental fit, and parsimonious fit. The information concerning the fitness index category, their level of acceptance, and comments are presented in Table 3.13.

Table 3.13: Index Category and the Level of Acceptance for every Fitness Index (Zainudin Awang, 2014, p. 64)

Category and Index	Level of Acceptance	Comments
Absolute Fit Index		
1) Chisq (Discrepency Chi Square)	P > .05	Sensitive to sample size >200
2) RMSEA (Root Mean Square of Error Approximation)	RMSEA < .08	Range .05 to .10 acceptable
3) GFI (Goodness of Fit Index)	GFI > .90	GFI =.95 is a good fit
Incremental Fit Index		
4) AGFI (Adjusted Goodness of Fit)	AGFI > .90	AGFI = .95 is a good fit
5) CFI (Comparative Fit Index)	CFI > .90	CFI = .95 is a good fit
6) TLI (Tucker Lewis Index)	TLI > .90	TLI =.95 is a good fit
7) NFI (Normed Fit Index)	NFI >.90	NFI = .95 is a good fit
Parsimonious Fit Index		
8) Chisq/df (Chi Square/Degrees of Freedom)	Chisq/df < 5.0	The value should be below 5.0

Since the number of samples involved in this study are more than 200, the researcher decided to report four model fitness indexes for all the models that would be discussed in this study. These four model fitness indexes are Root Mean Square of Error Approximation (RMSEA) and Goodness of Fit Index (GFI) for Absolute Fit Index, Comparative Fit Index (CFI) for Incremental Fit Index, and Chi Square/Degrees of Freedom (Chisq/df) for Parsimonious Fit Index.

The model re-specification is the procedure which can help the researcher to improve the hypothesized model with poor results of fit indexes. If researchers found any path that does not fit with the hypothesized model, they could either modify the path to improve the fitness of the model or remove that particular path completely from the hypothesized model according to the modification indices (MI) suggested (Zainudin

Awang, 2014). In MI, the improvement in model fit is measured by reduction in chi-square value. Each modification index represents the expected drop in the overall chi-square for the model fit if that particular parameter was to be freely estimated in a subsequent run (Byrne, 2010; Kline, 2011). The researcher can employ the MI of covariance with expected parameter change (EPC) value which is more than .10 to assist them to pinpoint the misfit of the hypothesized model. Byrne (2010) points out that the large MI in covariance denotes that there are errors in the measured items such as the content are overlapping or the existing of response bias in social desirability or yea- and nay-saying. However, the decision for proceeding a re-specification of the model should not merely depend on the MI value, the ultimate decision must be supported by the theoretical basis according to the literature review that grounded the model.

The model re-specification is a step for improving the hypothesized model through deleting the non-significant structure coefficients for trimming the model or adding the coefficients between factors and indicators to develop the model. The MIs provided the key information for denoting and adding of the coefficients between factors and indicators to develop the model. Moreover, the improving of the misfit of the hypothesized model should be limited to just deleting one item per time in the re-specification process because any deletion may affect other parts of the model simultaneously. Consequently, the model re-specification process should be reported until the hypothesized model has attained the benchmark of the acceptable fit indexes.

Besides, individual estimates of free parameters should be assessed by examining the magnitude and significance of the paths between each latent variable and its indicators (Byrne, 2010; Kline, 2011). The statistic test used is critical ratio (C.R.), which represents the parameter estimate divided by its standard error that operates as a z-statistic in testing that estimate is statistically different from zero (Byrne, 2010). According to Chua (2009) and Byrne (2010), C.R. above ±1.96 is considered as significant at 5% of the probability level ($p<.05$). Next, the magnitude of the standardized factor loading would be reported or showed in the form of AMOS graphic. Finally, relationships between the variables in term of mediating and moderating effects would be addressed and discussed based on this re-specified structural model.

Table 3.14 shows the types of statistical analysis used to analyze each of the proposed research questions in this study.

Table 3.14: Statistical Analysis Based on Research Questions

	Research Question	Variables	Type of Analysis
1	What are the levels of teacher acceptance and use of SMS in Negeri Sembilan secondary schools?	EndoV: Teacher Acceptance and Use of SMS (TAU)	Descriptive Statistic: Mean score & Standard Deviation
2.	What are the levels of principal technology leadership practices in Negeri Sembilan secondary schools?	ExoV: Principal Technology Leadership Practices (PTLP)	Descriptive Statistic: Mean score & Standard Deviation
3	What are the levels of teacher ICT competency in Negeri Sembilan secondary schools?	MeV: Teacher ICT competency (TIC)	Descriptive Statistic: Mean score & Standard Deviation
4	Is there a significant relationship between the principal technology leadership	ExoV: PTLP	Inferential Statistic: Pearson *r*

	practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools?	EndoV: TAU	Correlation
5	Is there a significant relationship between the principal technology leadership practices and teacher ICT competency in Negeri Sembilan secondary schools?	ExoV: PTLP MeV: TIC	Inferential Statistic: Pearson *r* Correlation
6.	Is there a significant relationship between teacher ICT competency and teacher acceptance and use of SMS in Negeri Sembilan secondary schools?	MeV: TIC EndoV: TAU	Inferential Statistic: Pearson *r* Correlation
7.	Which of the principal technology leadership practices dimensions are the significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools?	ExoV: PTLP EndoV: TAU	Inferential Statistic: Multiple Linear Regression (Stepwise)
8.	Which of the principal technology leadership practices dimensions are the significant predictors of teacher ICT competency in Negeri Sembilan secondary schools?	ExoV: PTLP EndoV: TIC	Inferential Statistic: Multiple Linear Regression (Stepwise)
9.	Which of the teacher ICT competency dimensions are the significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools?	ExoV: TIC EndoV: TAU	Inferential Statistic: Multiple Linear Regression (Stepwise)

Table 3.14, continued: Statistical Analysis Based on Research Questions

	Research Question	Variables	Type of Analysis
10	Is teacher ICT competency a mediator for the relationship between principal technology leadership practices and teacher acceptance and use of SMS?	MeV: TIC ExoV: PTLP EndoV: TAU	Inferential Statistic: SEM with AMOS
11	Do teacher demographic variables moderate the relationship between principal technology leadership practices and teacher acceptance and use of SMS?	MoV: Demographic variables ExoV: PTLP EndoV: TAU	Inferential Statistic: SEM with AMOS
12	Does the proposed model of principal technology leadership practices, teacher ICT competency, and teacher acceptance	ExoV: PTLP EndoV:	Inferential Statistic: SEM with AMOS

and use of SMS fit with the data collected from Negeri Sembilan secondary school teachers?	TAU MeV: TIC MoV: Demographic variables

3.8 Summary

This chapter describes in detail the methodology of the study such as research design; population and sample selection; the development of an instrument to examine the level of principal technology leadership practices, teacher acceptance and use of SMS, and teacher ICT competency; how to determine the validity and reliability of the developed instrument; data collection procedures; and data analysis are geared to how researcher answer the research questions. It is envisaged that this study leads to establish the relationship among principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. The subjects in this study are secondary school teachers in Negeri Sembilan. They were selected through probability sampling in several stages. Feedback from the experts and pilot study were obtained to further improve the content validity and reliability of the instrument to measure the level of principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS. The research procedure involved getting approval from the institution, EPRD, State Educational Department, and schools. The data analysis was carried out using Statistical Package for Social Sciences (SPSS) and Analysis of Moment Structures (AMOS) version 22.0. Both descriptive and inferential statistical methods were used to analyze the data to answer the research questions proposed.

CHAPTER 4: RESULTS OF THE DATA ANALYSIS

4.1 Introduction

This chapter presents the results of the data analysis based on the data collected from Negeri Sembilan secondary schools. The first section of this chapter describes the data preparation prior to the analysis, followed by preliminary data analysis in terms of the response rate; an overview of the respondents' demographic variable profiles by gender, age group, teaching experience, educational level, and experience in using ICT; normality test for the data collected; and validation of the developed instrument, measurement models, and structural model through CFA. This is then followed by presenting the statistical analysis results based on the research questions proposed. The results are presented in the form of descriptive statistics followed by inferential statistics for each of the research questions proposed.

4.2 Data Preparation Prior to Analysis

This section described several data preparation procedures prior to the preliminary and main data analysis. The data preparation procedures involved the basic data screening and cleaning steps (Pallant, 2013) to ensure the accuracy of the data and its conversion from raw data form to a more appropriate reduced and classified forms for data analysis. In other words, these steps were conducted to obtain an error free data and to validate the soundness of the data (Tabachnick & Fidell, 2012).

Furthermore, Kline (2011) emphasized that the data preparation and screening is crucial for two reasons: (i) the most widely used estimation methods for SEM require certain assumptions about the distributional characteristics of the data, and (ii) data-related problems can make SEM computer programs fail to yield a logical solution, or "*crash*".

The initial step in the data screening was carried out to ensure the consistency and completeness of the data. The researcher decided that respondents who completed at least 75% of the questionnaire were included in the data analysis and those with more than 25% unanswered questions were excluded (Sekaran, 2003).

Next, a data entry file in SPSS was established for the data entry procedure. Then, the raw data was manually keyed into this data entry file and the error rate of transmission of 0.05% was allowed (Zikmund et al., 2010). Meanwhile, the coding procedure was carried out. The survey data was coded where necessary including the responses to the demographic variables, itemizing the question numbers, variable names and labels, and value labels. According to Sekaran (2003), human errors could occur during this procedure. Thus, he suggested to check at least 10% of the coded questionnaires to ensure coding accuracy. Based on this suggestion, the researcher decided to check on 20% of the coded questionnaires through systematic sampling procedure. This was carried out by checking on every fifth record and if too many errors were found in that particular sample, checking for all items would be taken into consideration.

In the data cleaning step, the data were examined through SPSS, where the minimum and maximum values, means, and standard deviations of each of the survey items were inspected for plausibility (Tabachnick & Fidell, 2012). Out-of-range values in the data file were corrected in the SPSS data entry file by referring to the original questionnaire until all values were deemed reasonable.

Subsequently, treatment of missing data was carried out by analyzing the quantity and patterns of the missing data. According to Tabachnick and Fidell (2012), if the missing data represent less than 5% of the total data and it is missing in a random pattern from a large data set, "*almost any procedure for handling missing data values yield similar results*" (p. 63). Based on this recommendation, the researcher decided that cases with over 5% obvious errors and illegible responses were excluded for further analysis. The SPSS Missing Values Analysis procedure was performed to estimate the missing values and to detect the patterns within these missing data (Pallant, 2013; Tabachnick & Fidell, 2012).

4.3 Preliminary Data Analysis

This section includes information regarding the survey response rate, respondents' demographic variable profiles, normality test for the data collected, and validation of the developed instrument, measurement models, and structural model through Confirmatory Factor Analysis (CFA).

4.3.1 Survey Response Rate

A total of 450 questionnaires were distributed to the respondents and a total of 440 questionnaires were returned. This yields a response rate of 97.8%. However, 23 out of

440 of the questionnaires returned were excluded from further data analysis because they were not completed or due to noticeably unreliable responses. Hence, only 417 questionnaires returned were analyzed, representing a valid response rate of 92.7%. Based on Gay et al. (2012) the rule of thumb for the survey response rate based on a good sample is 50% and anything above 50% will increase the confidence with which researcher speak about their findings as generalizable to the population.

4.3.2 Teacher Demographic Variables

After the data were clean and ensure for quality, descriptive statistics was performed by using SPSS to identify the general characteristics of the respondents. Based on the valid 417 subjects responded to the survey questionnaires, a number of variables had been used in order to describe the sample characteristics. Table 4.1 shows the profiles of respondents' demographic variables in term of gender, age group, teaching experience, educational level, and experience in using ICT. The descriptions of the respondents' profiles are presented in term of descriptive statistic using frequency and percentage.

Table 4.1: Profiles of Respondents according to Demographic Variables (N = 417)

Variable	Frequency	Percentage (%)
Gender		
Male	93	22.3
Female	324	77.7
Age (At January 2015)		
Below 31 years old	92	22.1
31 - 40 years old	125	30.0
41 - 50 years old	139	33.3
Above 50 years old	61	14.6
Highest Educational Level		
Certificate/ Diploma	27	6.5
First Degree	331	79.4
Postgraduate (Master/ Doctorate)	59	14.1
Years of Teaching Experience		
Under 5 years	63	15.1
5 – 10 years	107	25.7
Above 10 years	247	59.2
Years of Experience in Using Computer		
Under 5 years	44	10.5
5 – 10 years	100	24.0
Above 10 years	273	65.5

As shown in Table 4.1, the total number of female respondents (n=324) is more than the male respondents (n=93) with the percentage of 77.7% female respondents compared to 22.3% male respondents. The distribution of respondents by age group showed that most respondents were in the age of 41-50 years old (33.3%) and 31-40 years old (30.0%). There is 22.1% of the respondents below 31 years old and the lowest age group is those above 50 years old with only 14.6%.

In term of highest educational level, there are 331 teachers out of 417 respondents (79.4%) have first degree, while only 6.5% (n=27) of the teachers have certificate or diploma qualification and 14.1% (n=59) of the teachers possess postgraduate qualification either in master or doctorate degree.

A total of 15.1% of respondents (n=63) have been teaching for less than five years, 25.7% of respondents (n=107) have teaching experience from five to ten years and more than half (59.2%) of the respondents (n=247) have been teaching more than ten years. In term of years of experience in using computer, it was found that majority (65.5%) of the respondents (n=273) admitted that they have used computer more than ten years, while only 10.5% of the respondents (n=44) said that they have less than five years of experience in using computer and there was 24.0% of the respondents (n=100) said that they have five to ten years of experience in using computer.

4.3.3 Normality Test for the Data Distribution

Normality test for the data distribution was performed to ensure that there was no violation of the assumption of normality which is one of the basic conditions for inferential statistics (Chua, 2013). Normality of the data can be assessed through the skewness and kurtosis statistics using SPSS (Pallant, 2013). The skewness and kurtosis statistics show the data distribution pattern and for a data to be normally distributed, the skewness and kurtosis values should be in the range of -1.96 to +1.96 (Chua, 2013). Besides, the normality of the data could also be presented in term of graphical such as histogram, steam-and-leaf plot, normal probability plot or boxplot (Chua, 2013).

In this study, the researcher conducted two types of normality test to analyze the data distribution which included univariate normality test for each of the items and multivariate normality test for each of the dimensions' mean scores in measuring each of the main variables (principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS) under this study. The normality for each of the items and dimensions would be reported using skewness and kurtosis statistics together with the histograms. At the same time, a normal curve is superimposed on the histogram to assess the correspondence of the actual distribution (Hair et al., 2010).

4.3.3.1 Teacher Acceptance and Use of SMS

Teacher acceptance and use of SMS is the endogenous (dependent) variable. This latent concept is measured by six dimensions (constructs) which are (i) Performance Expectancy; (ii) Effort Expectancy; (iii) Social Influence; (iv) Facilitating Condition; (v) Hedonic Motivation; and (iv) Habit. Each of these dimensions is measured by five items as the observed (indicator) variables and the total number of items in the item pool for teacher acceptance and use of SMS was 30 items. The researcher carried out univariate normality test to check whether each of these items was normally distributed and the multivariate normality test was carried out to identify the normality of the six dimensions' mean scores in measuring teacher acceptance and use of SMS.

(a) ***Univariate Normality Test***

The skewness and kurtosis for each of the teacher acceptance and use of SMS items are presented in Table 4.2.

Table 4.2: Skewness and Kurtosis for Each of the Teacher Acceptance and Use of SMS Items (Endogenous Variable)

Dimension	Item	Minimum	Maximum	Mean	Skewness	Kurtosis
Performance Expectancy	C1	1	10	7.15	-.875	.722
	C2	1	10	7.00	-.801	.783
	C3	1	10	7.03	-.761	.737
	C4	2	10	7.07	-.620	-.081
	C5	1	10	6.90	-.811	.739
Effort Expectancy	C6	2	10	7.08	-.402	-.283
	C7	2	10	7.05	-.488	.065
	C8	0	10	6.87	-.656	.635
	C9	2	10	7.01	-.406	-.099
	C10	1	10	6.98	-.614	.443
Social Influence	C11	1	10	6.83	-.596	.258
	C12	1	10	6.42	-.432	.062
	C13	2	10	7.43	-.593	-.033
	C14	0	10	6.12	-.573	.311
	C15	1	10	5.93	-.468	-.189
Facilitating Condition	C16	3	10	7.85	-.609	-.182
	C17	1	10	7.03	-.525	.035
	C18	3	10	7.29	-.463	.208
	C19	2	10	6.95	-.439	.162
	C20	2	10	7.01	-.614	.198
Hedonic Motivation	C21	0	10	6.91	-.740	.697
	C22	0	10	6.79	-.637	.638
	C23	0	10	6.95	-.622	.657
	C24	0	10	6.76	-.796	1.151
	C25	2	10	6.90	-.669	.382
Habit	C26	1	10	6.75	-.676	.479
	C27	0	10	6.48	-.633	.215
	C28	0	10	6.26	-.552	.320
	C29	0	10	6.36	-.610	.374
	C30	0	10	6.41	-.663	.596

Based on Table 4.2, it was found that the value of skewness range from -.875 to -.402 and the kurtosis range from -.283 to 1.152. Hence, this can be concluded that the data is normally distributed because both the skewness and kurtosis values of all the 30 items presented are within the normal distribution range (±1.96).

Additionally, based on the shape of the histograms and normal curves presented in Appendix L, the researcher could strongly emphasized that the data collected from each of the items in measuring teacher acceptance and use of SMS are normally distributed because the frequency distribution displayed a high distribution in the middle and a low distribution on both the left and right ends of the histogram.

(b) Multivariate Normality Test

The skewness and kurtosis for each of the mean scores for teacher acceptance and use of SMS dimensions are presented in Table 4.3.

Table 4.3: Skewness and Kurtosis for Each of the Dimensions' Mean Scores in Measuring Teacher Acceptance and Use of SMS (Endogenous Variable)

Dimension	Minimum	Maximum	Mean	Skewness	Kurtosis
Performance Expectancy	1.80	10.00	7.03	-.819	.526
Effort Expectancy	2.60	10.00	7.00	-.471	-.012
Social Influence	1.60	9.80	6.55	-.505	.151
Facilitating Conditions	2.60	10.00	7.23	-.488	.043
Hedonic Motivation	1.20	10.00	6.86	-.668	.541
Habit	1.00	10.00	6.45	-.602	.124

Table 4.3 showed that the value of skewness range from -.819 to -.471 and the kurtosis range from -.012 to .541. Hence, the researcher concluded that the data is normally distributed because both the skewness and kurtosis values of all the six dimensions' mean scores presented are within the normal distribution range (±1.96). This was further supported by the histograms and normal curves showed in Figure 4.1. The frequency distribution displayed a high distribution in the middle and a low distribution on both the left and right ends of the histograms indicated that the data were normally distributed.

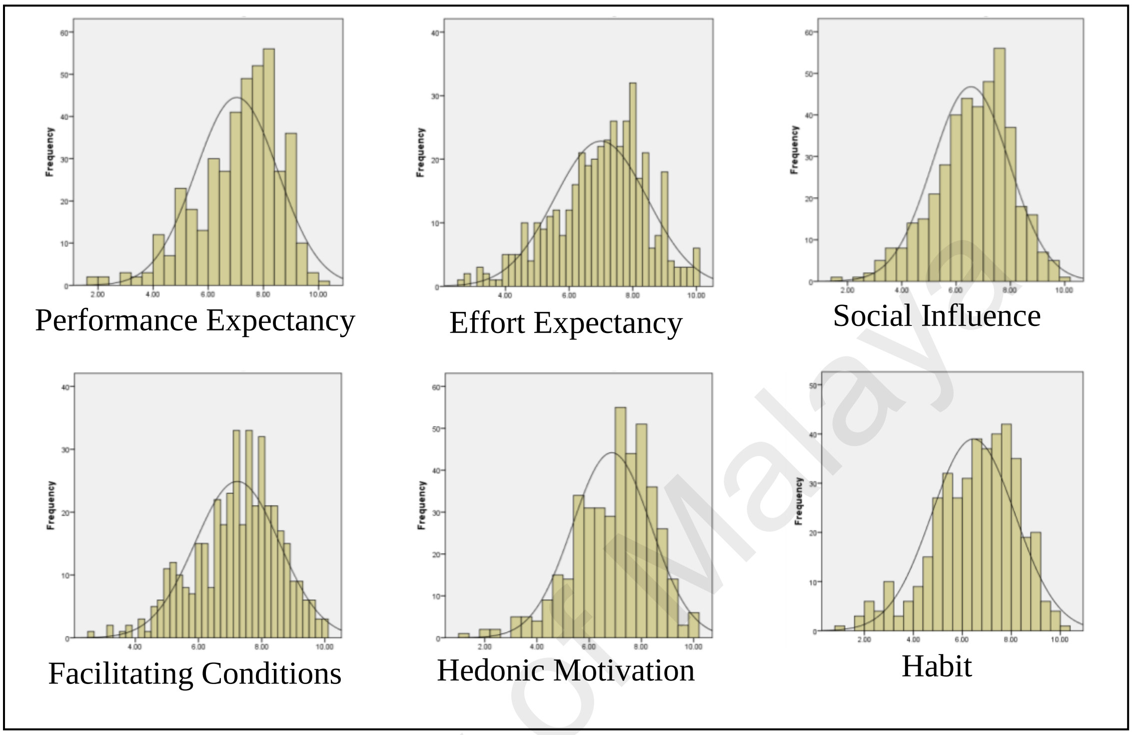


Figure 4.1: Histograms and normal curves for each of the dimensions' mean scores in measuring teacher acceptance and use of SMS

4.3.3.2 Principal Technology Leadership Practices

Principal technology leadership practices are the exogenous (independent) variable. This latent concept is measured by five dimensions (constructs) which are (i) Visionary Leadership; (ii) Digital Age Learning Culture; (iii) Excellence in Professional Practice; (iv) Systemic Improvement and (v) Digital Citizenship. Each of these dimensions is measured by five to eight items as the observed (indicator) variables and there are 32 items in the item pool for principal technology leadership practices. The univariate normality test was carried out to check whether each of these items is normally distributed and the multivariate normality test was carried out to identify the normality of the five dimensions' mean scores in measuring principal technology leadership practices.

(a) ***Univariate Normality Test***

Table 4.4 showed the skewness and kurtosis for each of the principal technology leadership practices items.

Table 4.4: Skewness and Kurtosis for Each of the Principal Technology Leadership Practices Items (Exogenous Variable)

Dimension	Item	Minimum	Maximum	Mean	Skewness	Kurtosis
Visionary Leadership	B1	2	10	7.27	-.566	.087
	B2	1	10	7.18	-.725	.545
	B3	1	10	7.05	-.507	.198
	B4	2	10	7.25	-.587	.232
	B5	3	10	7.34	-.592	.297
Digital Age Learning Culture	B6	3	10	7.25	-.611	.076
	B7	3	10	7.92	-.655	.310
	B8	2	10	6.88	-.501	-.035
	B9	2	10	7.30	-.640	.199
	B10	2	10	7.27	-.734	.690
	B11	2	10	7.16	-.827	.862
Excellence in Professional Practice	B12	0	10	6.78	-.588	.548
	B13	3	10	7.05	-.479	-.035
	B14	2	10	6.96	-.429	.015
	B15	3	10	7.17	-.566	-.038
	B16	2	10	7.17	-.606	.209
	B17	2	10	7.31	-.586	.172
	B18	3	10	7.16	-.645	.231
Systemic Improvement	B19	3	10	7.19	-.558	.128
	B20	0	10	7.40	-.849	1.793
	B21	1	10	7.50	-.603	.802
	B22	0	10	6.58	-.837	1.003
	B23	2	10	6.97	-.668	.420
	B24	1	10	6.79	-.589	.185
Digital Citizenship	B25	1	10	6.64	-.523	.207
	B26	3	10	7.58	-.746	.551

B27	2	10	7.24	-.651	.266
B28	1	10	7.10	-.657	.487
B29	3	10	7.28	-.566	.098
B30	3	10	7.04	-.580	.045
B31	2	10	6.98	-.584	.483
B32	2	10	6.97	-.424	-.058

Table 4.4 showed that the value of skewness range from -.849 to -.424 and the kurtosis range from -.058 to 1.793. Hence, this showed that the data is normally distributed because both the skewness and kurtosis values of all the 32 items presented are within the normal distribution range (±1.96).

Furthermore, based on the shape of the histograms and normal curves presented in Appendix M, the researcher concluded that the data collected from each of the items in measuring principal technology leadership practices are normally distributed because the frequency distribution displayed a high distribution in the middle and a low distribution on both the left and right ends of the histogram.

(b) ***Multivariate Normality Test***

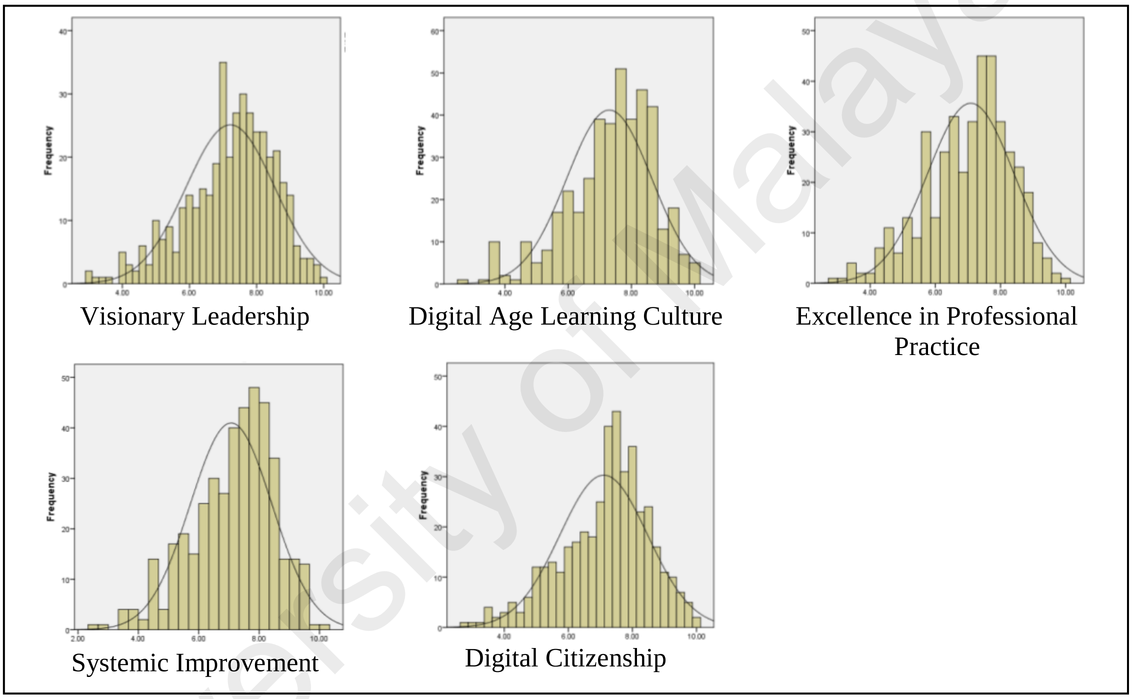
The value of skewness and kurtosis for each of the dimensions' mean scores in measuring principal technology leadership practices are presented in Table 4.5.

Table 4.5: Skewness and Kurtosis for Each of the Dimensions' Mean Scores in Measuring Principal Technology Leadership Practices (Exogenous Variable)

Dimension	Minimum	Maximum	Mean	Skewness	Kurtosis
Visionary Leadership	3.00	10.00	7.22	-.629	.206
Digital Age Learning Culture	2.67	9.83	7.30	-.718	.388
Excellence in Professional Practice	2.86	10.00	7.09	-.540	-.055
Systemic Improvement	2.50	10.00	7.07	-.572	.080

Digital Citizenship	2.75	10.00	7.10	-.600	.180

Based on Table 4.5, the value of skewness range from -.718 to -.540 and the kurtosis range from -.055 to .388. These indicated that the data is normally distributed because both the skewness and kurtosis values of all the six dimensions' mean scores presented are within the normal distribution range (±1.96). Subsequently, the multivariate normally of the data were further supported by the histograms showed in Figure 4.2.



The frequency distribution displayed a high distribution in the middle and a low distribution on both the left and right ends of the histograms indicated that the data were normally distributed.

Figure 4.2: Histograms and normal curves for each of the dimensions' mean scores in measuring principal technology leadership practices

4.3.3.3 Teacher ICT Competency

Teacher ICT competency is the mediating variable. This latent concept is measured by five dimensions (constructs) which are (i) Smart Pedagogy; (ii) Digital Age Learning Experiences and Assessments; (iii) Digital Age Work and Learning; (iv) Digital Citizenship and Responsibility; and (v) Professional Growth and Leadership. Each of these dimensions is measured by five to nine items as the observed (indicator) variables and there are 31 items in the item pool for teacher ICT competency. The univariate normality test was carried out to check whether each of the items is normally distributed and the multivariate normality test was carried out to identify the normality of the five dimensions' mean scores in measuring teacher ICT competency.

(a) ***Univariate Normality Test***

Table 4.6 showed the skewness and kurtosis for each of the teacher ICT competency items.

Table 4.6: Skewness and Kurtosis for Each of the Teacher ICT Competency Items (Mediating Variable)

Dimension	Item	Minimum	Maximum	Mean	Skewness	Kurtosis
Smart Pedagogy	D1	3	10	7.72	-.786	.743
	D2	3	10	7.50	-.499	.248
	D3	3	10	7.41	-.562	.247
	D4	3	10	7.44	-.561	.181
	D5	3	10	7.37	-.515	-.037
	D6	3	10	7.08	-.334	-.002
Digital Age Learning Experience and Assessment	D7	3	10	7.33	-.540	.197
	D8	3	10	7.18	-.552	.161
	D9	3	10	7.25	-.481	.032
	D10	3	10	7.30	-.523	.110
	D11	2	10	7.20	-.473	.096
	D12	3	10	7.39	-.616	.154
Digital Age Work and Learning	D13	2	10	7.21	-.588	.542
	D14	4	10	7.31	-.303	-.079
	D15	2	10	7.39	-.709	.606
	D16	3	10	7.41	-.486	.004
	D17	3	10	7.64	-.457	.475
Digital Citizenship and Responsibility	D18	3	10	7.36	-.391	.001
	D19	2	10	7.39	-.546	.420
	D20	3	10	7.27	-.623	.185
	D21	0	10	7.00	-.856	1.616
	D22	2	10	6.91	-.669	.817
Professional Growth and Leadership	D23	2	10	6.90	-.484	.162
	D24	3	10	6.65	-.303	-.245
	D25	3	10	6.59	-.241	-.260
	D26	1	10	6.68	-.454	.293
	D27	2	10	7.10	-.572	.469
	D28	1	10	6.85	-.561	.644
	D29	2	10	6.99	-.386	.131
	D30	1	10	6.84	-.601	.548
	D31	1	10	7.25	-.696	1.359

Table 4.6 showed that the value of skewness range from -.856 to -.241 and the kurtosis range from -.260 to 1.616. These indicated that the data is normally distributed because both the skewness and kurtosis values of all the 31 items presented are within the normal distribution range (±1.96).

Based on the shape of the histograms and normal curves presented in Appendix N, the researcher concluded that the data collected from each of the items in measuring teacher ICT competency are normally distributed because the frequency distribution displayed a high distribution in the middle and a low distribution on both the left and right ends of the histogram.

(b) Multivariate Normality Test

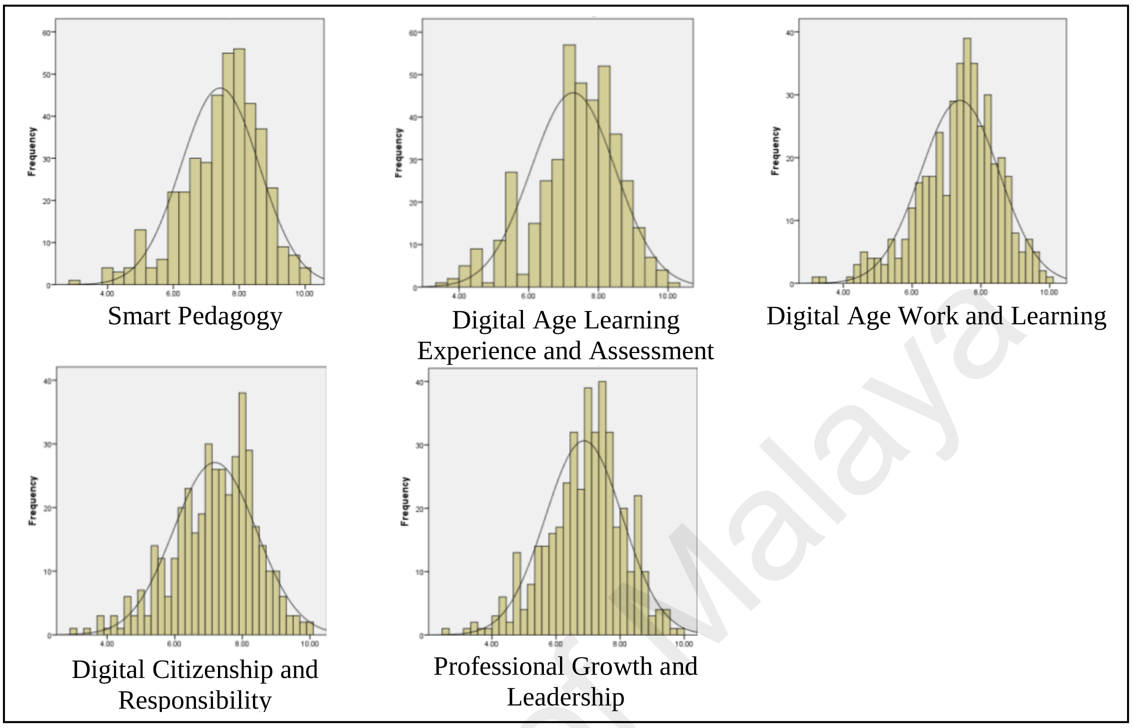
The skewness and kurtosis for each of the dimensions' mean score in measuring teacher ICT competency are presented in Table 4.7.

Table 4.7: Skewness and Kurtosis for Each of the Dimensions' Mean Scores in Measuring Teacher ICT Competency (Mediating Variable)

Dimension	Minimum	Maximum	Mean	Skewness	Kurtosis
Smart Pedagogy	3.00	10.00	7.42	-.620	.437
Digital Age Learning Experience and Assessment	3.50	10.00	7.28	-.587	.235
Digital Age Work and Learning	3.20	10.00	7.39	-.589	.532
Digital Citizenship and Responsibility	3.00	10.00	7.19	-.501	.175
Professional Growth and Leadership	2.56	9.78	6.87	-.453	.282

Table 4.7 showed that the value of skewness range from -.620 to -.453 and the kurtosis range from .175 to .437. Hence, the researcher concluded that the data is normally

distributed because both the skewness and kurtosis values of all the six dimensions' mean scores presented are within the normal distribution range (±1.96). These



multivariate normally of the data were further supported by the histograms showed in Figure 4.3, where the frequency distribution displayed a high distribution in the middle and a low distribution on both the left and right ends of the histograms indicated that the data were normally distributed.

Figure 4.3: Histograms and normal curves for each of the dimensions' mean scores in measuring teacher ICT competency

Based on the univariate and multivariate normality test for the data distribution of the three main variables (teacher acceptance and use of SMS, principal technology leadership practices, and teacher ICT competency) that have been conducted above, the researcher could conclude that the data are normally distributed for all the items and dimensions used to measure teacher acceptance and use of SMS, principal technology leadership practices, and teacher ICT competency. Hence, the basic condition to carry out inferential statistics analysis for the collected data is achieved.

4.3.4 Validation of the Developed Instrument, Measurement Models, and Structural Model through CFA

SEM is a confirmatory method providing a comprehensive means for assessing and modifying the measurement models as well as a structural model. This method has the ability to assess the unidimensionality, validity, and reliability of a measurement model (Zainudin Awang, 2014). Basically, there are two sub-models need to be established using SEM - the measurement model and the structural model (Byrne, 2010). First, the measurement models which focus on the relationships between the items and the hypothetical constructs are tested individually before the models for all the constructs are tested simultaneously. Finally, this simultaneously tested measurement model is utilized to test the relationships between variables in the structural model. Hence, the researchers need to validate each of the measurement models first before running the structural model (Zainudin Awang, 2013). In this section, the researcher presents the construct validity of the developed instrument, the validation of the measurement models for each construct (variable) and finally the validation of the structural model for this study.

4.3.4.1 Construct Validity of the Developed Instrument

Construct validity is the most important form of validity because it asks the fundamental validity question: What is the test really measuring? Construct validity is the extent to which a set of measured items actually reflects the theoretical latent construct those items are designed to measure (Hair et al., 2010). Thus, construct validity reflects the degree to which a test measures an intended hypothetical construct (Gay et al., 2012). The construct validity of an instrument is assessed through convergent and discriminant validity (L. Cohen et al., 2011; Pallant, 2013; Sekaran, 2003). According to Johnson and Christensen (2008), convergent validity is based on the relationship between the focal test scores and other independent measures of the same constructs while discriminant validity exists when the test scores on your focal test are not highly related to scores from the other test that are designed to measure theoretically different constructs. In other words, convergent validity is demonstrated when two related or similar factors or elements of a particular construct are shown (e.g. by measures or indicators) to be related or similar to each other, whilst discriminant validity required two or more unrelated items, attributes, elements or factors to be shown, (e.g. by measurement) to be unrelated to or different from each other (L. Cohen et al., 2011).

AMOS software could be used to model the relationship between latent constructs with multiple indicators (items) through CFA. In this case, more than one measurement models involved. The confirmatory factor analysis (CFA) is used to assess the convergent validity of the developed instrument. This validity is achieved when all items in a measurement model are statistically significant (Blunch, 2013) and factor loading of .50 or above for an indicator is often a standard to use (Creswell, 2014). A model which has items with high factor loadings on the latent constructs suggests that the items operate cohesively in a group which jointly explain the latent construct measured (Zainudin Awang, 2014). The discriminant validity is assessed through the correlation between the two items under the same construct and if the correlation coefficient is less than .90 this shows that the items do not have significant multicollinearity problem (Hair et al., 2010; Kline, 2011; Pallant, 2013). Finally, the overall construct validity is achieved when the Fitness Indexes for a construct achieved the required level as shown in Table 3.13 (Hair et al., 2010).

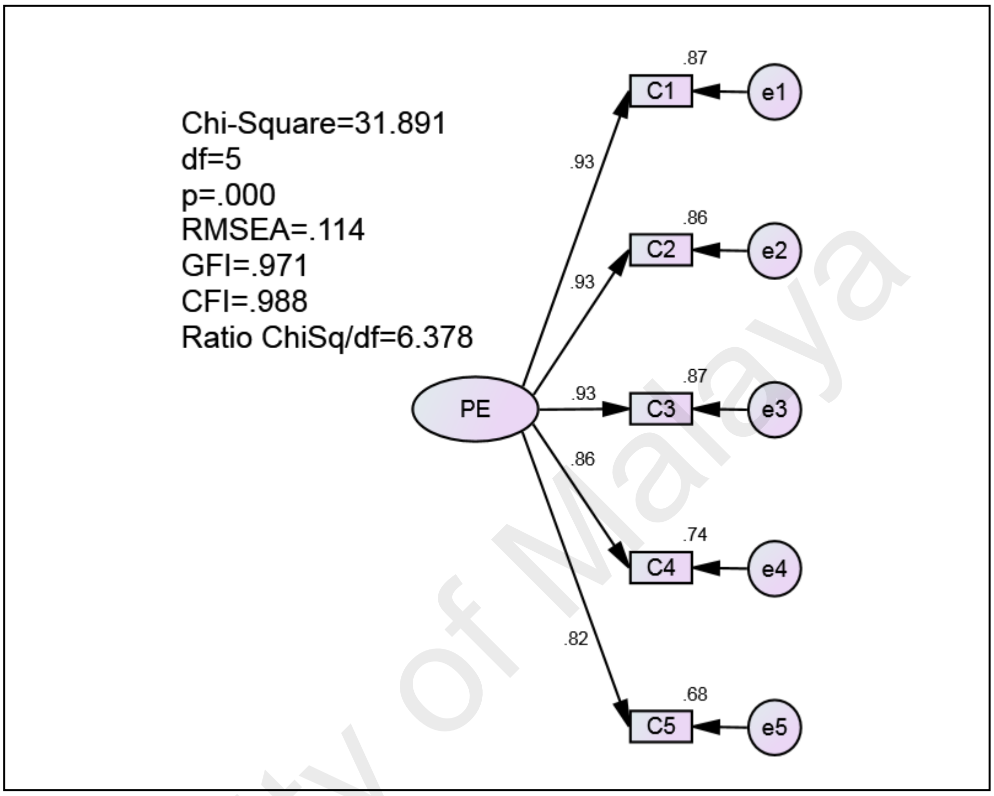
Measurement model is the model that demonstrated the relationships between each of the response items (indicators) and their underlying construct (Zainudin Awang, 2014). In this section, researcher would like to present the construct validity of the measurement models according to each of the dimensions for the three main variables (teacher acceptance and use of SMS, principal technology leadership practices, and teacher ICT competency) used in this study by performing confirmatory factor analysis (CFA) and inter-item correlation analysis.

(a) Teacher Acceptance and Use of SMS (Endogenous Variable)

Teacher acceptance and use of SMS is the endogenous (dependent) variable in this study. This latent concept is measured by six dimensions (constructs) which are (i) Performance Expectancy; (ii) Effort Expectancy; (iii) Social Influence; (iv) Facilitating Condition; (v) Hedonic Motivation; and (iv) Habit. Each of these dimensions is measured by five items as the observed (indicator) variables. Based on these six dimensions of teacher acceptance and use of SMS, six measurement models were run to assess the convergent and discriminant validity of the construct measured.

(i) Dimension 1: Performance Expectancy

This dimension consisted five items as the observed indicators. The CFA model for this dimension is showed in Figure 4.4.



F

igure 4.4: CFA model for Performance Expectancy Dimension

Based on Figure 4.4, the fitness indexes of this model do not achieve the level of fitness required for RMSEA=.114 (>.08), and Ratio Chisq/df=6.378 (>5.0). However, all the five items displayed factor loadings above .50. This meant that the unidimensionality of the performance expectancy construct have been achieved and no item needs to be dropped from this model. Thus, based on the suggestion of the modification indices, few of the measurement errors need to be set as "free parameter" to improve the fitness of the model. The measurement errors that need to be correlated are e4 with e5 (M.I.=7.598, Par Change=.116), e3 with e4 (M.I.=7.827, Par Change=.079), and e1 with e3 (M.I.=5.220, Par

Change=.046). After these measurement errors have been set as "free parameter", the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.5.

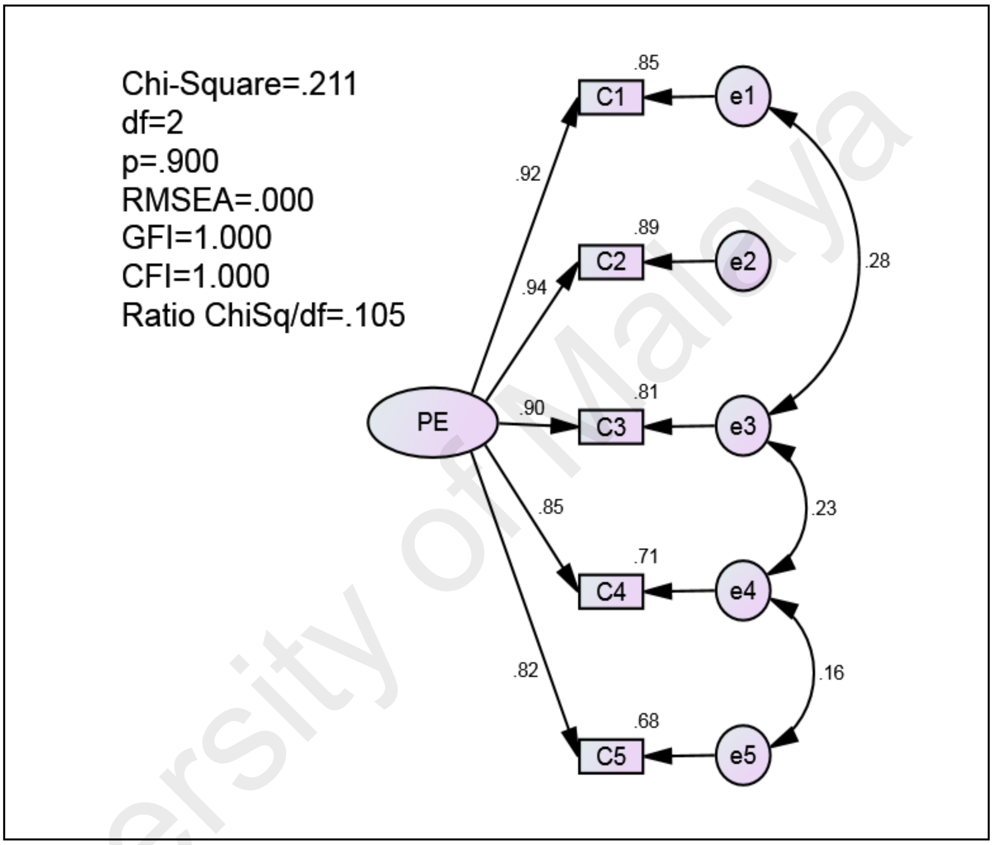


Figure 4.5: Re-specified CFA model for Performance Expectancy Dimension

Based on this re-specified model (Figure 4.5), all fitness indexes [RMSEA=.000 (<.08), GFI=1.000 (>.90), CFI=1.000 (>.90), and Chisq/df=.105 (<5.0)] have achieved the threshold values (Refer Table 3.13). This indicated that the re-specified model for performance expectancy dimension achieved construct validity. The CFA yield results as shown in Table 4.8.

Table 4.8: CFA result of the Re-specified Model for Performance Expectancy Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
C1	<---	PE	1.000				.920	.847
C2	<---	PE	1.006	.030	33.312	***	.944	.891
C3	<---	PE	.993	.028	35.961	***	.902	.814
C4	<---	PE	.942	.037	25.446	***	.845	.715
C5	<---	PE	.949	.039	24.112	***	.825	.680

*** Correlation is significant at the 0.001 level

Based on Table 4.8, the convergent validity of this re-specified model for performance expectancy dimension is achieved because all items are statistically significant and have acceptable factor loadings between .825-.944 which are more than .50.

After the construct validity and convergent validity for performance expectancy dimension have been established, the researcher performed the inter-item correlation analysis to check on the discriminant validity of the items in this latent construct. Table 4.9 shows the results of the inter-item correlation analysis.

Table 4.9: Correlation Coefficient (r value) between each of the items in Performance Expectancy Dimension

Path			Estimate	S.E.	C.R.	p	r
C1	<-->	C2	2.125	.159	13.381	***	.869
C1	<-->	C3	2.216	.165	13.461	***	.878
C1	<-->	C4	1.987	.159	12.517	***	.777
C1	<-->	C5	1.997	.162	12.308	***	.757
C2	<-->	C3	2.106	.159	13.214	***	.851
C2	<-->	C4	2.000	.157	12.716	***	.797
C2	<-->	C5	2.014	.161	12.523	***	.778
C3	<-->	C4	2.115	.164	12.905	***	.817
C3	<-->	C5	1.998	.164	12.210	***	.747
C4	<-->	C5	2.019	.166	12.189	***	.745

*** Correlation is significant at the 0.001 level

Table 4.9 showed that all the five items in the performance expectancy dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring the latent construct (performance expectancy) with the range of the correlation coefficients, r between .745-.878, these r values that represented the correlation coefficients among each of the indicators in the performance expectancy dimension are less than .90. Thus, the discriminant validity of all the items in measuring performance expectancy is achieved. Hence, all the indicators in measuring performance expectancy do not have significant multicollinearity problem.

(ii) Dimension 2: Effort Expectancy

The second dimension – effort expectancy also contained five items as the observed indicators. The CFA for this dimension is presented in Figure 4.6.

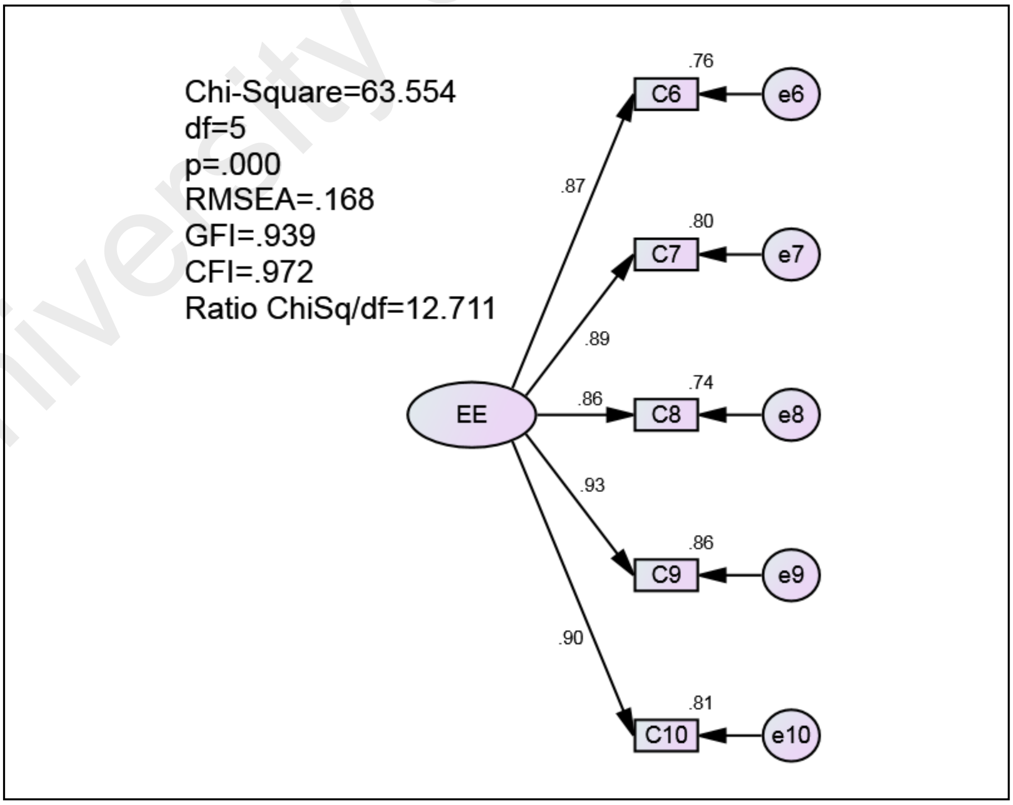


Figure 4.6: CFA model for Effort Expectancy Dimension

Figure 4.6 showed that the fitness indexes of this model do not achieve the level of fitness required for RMSEA=.168 (>.08), and Ratio Chisq/df=12.711 (>5.0). However, all the five items displayed factor loadings above .50. This meant that the unidimensionality of the effort expectancy construct have been achieved and no item needs to be dropped from this model. Subsequently, based on the suggestion of the modification indices, two of the measurement errors need to be set as "free parameter" to improve the fitness of the model. The measurement errors that need to be correlated are e6 with e7 (M.I.=50.039, Par Change=.212). After the measurement errors have been set as "free parameter", the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.7.

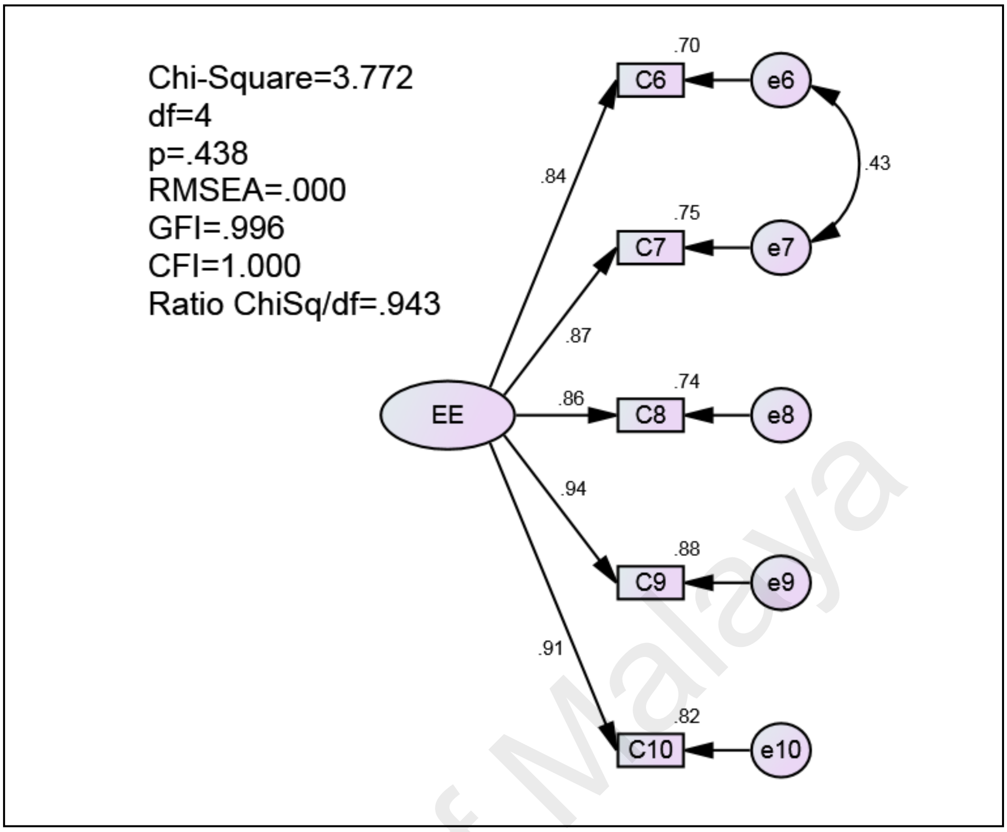


Figure 4.7: Re-specified CFA model for Effort Expectancy Dimension

Based on the re-specified model showed in Figure 4.7, all the fitness indexes [RMSEA=.000 (<.08), GFI=.996 (>.90), CFI=1.000 (>.90), and Chisq/df=.943 (<5.0)] have achieved the required level according to Table 3.13. This indicated that the re-specified model for performance expectancy dimension achieved construct validity. The CFA yield results as shown in Table 4.10.

Table 4.10: CFA result of the Re-specified Model for Effort Expectancy Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
C6	<---	EE	1.000				.839	.704
C7	<---	EE	1.043	.035	30.036	***	.867	.752
C8	<---	EE	1.113	.050	22.475	***	.863	.744
C9	<---	EE	1.177	.045	26.078	***	.940	.885
C10	<---	EE	1.162	.047	24.535	***	.907	.823

*** Correlation is significant at the 0.001 level

The result in Table 4.10 showed that the convergent validity of this re-specified model for effort expectancy dimension is achieved because all items are statistically significant and have acceptable factor loadings between .839-.940 which are greater than .50.

After the construct validity and convergent validity for effort expectancy dimension have been established, the researcher carried out the inter-item correlation analysis to check on the discriminant validity for all the items used to measure this latent construct. Table 4.11 shows the results of the inter-item correlation analysis.

Table 4.11: Correlation Coefficient (r value) between each of the Items in Effort Expectancy Dimension

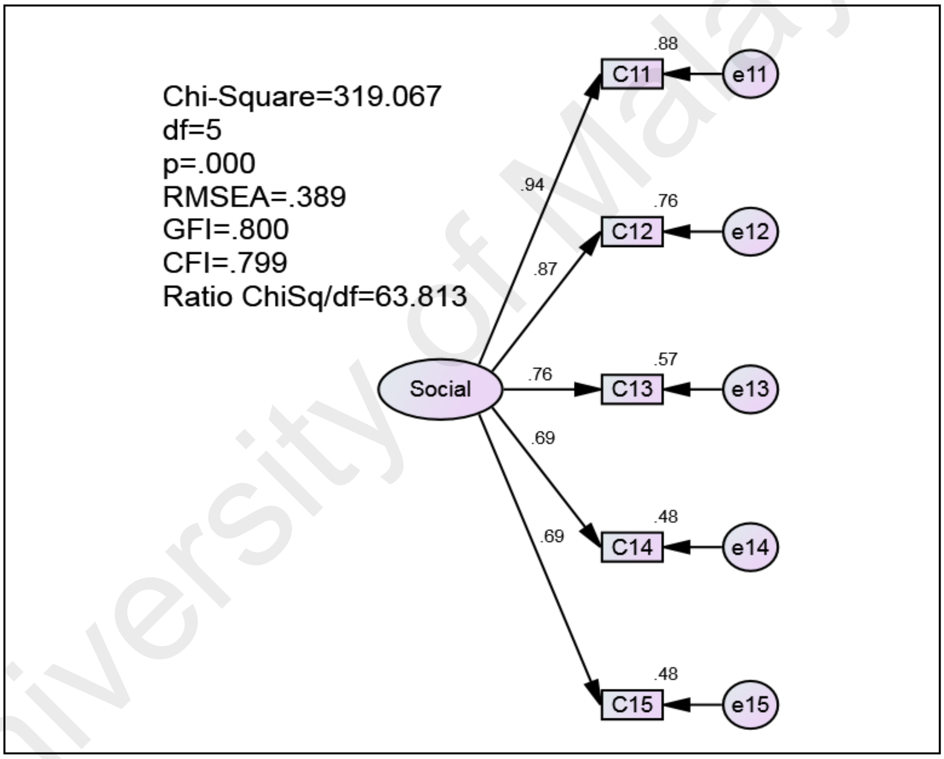
Path			Estimate	S.E.	C.R.	p	r
C6	<-->	C7	1.982	.151	13.147	***	.843
C6	<-->	C8	1.876	.154	12.170	***	.744
C6	<-->	C9	1.918	.152	12.583	***	.784
C6	<-->	C10	1.894	.154	12.304	***	.756
C7	<-->	C8	1.913	.156	12.253	***	.751
C7	<-->	C9	2.007	.156	12.867	***	.813
C7	<-->	C10	1.994	.158	12.636	***	.789
C8	<-->	C9	2.148	.167	12.847	***	.811
C8	<-->	C10	2.101	.168	12.493	***	.775
C9	<-->	C10	2.252	.170	13.270	***	.857

*** Correlation is significant at the 0.001 level

Table 4.11 showed that all the five items in the effort expectancy dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring effort expectancy (latent construct) with the range of the correlation coefficients, r between .744-.857, these r values that represented the correlation coefficients among each of the indicators in the effort expectancy dimension are less than .90. Thus, the discriminant validity of all the items in measuring effort expectancy is achieved. Hence, all the indicators in measuring effort expectancy do not have significant multicollinearity problem.

(iii) Dimension 3: Social Influence

Social influence dimension comprised five items as the observed indicators. The



CFA for this dimension is displayed in Figure 4.8.

Figure 4.8: CFA model for Social Influence Dimension

Figure 4.8 showed that all fitness indexes [RMSEA=.389 (>.08), GFI=.800 (<.90), CFI=.799 (<.90), and Ratio Chisq/df=63.813 (>5.0)] of this model do not achieve the level of fitness required. However, all the five items displayed factor loadings above .50. This meant that the unidimensionality of the social influence construct have been achieved and no item needs to be dropped from this model. Next, based on the suggestion of the modification indices, few of the measurement errors need to be set as "free parameter" to improve the fitness of the model. The measurement errors that need to be correlated are e14 with e15 (M.I.=219.098, Par Change=1.290), e12 with e15 (M.I.=11.260, Par Change=.151), and e12 with e13 (M.I.=5.565, Par Change=-.109). After these measurement errors have been set as "free parameter", the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.9.

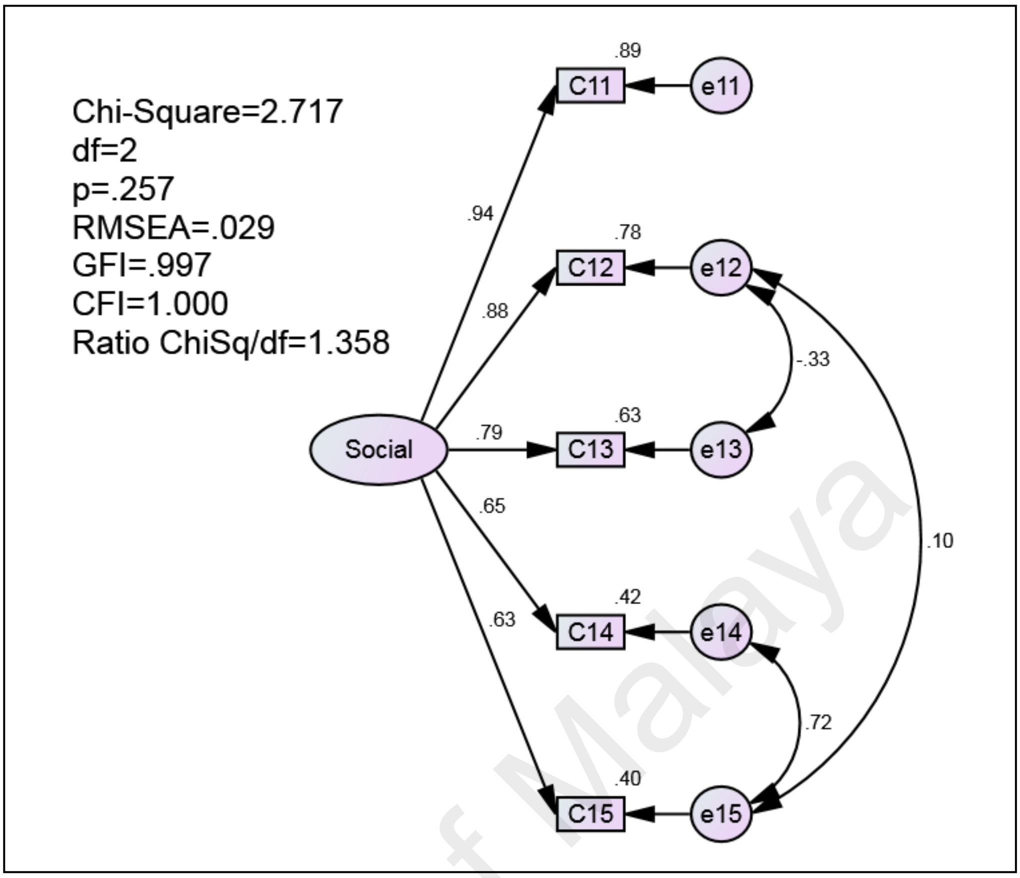


Figure 4.9: Re-specified CFA model for Social Influence Dimension

Based on this re-specified model (Refer Figure 4.9), all the fitness indexes [RMSEA=.029 (<.08), GFI=.997 (>.90), CFI=1.000 (>.90), and Chisq/df=1.358 (<5.0)] have achieved the required level based on Table 3.13. This indicated that the re-specified model for social influence dimension achieved construct validity. The CFA yield results as shown in Table 4.12.

Table 4.12: CFA result of the Re-specified Model for Social Influence Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
C11	<---	Social	1.000				.944	.891
C12	<---	Social	.988	.043	23.439	***	.884	.782
C13	<---	Social	.802	.041	19.367	***	.791	.625
C14	<---	Social	.752	.048	15.555	***	.645	.416
C15	<---	Social	.758	.051	14.871	***	.631	.399

*** Correlation is significant at the 0.001 level

Based on the result showed in Table 4.12, the convergent validity of this re-specified model for social influence dimension is achieved because all items are statistically significant and have acceptable factor loadings between .631-.944 which are more than .50.

After the construct validity and convergent validity of the social influence dimension have been established, the researcher decided to carry out the inter-item correlation analysis between each of these items to check on the discriminant validity for this latent construct. The results of the inter-item correlation analysis are showed in Table 4.13.

Table 4.13: Correlation Coefficient (r value) between each of the Items in Social Influence Dimension

Path			Estimate	S.E.	C.R.	p	r
C11	<-->	C12	2.279	.174	13.058	***	.833
C11	<-->	C13	1.838	.150	12.224	***	.749
C11	<-->	C14	1.711	.162	10.573	***	.606
C11	<-->	C15	1.741	.166	10.480	***	.599
C12	<-->	C13	1.572	.150	10.499	***	.600
C12	<-->	C14	1.740	.170	10.209	***	.578
C12	<-->	C15	1.878	.178	10.568	***	.606
C13	<-->	C14	1.361	.148	9.175	***	.504
C13	<-->	C15	1.313	.151	8.699	***	.472
C14	<-->	C15	2.670	.204	13.065	***	.834

*** Correlation is significant at the 0.001 level

By referring to Table 4.13, it was found that all the five items in the social influence dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring social influence (latent construct) with the range of the correlation coefficients, r between .472-.834, these r values that represented the correlation coefficients among each of the indicators in the social influence dimension are less than .90. Thus, the discriminant validity of all the items in measuring social influence is achieved. Hence, all the indicators in measuring social influence do not have significant multicollinearity problem.

(iv) Dimension 4: Facilitating Conditions

The fourth dimension – facilitating conditions consisted five items as the observed indicators. The CFA for this dimension is showed in Figure 4.10.

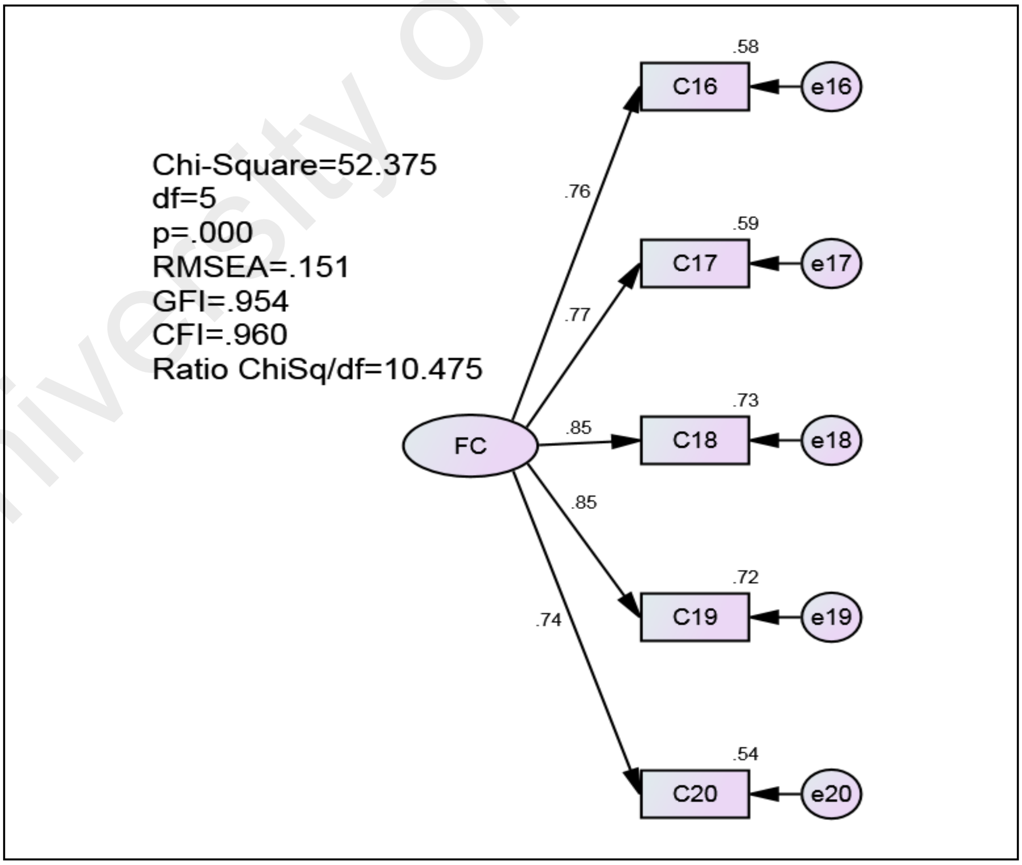


Figure 4.10: CFA model for Facilitating Conditions Dimension

Based on Figure 4.10, the fitness indexes of this model do not achieve the level of fitness required for RMSEA=.151 (>.08), and Ratio Chisq/df=10.475 (>5.0). However, all the five items displayed factor loadings above .50. This meant that the unidimensionality of the facilitating conditions construct have been achieved and no item needs to be dropped from this model. Then, based on the suggestion of the modification indices, few of the measurement errors need to be set as “free parameter” to improve the fitness of the model. The measurement errors that need to be correlated are e17 with e20 (M.I.=10.063, Par Change=.231), e16 with e17 (M.I.=12.498, Par Change=.239), and e16 with e19 (M.I.=11.524, Par Change=-.158). After these measurement errors have been set as “free parameter”, the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.11.

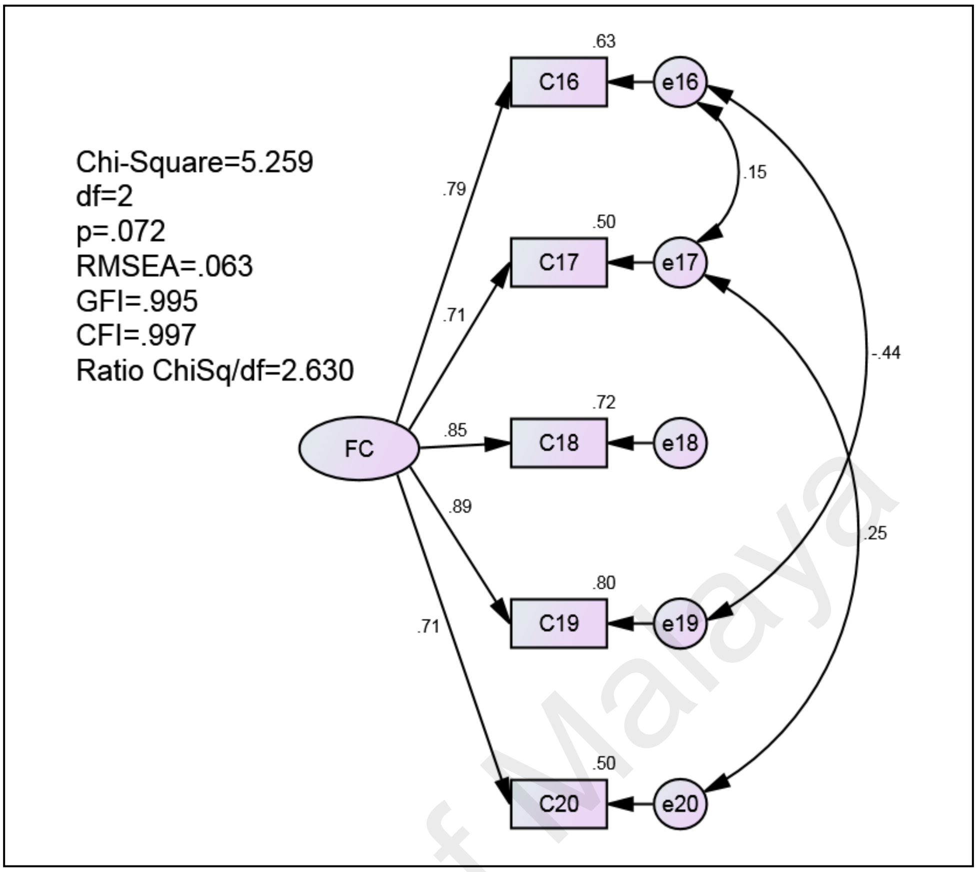


Figure 4.11: Re-specified CFA model for Facilitating Condition Dimension

Based on the re-specified model showed in Figure 4.11, all the fitness indexes [RMSEA=.063 (<.08), GFI=.995 (>.90), CFI=.997 (>.90), and Chisq/df=2.630 (<5.0)] have achieved the threshold values (Refer Table 3.13). This indicated that the re-specified model for facilitating conditions dimension achieved construct validity. The CFA yield results as shown in Table 4.14.

Table 4.14: CFA result of the Re-specified Model for Facilitating Conditions Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
C16	<---	FC	1.000				.795	.631
C17	<---	FC	1.024	.066	15.497	***	.710	.504
C18	<---	FC	.966	.058	16.708	***	.846	.715
C19	<---	FC	1.022	.061	16.649	***	.894	.799
C20	<---	FC	.929	.066	14.158	***	.707	.499

*** Correlation is significant at the 0.001 level

Based on Table 4.14, the convergent validity of this re-specified model for facilitating conditions dimension is achieved because all items are statistically significant and have acceptable factor loadings between .707-.894 which are greater than .50.

After the construct validity and convergent validity for facilitating conditions dimension have been established, the researcher performed the inter-item correlation analysis to determine the discriminant validity of the items used to measure this latent construct. The results of the inter-item correlation analysis are presented in Table 4.15.

Table 4.15: Correlation Coefficient (r value) between each of the Items in Facilitating Conditions Dimension

Path			**Estimate**	**S.E.**	**C.R.**	**p**	**r**
C16	<-->	C17	1.832	.168	10.887	***	.631
C16	<-->	C18	1.564	.136	11.470	***	.680
C16	<-->	C19	1.354	.131	10.343	***	.588
C16	<-->	C20	1.434	.148	9.713	***	.542
C17	<-->	C18	1.627	.152	10.733	***	.619
C17	<-->	C19	1.647	.152	10.816	***	.626
C17	<-->	C20	1.894	.175	10.818	***	.626
C18	<-->	C19	1.570	.128	12.263	***	.752
C18	<-->	C20	1.391	.136	10.233	***	.580
C19	<-->	C20	1.564	.141	11.131	***	.651

*** Correlation is significant at the 0.001 level

Table 4.15 showed that all the five items in the facilitating conditions dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring this latent construct with the range of the correlation coefficients, r between .542-.752, these r values that represented the correlation coefficients among each of the indicators in the facilitating conditions dimension are less than .90. Thus, the discriminant validity of all the items in measuring facilitating conditions is achieved. Hence, all the indicators in measuring facilitating conditions do not have significant multicollinearity problem.

(v) Dimension 5: Hedonic Motivation

Hedonic motivation dimension comprised five items as the observed indicators. The CFA for this dimension is presented in Figure 4.12.

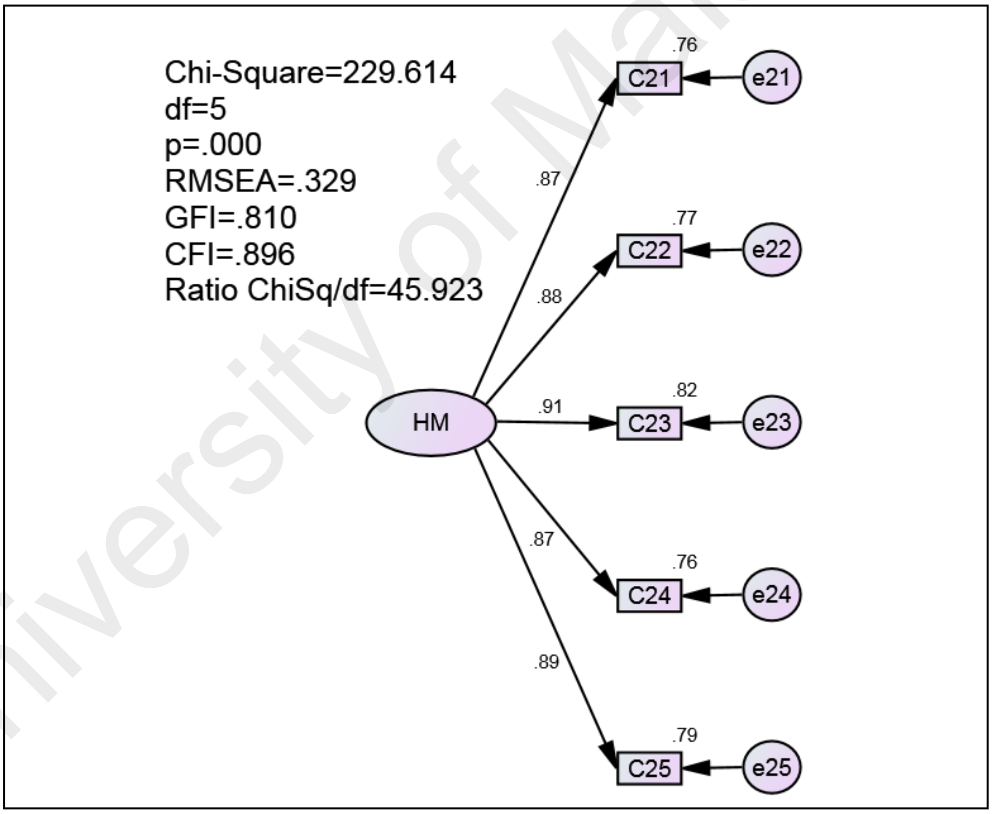


Figure 4.12: CFA model for Hedonic Motivation Dimension

Figure 4.12 showed that all the fitness indexes [RMSEA=.329 (>.08), GFI=.810 (<.90), CFI=.896 (<.90), and Ratio Chisq/df=45.923 (>5.0)] of this model do not achieve the level of fitness required. However, all the five items displayed higher factor loadings than .50. This meant that the unidimensionality of the hedonic motivation construct have been achieved and no item needs to be dropped from this model. In order to improve the fitness of the model, the researcher needs to set few of the measurement errors as "free parameter" based on the suggestion of the modification indices. The measurement errors that need to be correlated are e21 with e22 (M.I.=172.382, Par Change=.502), and e21 with e23 (M.I.=6.587, Par Change=.073). After these measurement errors have been set as "free parameter", the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.13.

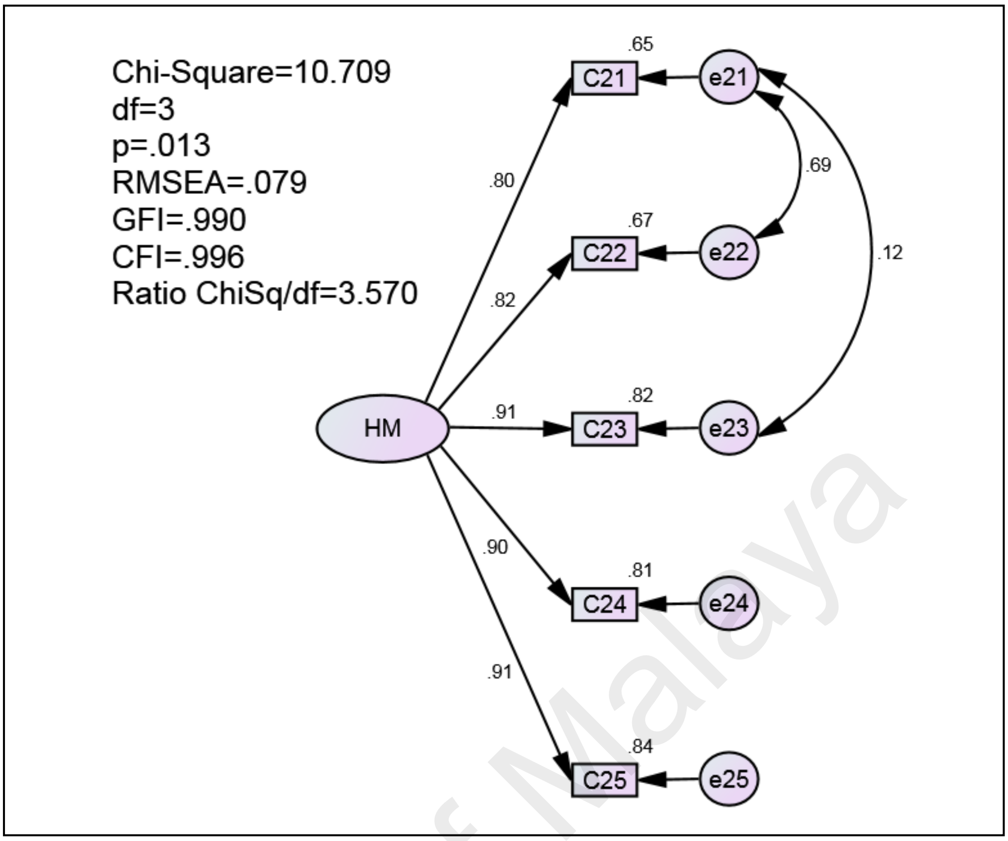


Figure 4.13: Re-specified CFA model for Hedonic Motivation Dimension

Based on the re-specified model showed in Figure 4.13, all the fitness indexes [RMSEA=.079 (<.08), GFI=.990 (>.90), CFI=.996 (>.90), and Chisq/df=3.570 (<5.0)] have achieved the required level according to Table 3.13. This indicated that the construct validity of this re-specified model for hedonic motivation dimension is achieved. Table 4.16 shows the result of CFA analysis.

Table 4.16: CFA result of the Re-specified Model for Hedonic Motivation Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
C21	<---	HM	1.000				.803	.646
C22	<---	HM	1.003	.030	33.902	***	.819	.671
C23	<---	HM	1.095	.047	23.500	***	.908	.825
C24	<---	HM	1.122	.051	21.952	***	.902	.813
C25	<---	HM	1.064	.047	22.402	***	.915	.837

*** Correlation is significant at the 0.001 level

Based on the result showed in Table 4.16, the convergent validity of this re-specified model for hedonic motivation dimension is achieved because all items are statistically significant and have acceptable factor loadings between .803-.915 which are more than .50.

After the construct validity and convergent validity for hedonic motivation dimension have been established, the researcher performed the inter-item correlation analysis to determine the discriminant validity for this latent construct. The results of this analysis are presented in Table 4.17.

Table 4.17: Correlation Coefficient (r value) between each of the Items in Hedonic Motivation Dimension

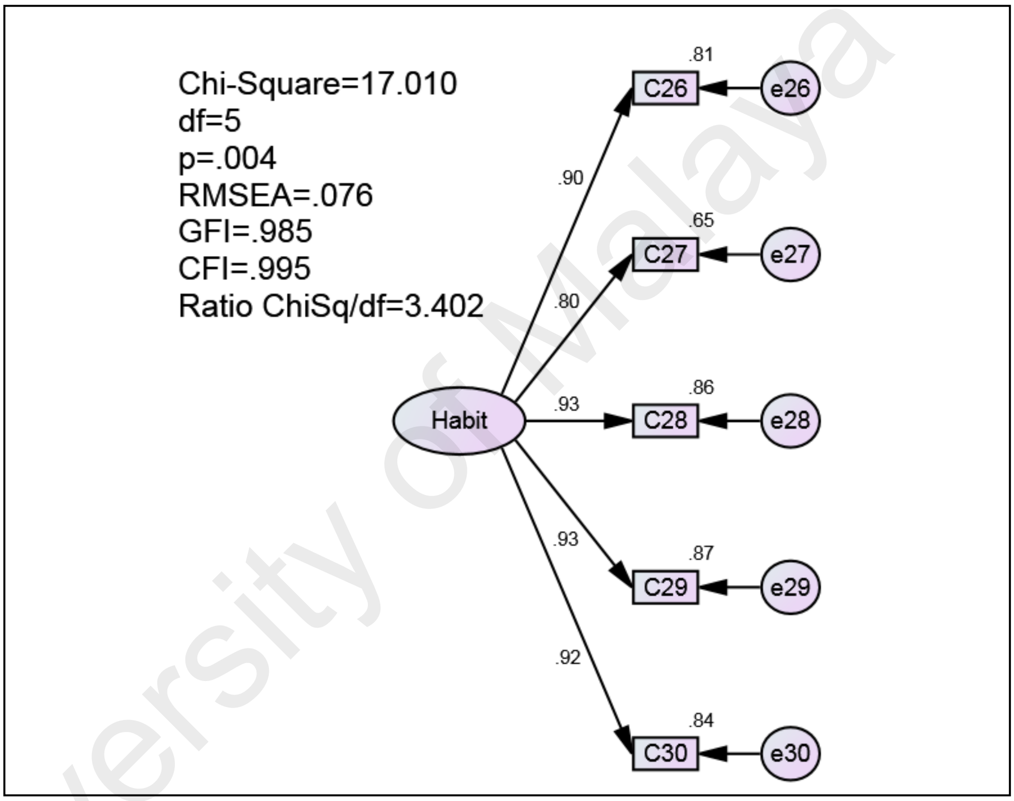
Path			Estimate	S.E.	C.R.	p	r
C21	<-->	C22	2.529	.186	13.592	***	.894
C21	<-->	C23	2.156	.173	12.478	***	.773
C21	<-->	C24	2.054	.173	11.850	***	.714
C21	<-->	C25	1.943	.163	11.948	***	.723
C22	<-->	C23	2.100	.169	12.425	***	.768
C22	<-->	C24	2.028	.170	11.902	***	.719
C22	<-->	C25	1.962	.161	12.178	***	.744
C23	<-->	C24	2.267	.176	12.889	***	.815
C23	<-->	C25	2.137	.165	12.960	***	.823
C24	<-->	C25	2.242	.171	13.086	***	.837

*** Correlation is significant at the 0.001 level

Table 4.17 showed that all the five items in the hedonic motivation dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring hedonic motivation (latent construct) with the range of the correlation coefficients, r between .714-.894, these r values that represented the correlation coefficients among each of the indicators in the hedonic motivation dimension are less than .90. Thus, the discriminant validity of all the items in measuring hedonic motivation is achieved. Hence, all the indicators in measuring hedonic motivation do not have significant multicollinearity problem.

(vi) Dimension 6: Habit

The last dimension - habit also contained five items as the observed indicators. The CFA for this dimension is displayed in Figure 4.14.



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igure 4.14: CFA model for Habit Dimension

Figure 4.14 showed that all fitness indexes [RMSEA=.076 (<.08), GFI=.985 (>.90), CFI=.995 (>.90), and Ratio Chisq/df=3.402 (<5.0)] of this model achieved the level of fitness required based on Table 3.13, thus, the construct validity of this model is achieved. Furthermore, all the five items displayed factor loadings above .50. This meant that the unidimensionality of this habit construct have been achieved and no item needs to be dropped from this model. The CFA yield results as shown in Table 4.18.

Table 4.18: CFA result for Habit Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
C26	<---	Habit	1.000				.902	.814
C27	<---	Habit	.936	.041	22.581	***	.804	.647
C28	<---	Habit	1.092	.034	31.708	***	.930	.864
C29	<---	Habit	1.090	.034	32.094	***	.934	.872
C30	<---	Habit	1.107	.036	30.409	***	.916	.838

*** Correlation is significant at the 0.001 level

Based on the result showed in Table 4.18, the convergent validity of this model of habit dimension is achieved because all items are statistically significant and have acceptable factor loadings between .804-.934 which are more than .50.

After the construct validity and convergent validity for this habit dimension have been established, the researcher carried out the inter-item correlation analysis to check on the discriminant validity for all the items used to measure this latent construct. Table 4.19 shows the results of the inter-item correlation analysis.

Table 4.19: Correlation Coefficient (r value) between each of the Items in Habit Dimension

Path			Estimate	S.E.	C.R.	p	r
C26	<-->	C27	2.459	.201	12.246	***	.751
C26	<-->	C28	2.731	.210	12.990	***	.826
C26	<-->	C29	2.772	.211	13.156	***	.844
C26	<-->	C30	2.818	.217	13.011	***	.828
C27	<-->	C28	2.615	.213	12.273	***	.753
C27	<-->	C29	2.495	.209	11.956	***	.724
C27	<-->	C30	2.653	.218	12.163	***	.743
C28	<-->	C29	3.051	.227	13.445	***	.877
C28	<-->	C30	3.059	.232	13.196	***	.849
C29	<-->	C30	3.058	.231	13.245	***	.854

*** Correlation is significant at the 0.001 level

Table 4.19 showed that all the five items in the habit dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring this latent construct (habit) with the range of the correlation coefficients, r between .724-.877, these r values that represented the correlation coefficients among each of the indicators in the habit dimension are less than .90. Thus, the discriminant validity of all the items in measuring habit is achieved. Hence, all the indicators in measuring habit do not have significant multicollinearity problem.

Based on the analysis of the six measurement models of teacher acceptance and use of SMS that have been performed above, it can be concluded that all the six measurement models according to each dimension of teacher acceptance and use of SMS have achieved construct validity, convergent validity, and discriminant validity.

(b) ***Principal Technology Leadership Practices (Exogenous Variable)***

Principal technology leadership practices are the exogenous (independent) variable in this study. This latent concept is measured by five dimensions (constructs) which are (i) Visionary leadership; (ii) Digital age learning culture; (iii) Excellence in professional practice; (iv) Systemic improvement and (v) Digital citizenship. Each of these dimensions is measured by five to eight items as the observed (indicator) variables. Based on these five dimensions of principal technology leadership practices, five measurement models were run to assess the convergent and discriminant validity of the construct measured.

(i) Dimension 1: Visionary Leadership

This dimension consisted five items as the observed indicators. The CFA model for this dimension is showed in Figure 4.15.

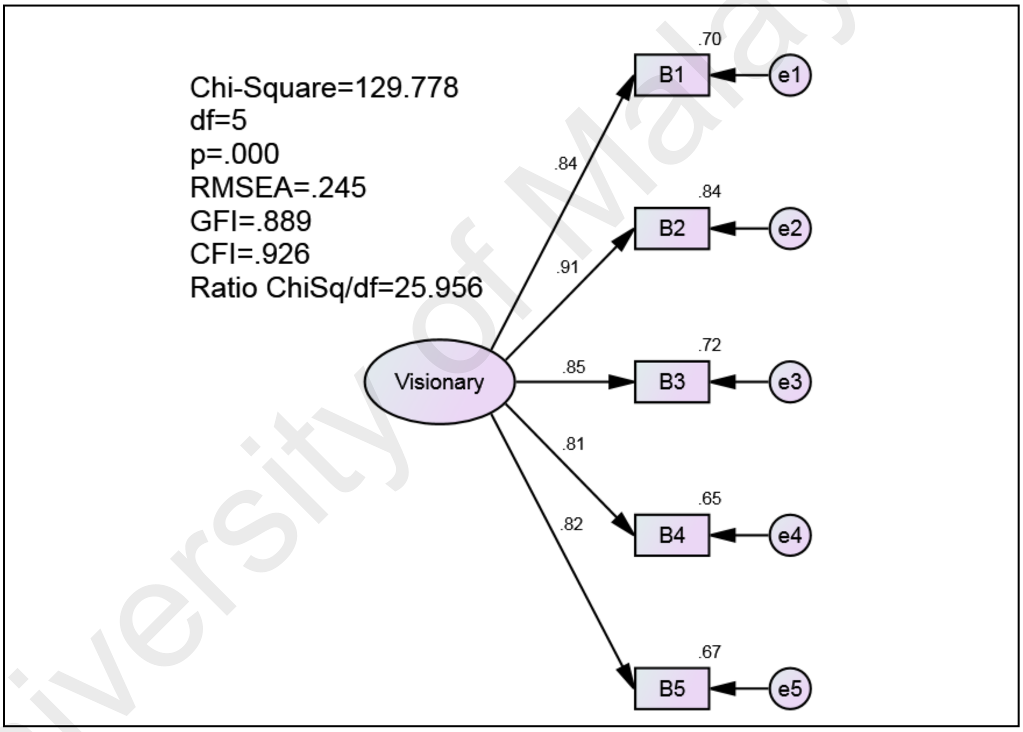


Figure 4.15: CFA model for Visionary Leadership Dimension

Figure 4.15 indicated that the fitness indexes of the visionary leadership dimension model do not achieve the level of fitness required for RMSEA=.245 (>.08), GFI=.889 (<.90), and Ratio Chisq/df=25.956 (>5.0). However, all the five items displayed factor loadings above .50. This meant that the unidimensionality of the visionary leadership construct have been achieved and no item needs to be dropped from this model. Based on the suggestion of the modification indices, the researcher found that two of the measurement errors need to be set as "free parameter" to improve the fitness of the model. The measurement errors that need to be correlated are e4 with e5 (M.I.=105.484, Par Change=.424). After these measurement errors have been set as "free parameter", the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.16.

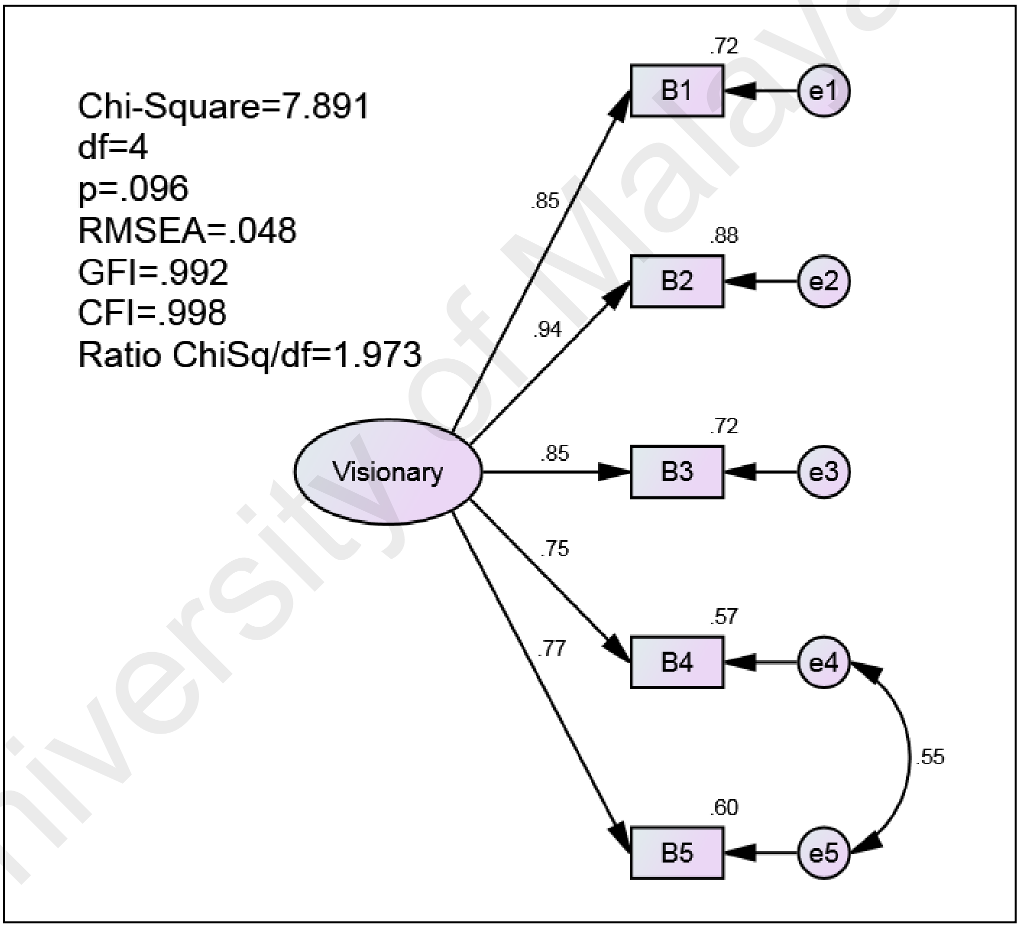


Figure 4.16: Re-specified CFA model for Visionary Leadership Dimension

Based on the re-specified model showed in Figure 4.16, it was found that all the fitness indexes [RMSEA=.048 (<.08), GFI=.992 (>.90), CFI=.998 (>.90), and Chisq/df=1.973 (<5.0)] have achieved the threshold values (Refer Table 3.13). This indicated that the re-specified model for visionary leadership dimension achieved construct validity. The CFA yield results as shown in Table 4.20.

Table 4.20: CFA result of the Re-specified Model for Visionary Leadership Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
B1	<---	Visionary	1.000				.846	.715
B2	<---	Visionary	1.117	.044	25.448	***	.939	.883
B3	<---	Visionary	1.051	.048	21.901	***	.850	.722
B4	<---	Visionary	.899	.050	18.152	***	.755	.570
B5	<---	Visionary	.888	.047	18.784	***	.772	.596

*** Correlation is significant at the 0.001 level

Based on the result showed on Table 4.20, the convergent validity of this re-specified model for visionary leadership dimension is achieved because all items are statistically significant and have factor loadings between .755-.939 which are greater than .50.

After the construct validity and convergent validity for visionary leadership dimension have been established, the researcher performed the inter-item correlation analysis to check on the discriminant validity for this latent construct. The results of the inter-item correlation analysis are presented in Table 4.21.

Table 4.21: Correlation Coefficient (r value) between each of the Items in Visionary Leadership Dimension

Path			Estimate	S.E.	C.R.	p	r
B1	<-->	B2	1.793	.141	12.724	***	.798
B1	<-->	B3	1.646	.140	11.744	***	.704
B1	<-->	B4	1.417	.130	10.868	***	.630
B1	<-->	B5	1.458	.128	11.361	***	.671
B2	<-->	B3	1.881	.148	12.741	***	.800
B2	<-->	B4	1.589	.136	11.722	***	.702
B2	<-->	B5	1.571	.132	11.901	***	.718
B3	<-->	B4	1.572	.139	11.327	***	.668
B3	<-->	B5	1.494	.133	11.195	***	.657
B4	<-->	B5	1.776	.138	12.850	***	.811

*** Correlation is significant at the 0.001 level

Table 4.21 showed that all the five items in the visionary leadership dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring visionary leadership (latent construct) with the range of the correlation coefficients, r between .630-.811, these r values that represented the correlation coefficients among each of the indicators in the visionary leadership dimension are less than .90. Thus, the discriminant validity of all the items in measuring visionary leadership is achieved. Hence, all the indicators in measuring visionary leadership do not have significant multicollinearity problem.

(ii) Dimension 2: Digital Age Learning Culture

Digital age learning culture dimension comprised six items as the observed indicators. The CFA for this dimension is presented in Figure 4.17.

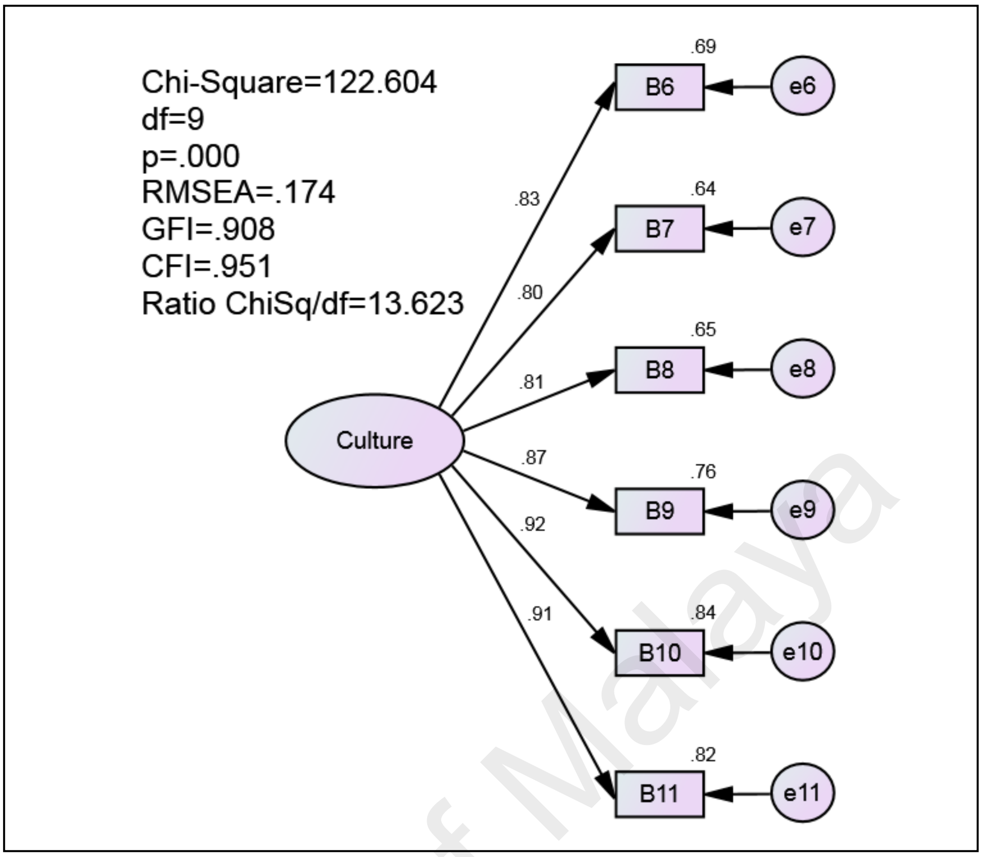
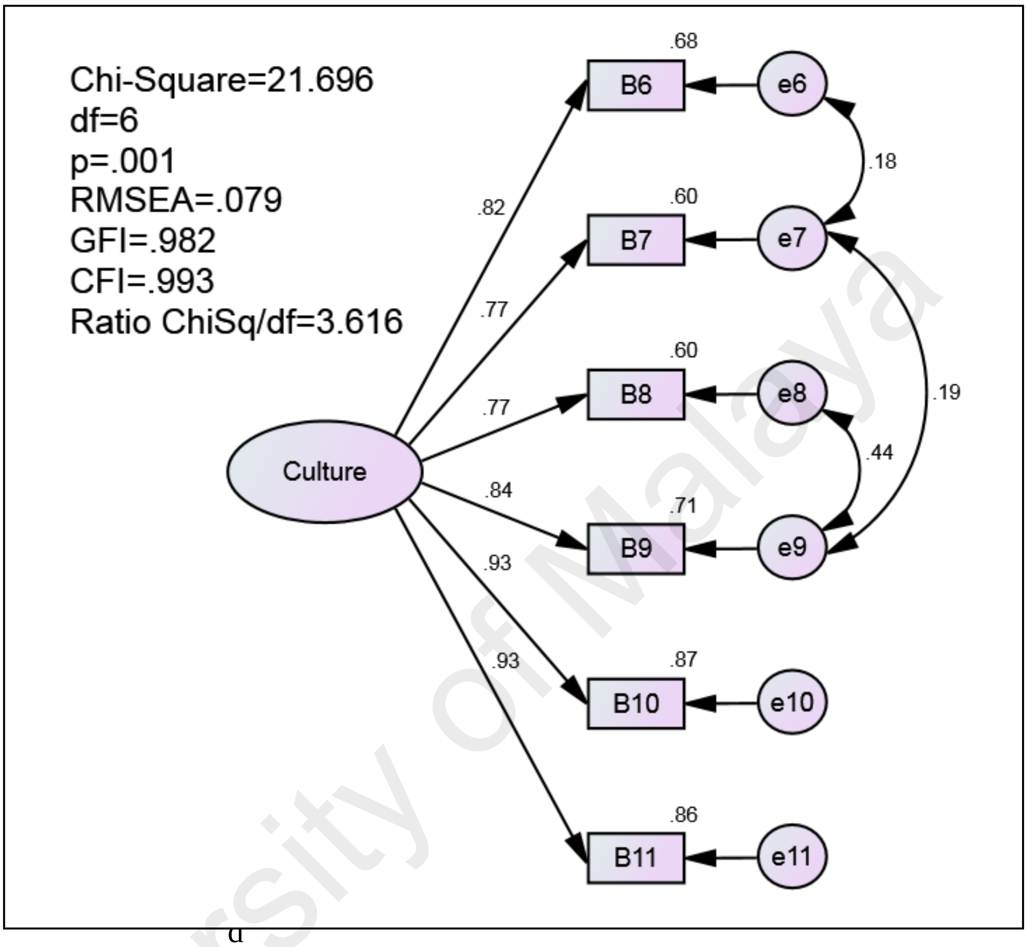


Figure 4.17: CFA model for Digital Age Learning Culture Dimension

Figure 4.17 showed that the fitness indexes of this model do not achieve the level of fitness required for RMSEA=.174 (>.08), and Ratio Chisq/df=13.623 (>5.0). However, all the six items displayed factor loadings above .50, this indicated that the unidimensionality of the digital age learning culture construct have been achieved and no item needs to be dropped from this model. Based on the suggestion of the modification indices, the researcher found that few of the measurement errors need to be set as “free parameter” to improve the fitness of the model. The measurement errors that need to be correlated are e8 with e9 (M.I.=64.009, Par Change=.323), e7 with e9 (M.I.=16.689, Par Change=.138), and e6 with e7 (M.I.=11.722, Par Change=.132). After these measurement errors have been set as “free parameter”, the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.18.



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CFA model for Digital Age Learning Culture Dimension

Based on the re-specified model showed in Figure 4.18, all the fitness indexes [RMSEA=.079 (<.08), GFI=.982 (>.90), CFI=.993 (>.90), and Chisq/df=3.616 (<5.0)] have achieved the required level according to Table 3.13. This indicated that the re-specified model for digital age learning culture dimension achieved construct validity. The results of the CFA analysis are presented in Table 4.22.

Table 4.22: CFA result of the Re-specified Model for Digital Age Learning Culture Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
B6	<---	Culture	1.000				.822	.676
B7	<---	Culture	.910	.045	20.341	***	.774	.600
B8	<---	Culture	1.040	.057	18.324	***	.772	.597
B9	<---	Culture	1.061	.051	20.794	***	.841	.707
B10	<---	Culture	1.158	.047	24.581	***	.934	.872
B11	<---	Culture	1.149	.047	24.256	***	.926	.857

*** Correlation is significant at the 0.001 level

The result in Table 4.22 showed that the convergent validity of this re-specified model for digital age learning culture dimension is achieved because all items are statistically significant and have factor loadings between .772-.934 which are greater than .50.

After the construct validity and convergent validity for digital age learning culture dimension have been established, the researcher carried out the inter-item correlation analysis to determine the discriminant validity for this latent construct. The results of the inter-item correlation analysis are presented in Table 4.23.

Table 4.23: Correlation Coefficient (r value) between each of the Items in Digital Age Learning Culture Dimension

Path			Estimate	S.E.	C.R.	p	r
B6	<-->	B7	1.516	.128	11.822	***	.711
B6	<-->	B8	1.566	.142	11.019	***	.642
B6	<-->	B9	1.668	.139	12.005	***	.728
B6	<-->	B10	1.688	.138	12.257	***	.752
B6	<-->	B11	1.717	.139	12.383	***	.764
B7	<-->	B8	1.502	.137	10.947	***	.636
B7	<-->	B9	1.633	.135	12.095	***	.736
B7	<-->	B10	1.566	.131	11.925	***	.721
B7	<-->	B11	1.519	.130	11.676	***	.698
B8	<-->	B9	2.042	.160	12.788	***	.805
B8	<-->	B10	1.808	.151	11.996	***	.727
B8	<-->	B11	1.733	.149	11.655	***	.696
B9	<-->	B10	1.807	.145	12.483	***	.774
B9	<-->	B11	1.791	.144	12.406	***	.766

Path			Estimate	S.E.	C.R.	p	r
B10	<-->	B11	1.998	.149	13.406	***	.872

*** Correlation is significant at the 0.001 level

Table 4.23 showed that all the six items in the digital age learning culture dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring digital age learning culture (latent construct) with the range of the correlation coefficients, r between .636-.872. These r values that represented the correlation coefficients among each of the indicators in the digital age learning culture dimension are less than .90. Thus, the discriminant validity of all the items in measuring digital age learning culture is achieved. Hence, all the indicators in measuring digital age learning culture do not have significant multicollinearity problem.

(iii) Dimension 3: Excellence in Professional Practice

The third dimension – excellence in professional practice dimension comprised seven items as the observed indicators. The CFA for this dimension is displayed in Figure 4.19.

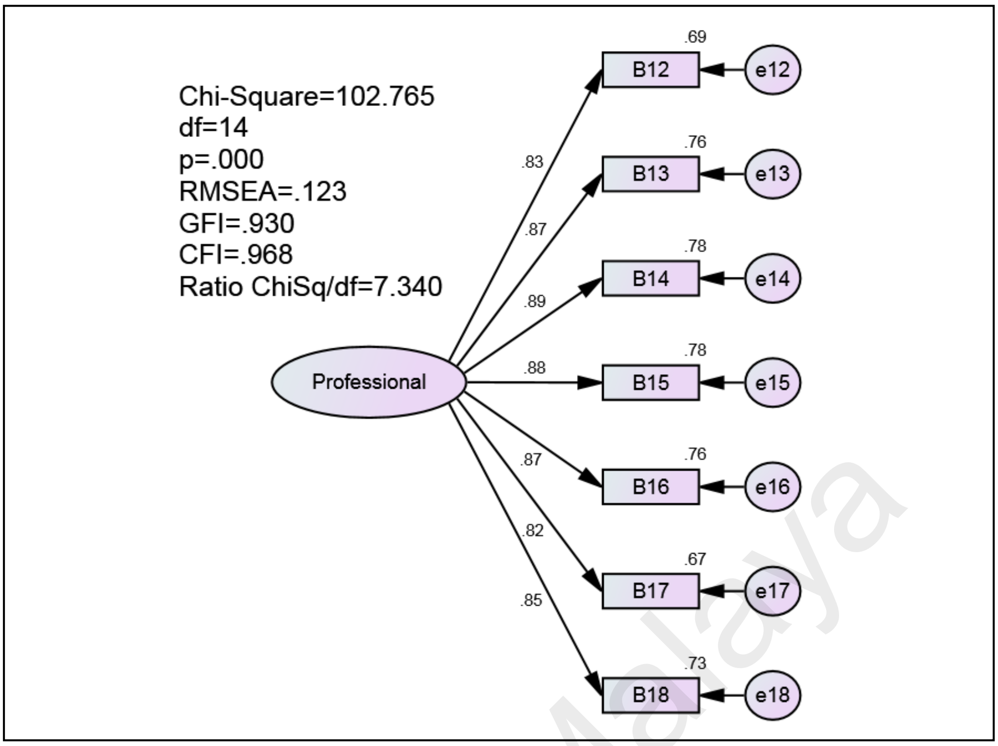
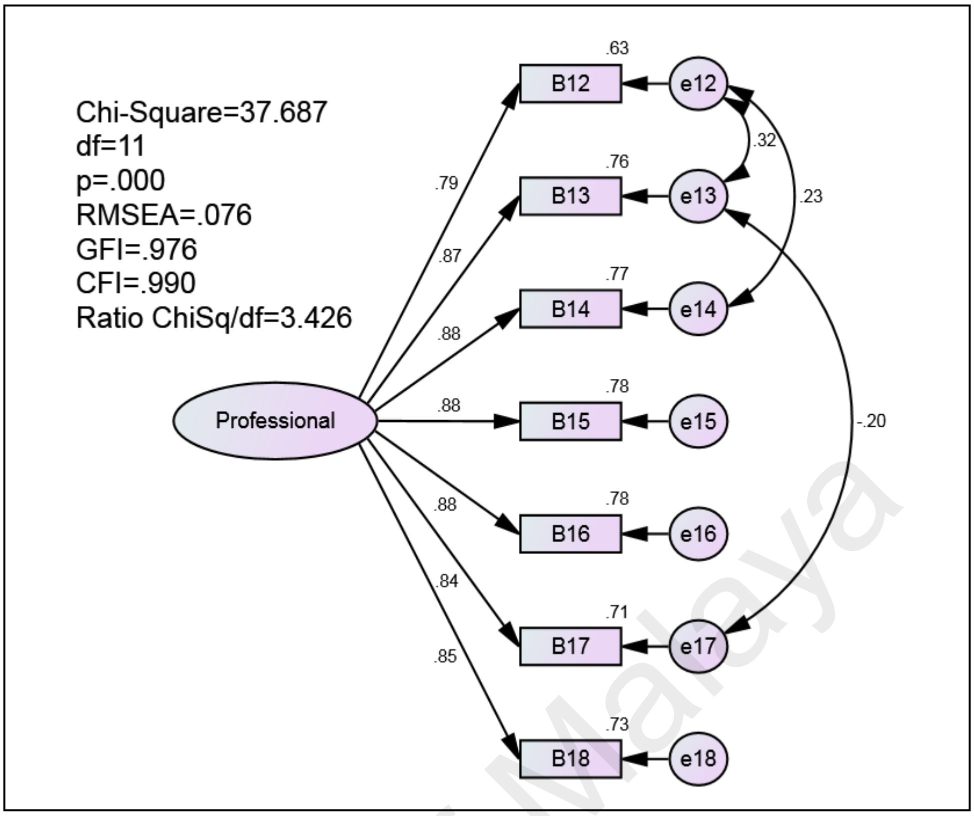


Figure 4.19: CFA model for Excellence in Professional Practice Dimension

Based on Figure 4.19 showed above, it was found that the fitness indexes of this model do not achieve the level of fitness required for RMSEA=.123 (>.08), and Ratio Chisq/df=7.340 (>5.0). However, all the seven items have factor loadings above .50. This meant that the unidimensionality of the excellence in professional practice construct have been achieved and no item needs to be dropped from this model. Subsequently, based on the suggestion of the modification indices, few of the measurement errors need to be set as "free parameter" to improve the fitness of the model. The measurement errors that need to be correlated are e12 with e13 (M.I.=33.855, Par Change=.201), e12 with e14 (M.I.=15.518, Par Change=.138), and e13 with e17 (M.I.=9.313, Par Change= -.099). After these measurement errors have been set as "free parameter", the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.20.



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igure 4.20: Re-specified CFA model for Excellence in Professional Practice Dimension

Based on this re-specified model of excellence in professional practice dimension showed in Figure 4.20, it was found that all the fitness indexes [RMSEA=.076 (<.08), GFI=.976 (>.90), CFI=.990 (>.90), and Chisq/df=3.426 (<5.0)] have achieved the required level (Refer Table 3.13). This indicated that the re-specified model for excellence in professional practice dimension achieved construct validity. The CFA yield results as shown in Table 4.24.

Table 4.24: CFA result of the Re-specified Model for Excellence in Professional Practice Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
B12	<---	Professional	1.000				.792	.628
B13	<---	Professional	.987	.040	24.459	***	.870	.756
B14	<---	Professional	1.073	.046	23.459	***	.875	.766
B15	<---	Professional	1.040	.050	20.937	***	.882	.779
B16	<---	Professional	1.014	.048	20.957	***	.883	.780
B17	<---	Professional	1.038	.053	19.587	***	.844	.712
B18	<---	Professional	1.019	.051	20.001	***	.854	.729

*** Correlation is significant at the 0.001 level

Based on the result showed in Table 4.24, the convergent validity of this re-specified model for excellence in professional practice dimension is achieved because all items are statistically significant and have factor loadings between .792-.883 which are more than .50.

After the construct validity and convergent validity of the excellence in professional practice dimension have been established, the researcher carried out the correlation analysis between each of these items to check on the discriminant validity for this latent construct. The results of the inter-item correlation analysis are presented in Table 4.25.

Table 4.25: Correlation Coefficient (r value) between each of the Items in Excellence in Professional Practice Dimension

Path			Estimate	S.E.	C.R.	p	r
B12	<-->	B13	1.821	.144	12.681	***	.794
B12	<-->	B14	1.893	.153	12.397	***	.765
B12	<-->	B15	1.698	.143	11.858	***	.715
B12	<-->	B16	1.591	.138	11.551	***	.687
B12	<-->	B17	1.528	.143	10.694	***	.616
B12	<-->	B18	1.712	.145	11.820	***	.711
B13	<-->	B14	1.716	.138	12.452	***	.771
B13	<-->	B15	1.603	.131	12.233	***	.750
B13	<-->	B16	1.608	.129	12.458	***	.771
B13	<-->	B17	1.486	.132	11.299	***	.665
B13	<-->	B18	1.623	.133	12.226	***	.749
B14	<-->	B15	1.829	.144	12.671	***	.793
B14	<-->	B16	1.683	.138	12.223	***	.749
B14	<-->	B17	1.751	.146	11.991	***	.727
B14	<-->	B18	1.754	.143	12.242	***	.750
B15	<-->	B16	1.700	.135	12.615	***	.787
B15	<-->	B17	1.741	.142	12.264	***	.753
B15	<-->	B18	1.641	.136	12.031	***	.730
B16	<-->	B17	1.709	.139	12.319	***	.758
B16	<-->	B18	1.645	.134	12.253	***	.752
B17	<-->	B18	1.716	.142	12.048	***	.732

*** Correlation is significant at the 0.001 level

By referring to Table 4.25, it was found that all the seven items in the excellence in professional practice dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring excellence in professional practice (latent construct) with the range of the correlation coefficients, r between .616-.794. These r values that represented the correlation coefficients among each of the indicators in the excellence in professional practice dimension are less than .90. Thus, the discriminant validity of all the items in measuring excellence in professional practice is achieved. Hence, all the indicators in measuring excellence in professional practice do not have significant multicollinearity problem.

(iv) Dimension 4: Systemic Improvement

The fourth dimension – systemic improvement consisted six items as the observed indicators. The CFA for this dimension is showed in Figure 4.21.

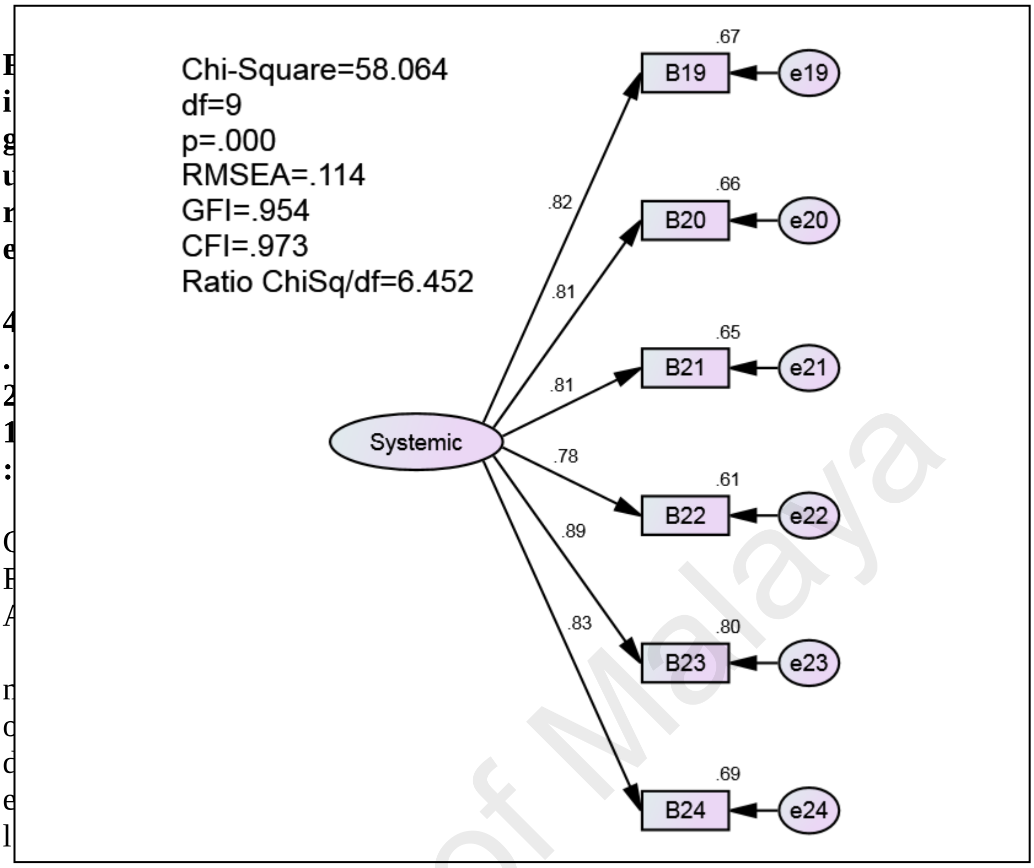


Figure 4.21: CFA

for Systemic Improvement Dimension

Based on Figure 4.21, the fitness indexes of this model do not achieve the level of fitness required for RMSEA=.114 (>.08), and Ratio Chisq/df=6.452 (>5.0). However, all the six items displayed factor loadings above .50. This indicated that the unidimensionality of the systemic improvement construct have been achieved and no item needs to be dropped from this model. Based on the suggestion of the modification indices, the researcher found that few of the measurement errors need to be set as “free parameter” to improve the fitness of the model. The measurement errors that need to be correlated are e23 with e24 (M.I.=9.919, Par Change=.123), e22 with e23 (M.I.=10.147, Par Change=.155), e22 with e24 (M.I.=6.092, Par Change=.151), and e19 with e24 (M.I.=9.550, Par Change=.133). After these measurement errors have been set as “free parameter", the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.22

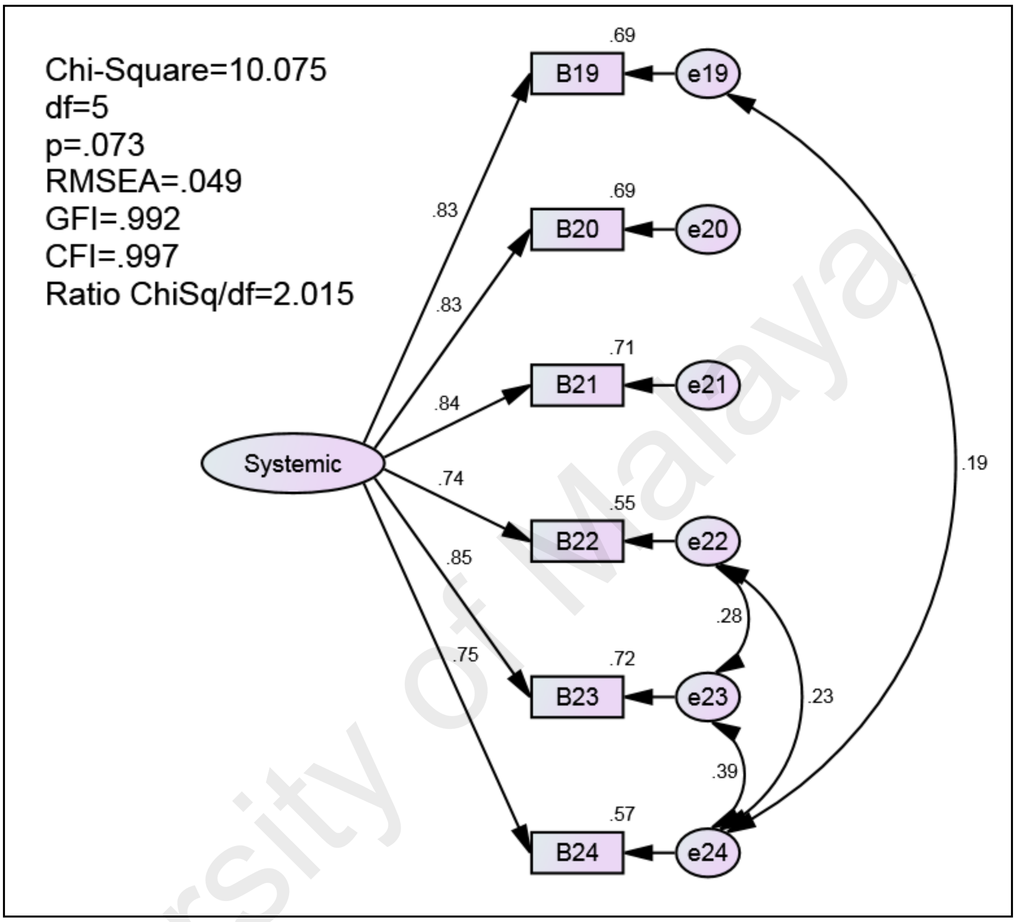


Figure 4.22: Re-specified CFA model for Systemic Improvement Dimension

Based on the re-specified CFA model for systemic improvement dimension showed above (Refer Figure 4.22), all the fitness indexes [RMSEA=.049 (<.08), GFI=.992 (>.90), CFI=.997 (>.90), and Chisq/df=2.015 (<5.0)] have achieved the threshold values required according to Table 3.13. This indicated that the re-specified model for systemic improvement dimension achieved construct validity. The results of the CFA analysis is presented in Table 4.26.

Table 4.26: CFA result of the Re-specified Model for Systemic Improvement Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
B19	<---	Systemic	1.000				.829	.687
B20	<---	Systemic	1.041	.053	19.785	***	.833	.694
B21	<---	Systemic	1.013	.050	20.115	***	.843	.710
B22	<---	Systemic	1.159	.070	16.566	***	.741	.549
B23	<---	Systemic	1.092	.054	20.101	***	.846	.715
B24	<---	Systemic	1.047	.056	18.591	***	.752	.565

*** Correlation is significant at the 0.001 level

Based on the CFA result showed in Table 4.26, the convergent validity of this re-specified model for systemic improvement dimension is achieved because all items are statistically significant and have acceptable factor loadings between .741-.846 which are greater than .50.

After the construct validity and convergent validity for systemic improvement dimension have been established, the researcher carried out the inter-item correlation analysis to check on the discriminant validity for this latent construct. The results of the inter-item correlation analysis are presented in Table 4.27.

Table 4.27: Correlation Coefficient (r value) between each of the Items in Systemic Improvement Dimension

Path			Estimate	S.E.	C.R.	p	r
B19	<-->	B20	1.489	.129	11.535	***	.686
B19	<-->	B21	1.470	.125	11.751	***	.705

Path			Estimate	S.E.	C.R.	p	r
B19	<-->	B22	1.606	.155	10.379	***	.591
B19	<-->	B24	1.679	.144	11.638	***	.695
B19	<-->	B23	1.586	.135	11.782	***	.708
B20	<-->	B21	1.512	.129	11.692	***	.700
B20	<-->	B22	1.751	.163	10.770	***	.622
B20	<-->	B24	1.639	.147	11.170	***	.655
B20	<-->	B23	1.640	.139	11.765	***	.706
B21	<-->	B22	1.732	.158	10.997	***	.640
B21	<-->	B24	1.463	.138	10.594	***	.608
B21	<-->	B23	1.573	.134	11.752	***	.705
B22	<-->	B24	2.050	.184	11.165	***	.654
B22	<-->	B23	2.113	.176	11.992	***	.727
B23	<-->	B24	1.999	.160	12.477	***	.773

*** Correlation is significant at the 0.001 level

Table 4.27 showed that all the six items in the systemic improvement dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring systemic improvement construct with the range of the correlation coefficients, r between .591-.773. These r values that represented the correlation coefficients among each of the indicators in the systemic improvement dimension are less than .90. Thus, the discriminant validity of all the items in measuring systemic improvement is achieved. Hence, all the indicators in measuring systemic improvement do not have significant multicollinearity problem.

(v) Dimension 5: Digital Citizenship

Digital citizenship dimension comprised eight items as the observed indicators. The CFA for this dimension is presented in Figure 4.23.

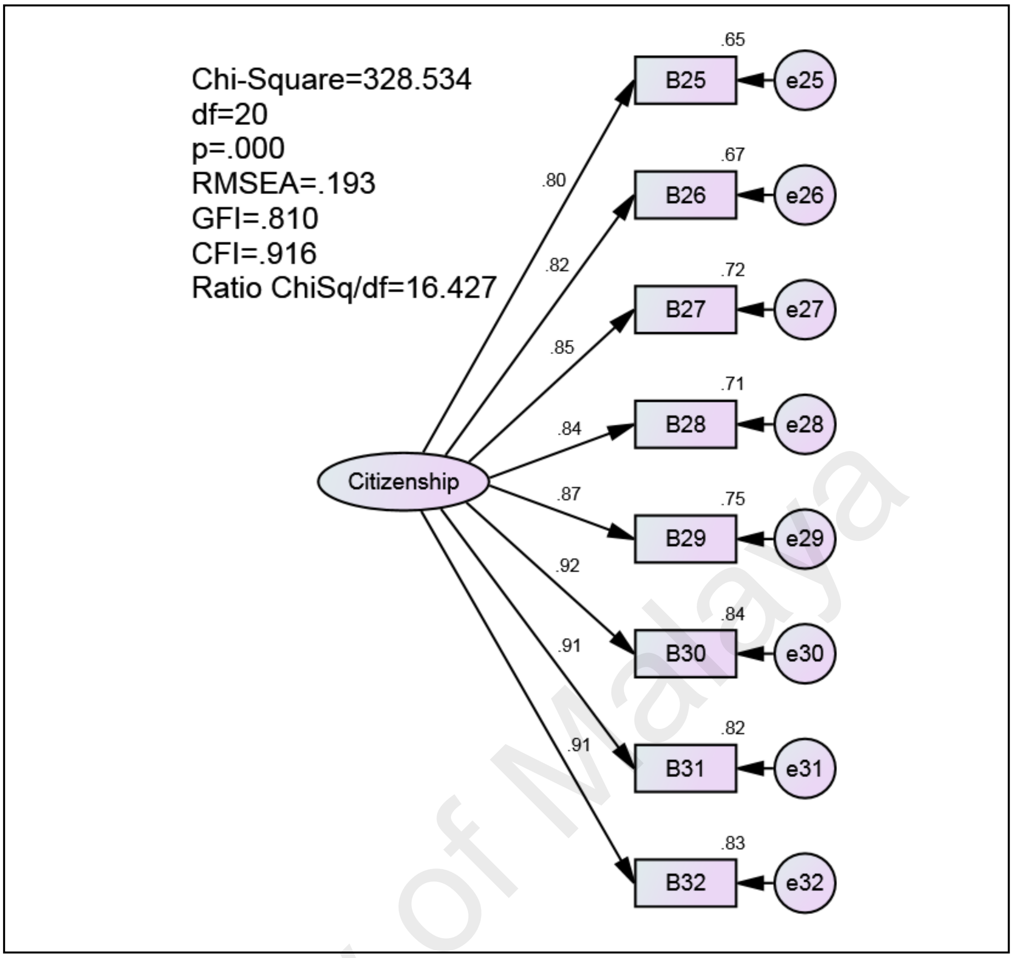


Figure 4.23: CFA model for Digital Citizenship Dimension

Figure 4.23 showed that three out of the four fitness indexes [RMSEA=.193 (>.08), GFI=.810 (<.90), and Ratio Chisq/df=16.427 (>5.0)] of this model do not achieve the level of fitness required. However, all the eight items have factor loadings greater than .50. This meant that the unidimensionality of the digital citizenship construct have been achieved and no item needs to be dropped from this model. In order to improve the fitness of the model, the researcher needs to set few of the measurement errors as "free parameter" based on the suggestion of the modification indices. The measurement errors that need to be correlated are e27 with e28 (M.I.=92.148, Par Change=.385), e26 with e27 (M.I.=46.499, Par Change=.251), e26 with e28 (M.I.=43.526, Par Change=.229), e25 with e28

(M.I.=21.657, Par Change=.194), e26 with e29 (M.I.=15.247, Par Change=.116), and e25 with e26 (M.I.=14.102, Par Change=.152). After these measurement errors have been set as “free parameter”, the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is displayed in Figure 4.24.

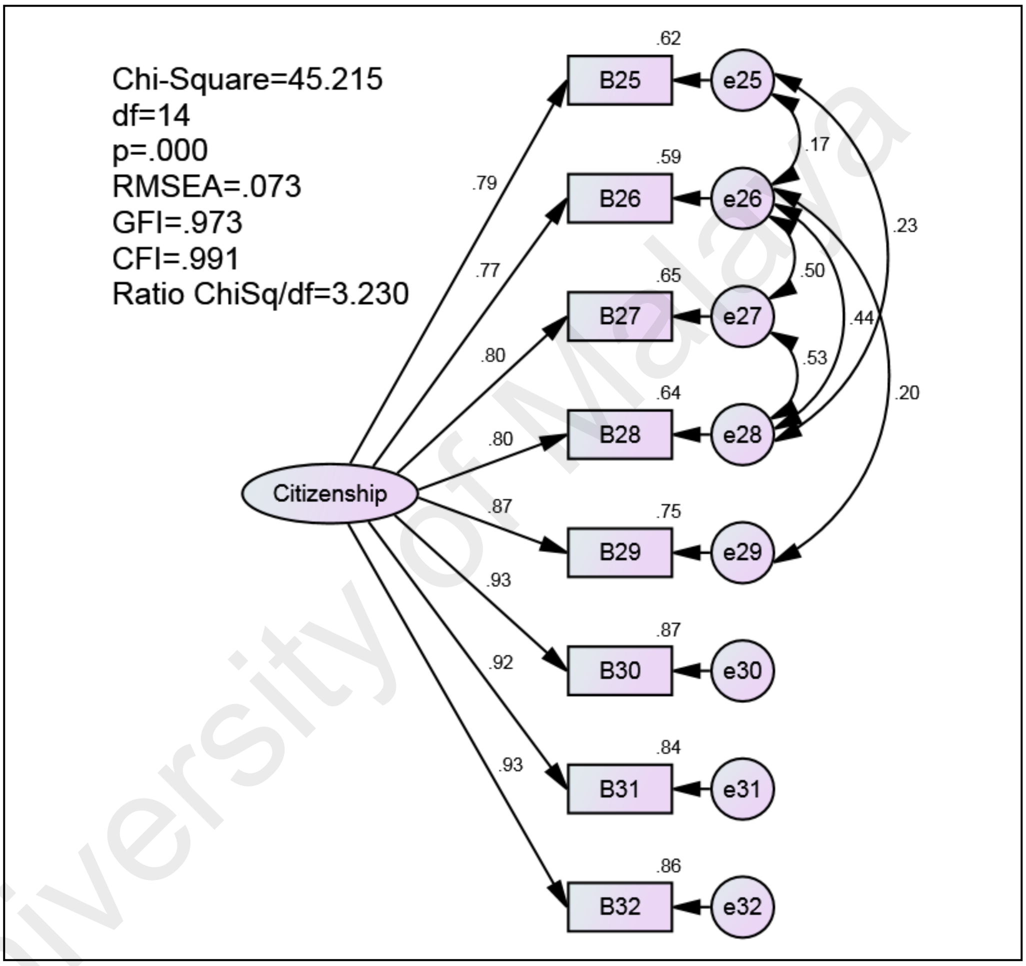


Figure 4.24: Re-specified CFA model for Digital Citizenship Dimension

Based on the re-specified CFA model for digital citizenship dimension showed in Figure 4.24, it was found that all the fitness indexes [RMSEA=.073 (<.08), GFI=.973 (>.90), CFI=.991 (>.90), and Chisq/df=3.230 (<5.0)] have achieved the required level according to Table 3.13. This indicated that the construct validity of this re-specified model for digital citizenship dimension is achieved. The result of CFA analysis is presented in Table 4.28.

Table 4.28: CFA result of the Re-specified Model for Digital Citizenship Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
B25	<---	Citizenship	1.000				.788	.620
B26	<---	Citizenship	.835	.044	19.092	***	.766	.587
B27	<---	Citizenship	.978	.053	18.532	***	.804	.647
B28	<---	Citizenship	.933	.045	20.921	***	.800	.641
B29	<---	Citizenship	.923	.045	20.544	***	.868	.753
B30	<---	Citizenship	1.025	.045	22.812	***	.934	.872
B31	<---	Citizenship	.997	.045	22.262	***	.918	.843
B32	<---	Citizenship	1.025	.045	22.570	***	.927	.859

*** Correlation is significant at the 0.001 level

Based on the CFA result showed in Table 4.28, the convergent validity of this re-specified model for digital citizenship dimension is achieved because all items are statistically significant and have factor loadings higher than .50 which are in the range between .766-.934.

After the construct validity and convergent validity for digital citizenship dimension have been established, the researcher performed the inter-item correlation analysis to determine the discriminant validity for this latent construct. The results of this analysis are presented in Table 4.29

Table 4.29: Correlation Coefficient (r value) between each of the Items in Digital Citizenship Dimension

Path			Estimate	S.E.	C.R.	p	r
B25	<-->	B26	1.763	.153	11.548	***	.687
B25	<-->	B27	1.922	.168	11.411	***	.675
B25	<-->	B28	2.009	.167	12.052	***	.732
B25	<-->	B29	1.661	.147	11.318	***	.667
B25	<-->	B30	1.875	.156	12.015	***	.729
B25	<-->	B31	1.792	.153	11.746	***	.704
B25	<-->	B32	1.938	.159	12.221	***	.748
B26	<-->	B27	2.006	.156	12.898	***	.816
B26	<-->	B28	1.852	.147	12.567	***	.782
B26	<-->	B29	1.570	.130	12.031	***	.730
B26	<-->	B30	1.570	.133	11.779	***	.707
B26	<-->	B31	1.534	.131	11.682	***	.699
B26	<-->	B32	1.565	.134	11.698	***	.700
B27	<-->	B28	2.199	.168	13.096	***	.838
B27	<-->	B29	1.712	.144	11.896	***	.718
B27	<-->	B30	1.868	.152	12.330	***	.759

Path			Estimate	S.E.	C.R.	p	r
B27	<-->	B31	1.788	.148	12.067	***	.734
B27	<-->	B32	1.780	.150	11.893	***	.718
B28	<-->	B29	1.575	.137	11.532	***	.685
B28	<-->	B30	1.730	.144	12.019	***	.729
B28	<-->	B31	1.746	.143	12.174	***	.744
B28	<-->	B32	1.758	.145	12.091	***	.736
B29	<-->	B30	1.783	.137	13.007	***	.828
B29	<-->	B31	1.688	.133	12.664	***	.792
B29	<-->	B32	1.711	.135	12.634	***	.789
B30	<-->	B31	1.871	.142	13.214	***	.851
B30	<-->	B32	1.934	.145	13.330	***	.864
B31	<-->	B32	1.920	.144	13.357	***	.867

*** Correlation is significant at the 0.001 level

Table 4.29 showed that all the eight items in the digital citizenship dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring digital citizenship (latent construct) with the range of the correlation coefficients, r between .667-.867. These r values that represented the correlation coefficients among each of the indicators in the digital citizenship dimension are less than .90. Thus, the discriminant validity of all the items in measuring digital citizenship is achieved. Hence, all the indicators in measuring digital citizenship do not have significant multicollinearity problem.

Based on the analysis of the five measurement models of principal technology leadership practices that have been performed above, it can be concluded that all the five measurement models according to each dimension of principal technology leadership practices have achieved construct validity, convergent validity, and discriminant validity.

(c) ***Teacher ICT Competency (Mediating Variable)***

Teacher ICT competency is the mediating variable in this study. This latent concept is measured by five dimensions (constructs) which are (i) Smart Pedagogy; (ii) Digital age learning experiences and assessments; (iii) Digital age work and learning; (iv) Digital citizenship and responsibility; and (v) Professional growth and leadership. Each of these dimensions is measured by five to nine items as the observed (indicator) variables. Based on these five dimensions of teacher ICT competency, five measurement models were run to assess the convergent and discriminant validity of the construct measured.

(i) Dimension 1: Smart Pedagogy

The first dimension – smart pedagogy consisted six items as observed indicators. The CFA model for this dimension is showed in Figure 4.25.

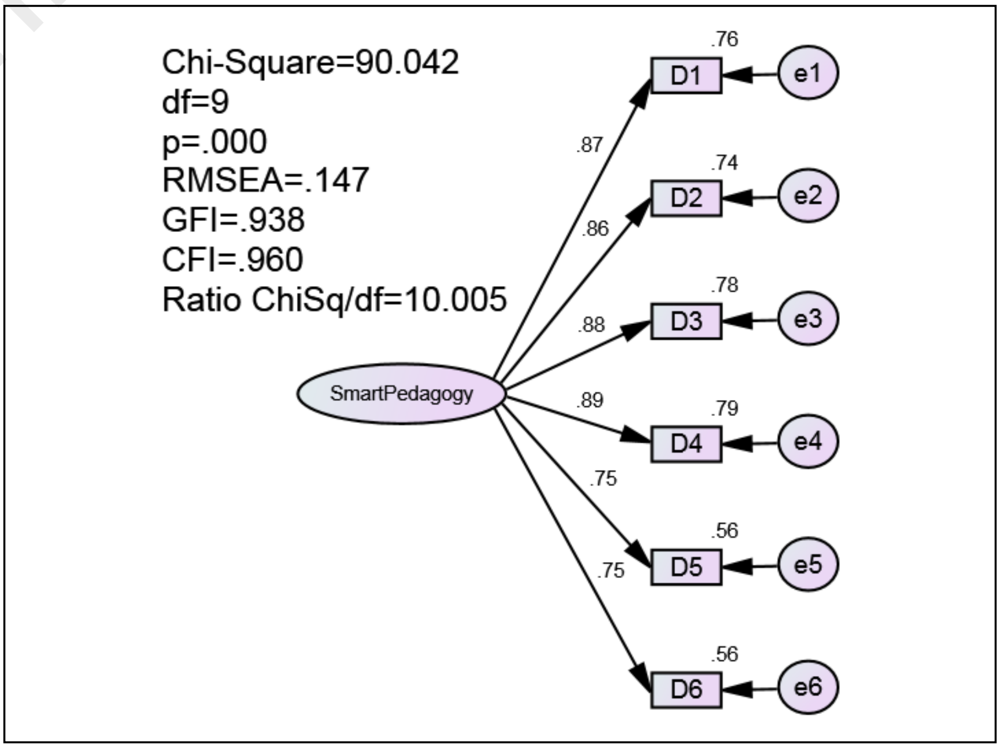


Figure 4.25: CFA model for Smart Pedagogy Dimension

Figure 4.25 indicated that the fitness indexes of the smart pedagogy dimension model do not achieve the level of fitness required for RMSEA=.147 (>.08), Ratio Chisq/df=10.005 (>5.0). However, all the six items showed factor loadings greater than .50. This indicated that the unidimensionality of the smart pedagogy construct have been achieved and no item needs to be dropped from this model. Based on the suggestion of the modification indices, the researcher found that few measurement errors need to be set as "free parameter" to improve the fitness of the model. The measurement errors that need to be correlated are e5 with e6 (M.I.=44.257, Par Change=.298), and e1 with e5 (M.I.=27.102, Par Change=.172). After these measurement errors have been set as "free parameter", the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.26.

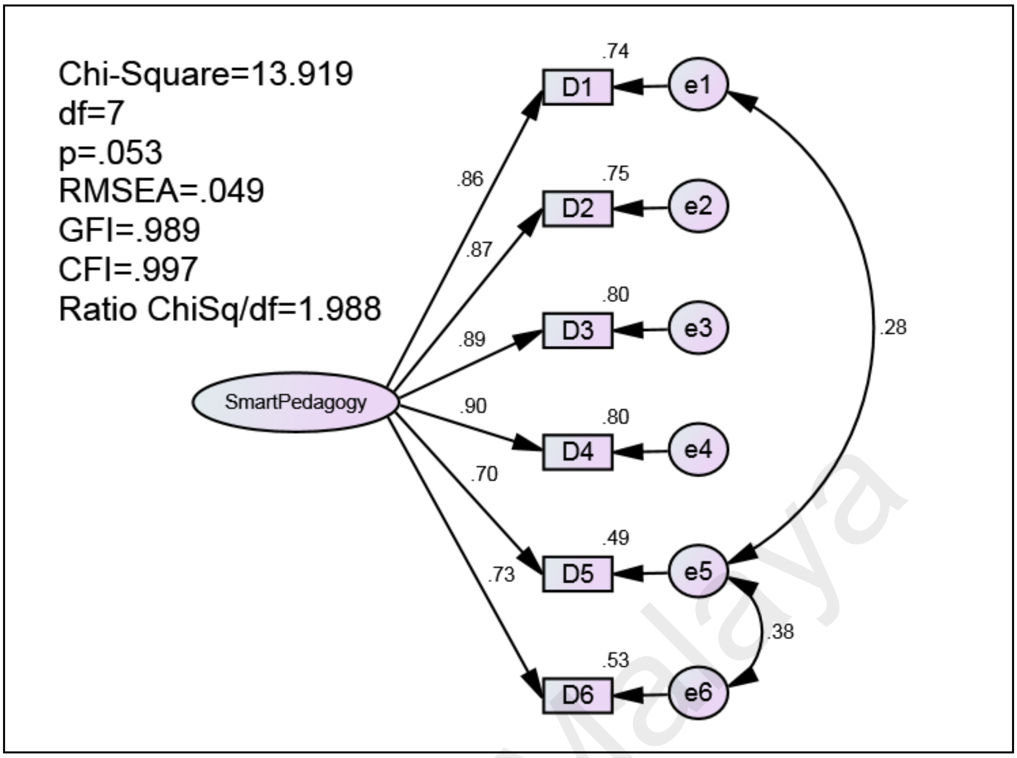


Figure 4.26: Re-specified CFA model for Smart Pedagogy Dimension

Based on the re-specified CFA model for smart pedagogy dimension showed in Figure 4.26, it was found that all the fitness indexes [RMSEA=.049 (<.08), GFI=.989 (>.90), CFI=.997 (>.90), and Chisq/df=1.988 (<5.0)] have achieved the required threshold values (Refer Table 3.13). This indicated that the re-specified model for smart pedagogy dimension achieved construct validity. The CFA yield results as shown in Table 4.30.

Table 4.30: CFA result of the Re-specified Model for Smart Pedagogy Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
D1	<---	SmartPedagogy	1.000				.860	.740
D2	<---	SmartPedagogy	1.028	.044	23.520	***	.868	.753
D3	<---	SmartPedagogy	1.069	.043	24.829	***	.894	.799
D4	<---	SmartPedagogy	1.093	.044	24.889	***	.895	.801
D5	<---	SmartPedagogy	.878	.046	19.051	***	.701	.491
D6	<---	SmartPedagogy	.867	.049	17.696	***	.731	.534

*** Correlation is significant at the 0.001 level

Based on the result showed in Table 4.30, the convergent validity of this re-specified model for smart pedagogy dimension is achieved because all items are statistically significant and have factor loadings between .701-.895 which are greater than .50.

After the construct validity and convergent validity for smart pedagogy dimension have been established, the researcher carried out the inter-item correlation analysis to check on the discriminant validity for this latent construct. The results of the inter-item correlation analysis are presented in Table 4.31.

Table 4.31: Correlation Coefficient (r value) between each of the Items in Smart Pedagogy Dimension

	Path		**Estimate**	**S.E.**	**C.R.**	**p**	**r**
D1	<-->	D2	1.390	.111	12.473	***	.773
D1	<-->	D3	1.369	.111	12.284	***	.754
D1	<-->	D4	1.429	.115	12.450	***	.771
D1	<-->	D5	1.324	.113	11.679	***	.698
D1	<-->	D6	1.099	.103	10.624	***	.610
D2	<-->	D3	1.434	.115	12.498	***	.775
D2	<-->	D4	1.444	.117	12.383	***	.764
D2	<-->	D5	1.178	.111	10.615	***	.609
D2	<-->	D6	1.135	.106	10.721	***	.618
D3	<-->	D4	1.537	.120	12.796	***	.806
D3	<-->	D5	1.202	.112	10.701	***	.616
D3	<-->	D6	1.243	.109	11.359	***	.671
D4	<-->	D5	1.295	.117	11.115	***	.650
D4	<-->	D6	1.257	.111	11.279	***	.664
D5	<-->	D6	1.344	.116	11.631	***	.694

*** Correlation is significant at the 0.001 level

Table 4.31 showed that all the six items in the smart pedagogy dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring smart pedagogy (latent construct) with the range of the correlation coefficients, r between .609-.806. These r values that represented the correlation coefficients among each of the indicators in the smart pedagogy dimension are less than .90. Thus, the discriminant validity of all the items in measuring smart pedagogy is achieved. Hence, all the indicators in measuring smart pedagogy do not have significant multicollinearity problem.

(ii) Dimension 2: Digital Age Learning Experience and Assessments

Digital age learning experience and assessments dimension comprised six items as observed indicators. The CFA for this dimension is presented in Figure 4.27.

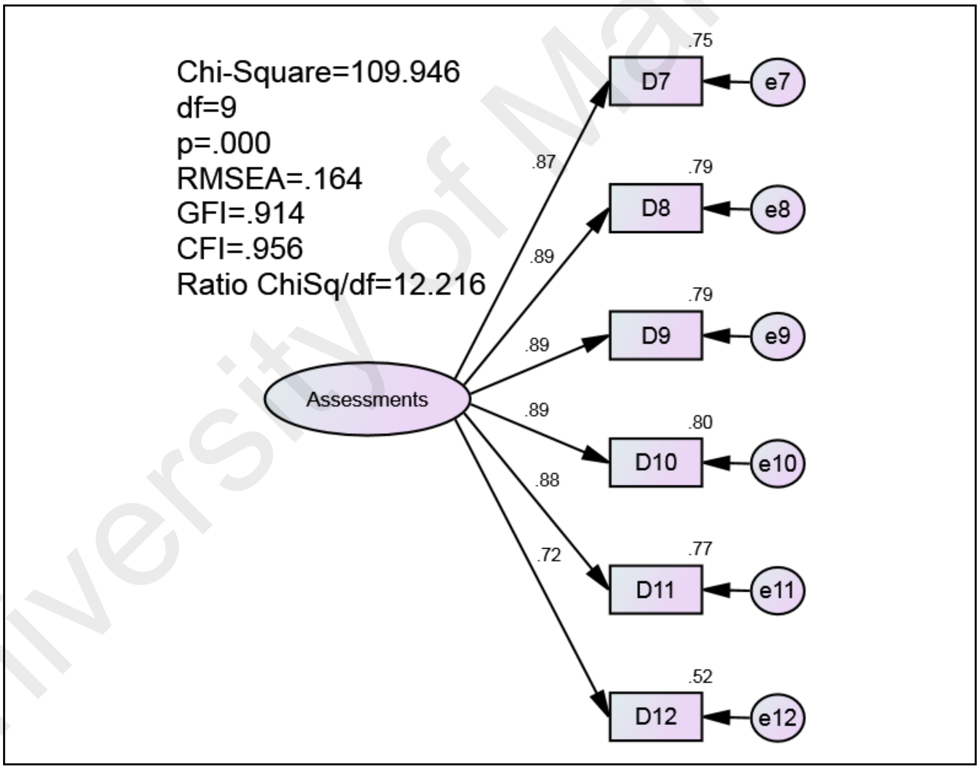
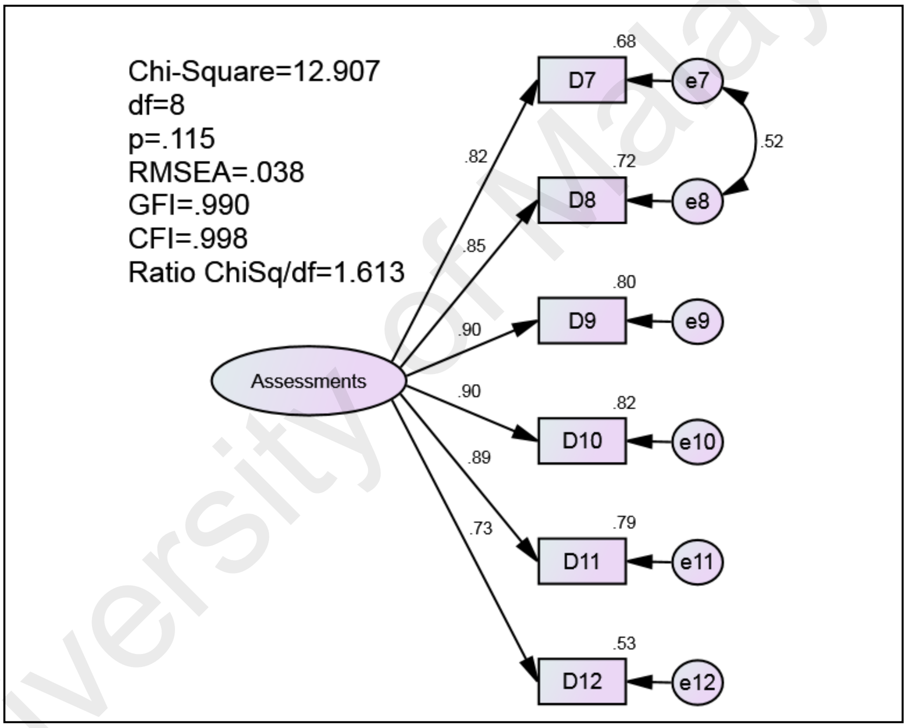


Figure 4.27: CFA model for Digital Age Learning Experience and Assessments Dimension

Based on Figure 4.27 showed above, it was found that the fitness indexes of this model do not achieve the level of fitness required for RMSEA=.164 (>.08) and Ratio Chisq/df=12.216 (>5.0). However, all the six items showed factor loadings that are greater than .50, this indicated that the unidimensionality of the digital age learning experience and assessments construct have been achieved and no item needs to be dropped from this model. Subsequently, based on the suggestion of the modification indices, the researcher found that two of the



measurement errors need to be set as “free parameter” to improve the fitness of the model. The measurement errors that need to be correlated are e7 with e8 (M.I.=83.226, Par Change=.228). After these measurement errors have been set as “free parameter”, the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is displayed in Figure 4.28.

Figure 4.28: Re-specified CFA model for Digital Age Learning Experience and Assessments Dimension

Based on the re-specified CFA model for digital age learning experience and assessments showed in Figure 4.28, it was found that all the fitness indexes [RMSEA=.038 (<.08), GFI=.990 (>.90), CFI=.998 (>.90), and Chisq/df=1.613 (<5.0)] have achieved the required level according to Table 3.13. This indicated that the re-specified model for digital age learning experience and assessments dimension achieved construct validity. The results of the CFA analysis are presented in Table 4.32.

Table 4.32: CFA result of the Re-specified Model for Digital Age Learning Experience and Assessments Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
D7	<---	Assessments	1.000				.824	.680
D8	<---	Assessments	1.011	.033	30.573	***	.851	.725
D9	<---	Assessments	1.083	.047	22.949	***	.895	.802
D10	<---	Assessments	1.036	.045	23.288	***	.904	.817
D11	<---	Assessments	1.118	.049	22.749	***	.890	.793
D12	<---	Assessments	.908	.054	16.816	***	.726	.528

*** Correlation is significant at the 0.001 level

The result in Table 4.32 showed that the convergent validity of this re-specified model for digital age learning experience and assessments dimension is achieved because all items are statistically significant and have factor loadings between .726-.904 which are greater than .50.

After the construct validity and convergent validity for digital age learning experience and assessments dimension have been established, the researcher performed the inter-item correlation analysis to determine the discriminant validity for this latent construct. The results of the inter-item correlation analysis are presented in Table 4.33.

Table 4.33: Correlation Coefficient (r value) between each of the Items in Digital Age Learning Experience and Assessments Dimension

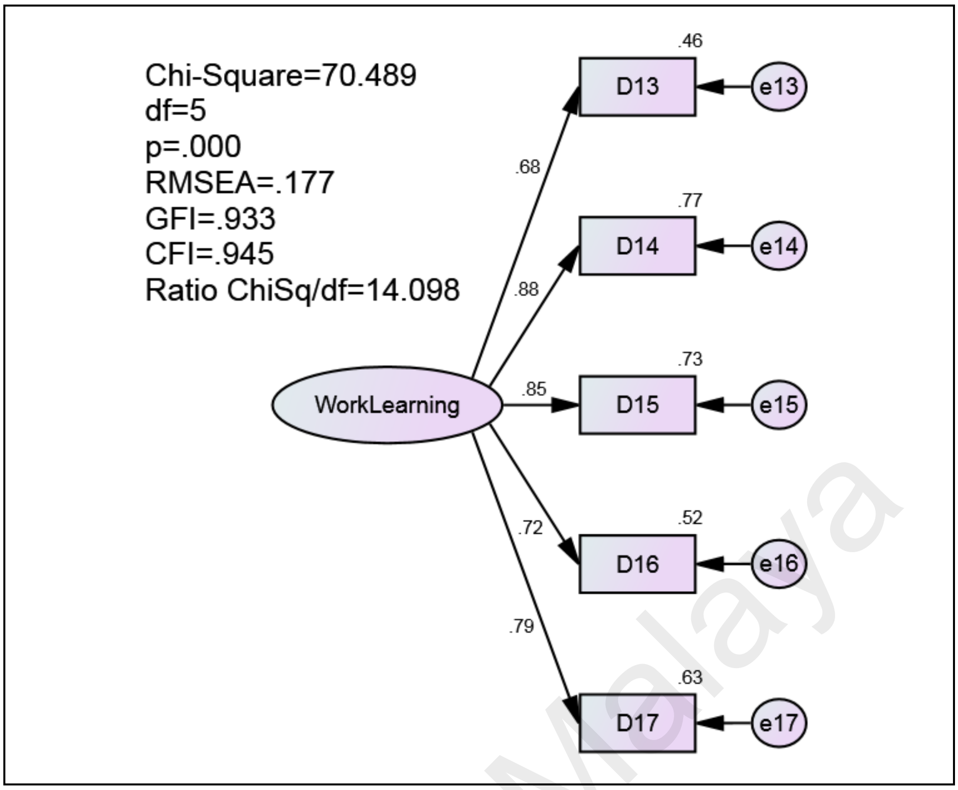
Path			**Estimate**	**S.E.**	**C.R.**	**p**	**r**
D7	<-->	D8	1.593	.120	13.256	***	.855
D7	<-->	D9	1.416	.116	12.197	***	.746
D7	<-->	D10	1.343	.110	12.202	***	.747
D7	<-->	D11	1.415	.119	11.896	***	.718
D7	<-->	D12	1.207	.113	10.690	***	.615
D8	<-->	D9	1.438	.115	12.487	***	.774
D8	<-->	D10	1.363	.109	12.481	***	.774
D8	<-->	D11	1.441	.118	12.210	***	.747
D8	<-->	D12	1.149	.110	10.472	***	.598
D9	<-->	D10	1.444	.113	12.788	***	.805
D9	<-->	D11	1.575	.123	12.760	***	.802
D9	<-->	D12	1.224	.113	10.816	***	.626
D10	<-->	D11	1.497	.117	12.775	***	.803
D10	<-->	D12	1.232	.109	11.285	***	.664
D11	<-->	D12	1.358	.120	11.337	***	.669

*** Correlation is significant at the 0.001 level

Based on the inter-item correlation analysis showed in Table 4.33. it was found that all the six items in the digital age learning experience and assessments dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring digital age learning experience and assessments (latent construct) with the range of the correlation coefficients, r between .598-.855. These r values that represented the correlation coefficients among each of the indicators in the digital age learning experience and assessments dimension are less than .90. Thus, the discriminant validity of all the items in measuring digital age learning experience and assessments is achieved. Hence, it can be concluded that all the indicators in measuring digital age learning experience and assessments do not have significant multicollinearity problem.

(iii) Dimension 3: Digital Age Work and Learning

The third dimension – digital age work and learning dimension comprised five items as the observed indicators. The CFA for this dimension is displayed in Figure 4.29.



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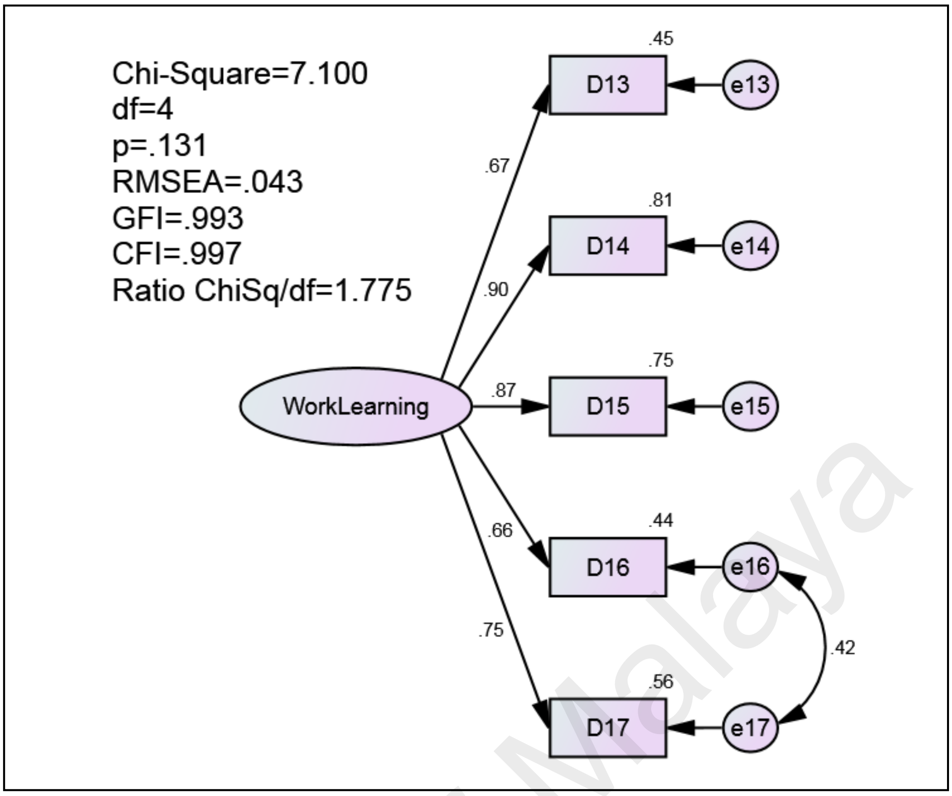
igure 4.29: CFA model for Digital Age Work and Learning Dimension

Based on Figure 4.29 showed above, it was found that the fitness indexes of this model do not achieve the level of fitness required for RMSEA=.177 (>.08) and Ratio Chisq/df=14.098 (>5.0). However, all the five items have factor loadings greater than .50. This meant that the unidimensionality of the digital age work and learning construct have been achieved and no item needs to be dropped from this model. Subsequently, based on the suggestion of the modification indices, the researcher found that two of the measurement errors need to be set as “free parameter” to improve the fitness of the model. The measurement errors that need to be correlated are e16 with e17 (M.I.=54.745, Par Change=.341). After these measurement errors have been set as “free parameter”, the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.30.



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igure 4.30: Re-specified CFA model for Digital Age Work and Learning Dimension

Based on this re-specified model for digital age work and learning dimension showed in Figure 4.30, it was found that all the fitness indexes [RMSEA=.043 (<.08), GFI=.993 (>.90), CFI=.997 (>.90), and Chisq/df=1.775 (<5.0)] have achieved the required level (Refer Table 3.13). This indicated that the re-specified model for digital age work and learning dimension achieved construct validity. The CFA yield results as shown in Table 4.34.

Table 4.34: CFA result of the Re-specified Model for Digital Age Work and Learning Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
D13	<---	WorkLearning	1.000				.672	.452
D14	<---	WorkLearning	1.255	.081	15.568	***	.899	.808
D15	<---	WorkLearning	1.295	.085	15.260	***	.867	.751

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
D16	<---	WorkLearning	1.066	.088	12.153	***	.663	.440
D17	<---	WorkLearning	1.051	.078	13.546	***	.748	.560

*** Correlation is significant at the 0.001 level

Based on the result showed in Table 4.34, the convergent validity of this re-specified model for digital age work and learning dimension is achieved because all items are statistically significant and have factor loadings between .663-.899 which are greater than .50.

After the construct validity and convergent validity of the digital age work and learning dimension have been established, the researcher carried out the correlation analysis between each of these items to check on the discriminant validity for this latent construct. The results of the inter-item correlation analysis are presented in Table 4.35.

Table 4.35: Correlation Coefficient (r value) between each of the Items in Digital Age Work and Learning Dimension

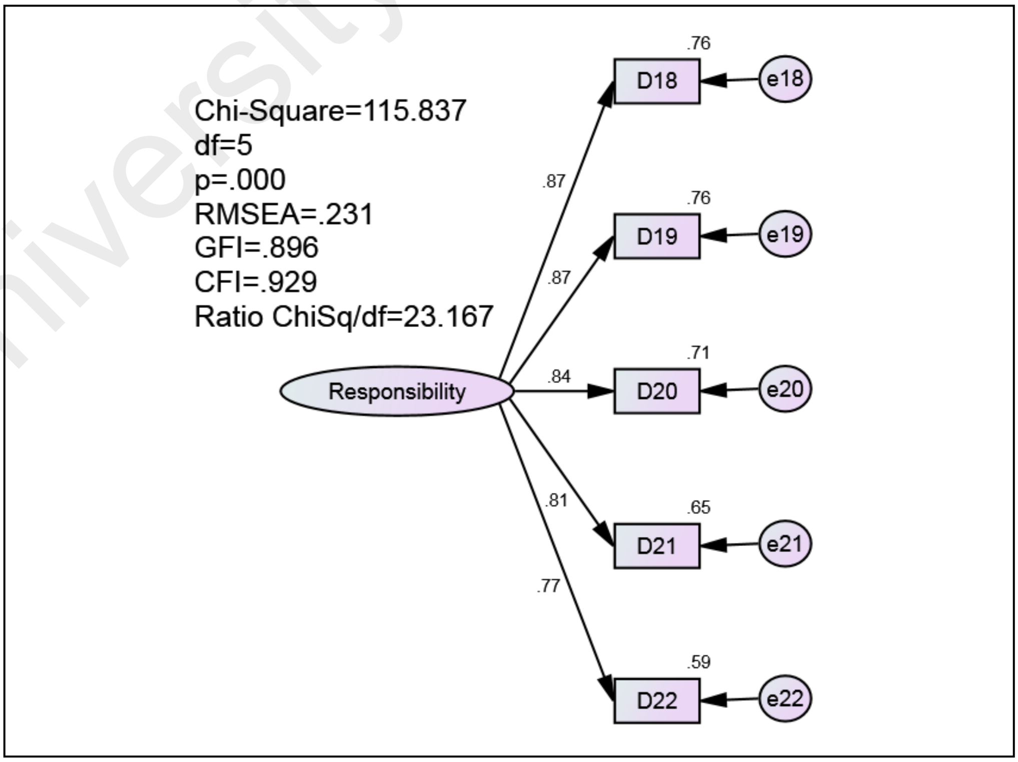
Path			Estimate	S.E.	C.R.	p	r
D13	<-->	D14	1.075	.102	10.490	***	.600
D13	<-->	D15	1.081	.108	10.017	***	.564
D13	<-->	D16	1.037	.113	9.156	***	.502
D13	<-->	D17	.974	.101	9.694	***	.540
D14	<-->	D15	1.414	.112	12.603	***	.786
D14	<-->	D16	1.130	.110	10.276	***	.583
D14	<-->	D17	1.128	.100	11.309	***	.666
D15	<-->	D16	1.186	.117	10.128	***	.572
D15	<-->	D17	1.167	.106	11.047	***	.644
D16	<-->	D17	1.376	.117	11.756	***	.705

*** Correlation is significant at the 0.001 level

Referred to Table 4.35, it was found that all the five items in the digital age work and learning dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring digital age work and learning (latent construct) with the range of the correlation coefficients, r between .502-.786. These r values that represented the correlation coefficients among each of the indicators in the digital age work and learning dimension are less than .90. Thus, the discriminant validity of all the items in measuring digital age work and learning is achieved. Hence, all the indicators in measuring digital age work and learning do not have significant multicollinearity problem.

(iv) Dimension 4: Digital Citizenship and Responsibility

The fourth dimension – digital citizenship and responsibility consisted five items as the observed indicators. The CFA for this dimension is showed in Figure 4.31.



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igure 4.31: CFA model for Digital Citizenship and Responsibility Dimension

Based on Figure 4.31, the fitness indexes of this model do not achieve the level of fitness required for RMSEA=.231 (>.08), GFI=.896 (<.90) and Ratio Chisq/df=23.167 (>5.0). However, all the five items have factor loadings greater than .50. This indicated that the unidimensionality digital citizenship and responsibility construct have been achieved and no item needs to be dropped from this model. Based on the suggestion of the modification indices, the researcher found that two of the measurement errors need to be set as "free parameter" to improve the fitness of the model. The measurement errors that need to be correlated are e21 with e22 (M.I.=94.240, Par Change=.425). After these measurement errors have been set as "free parameter", the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.32.

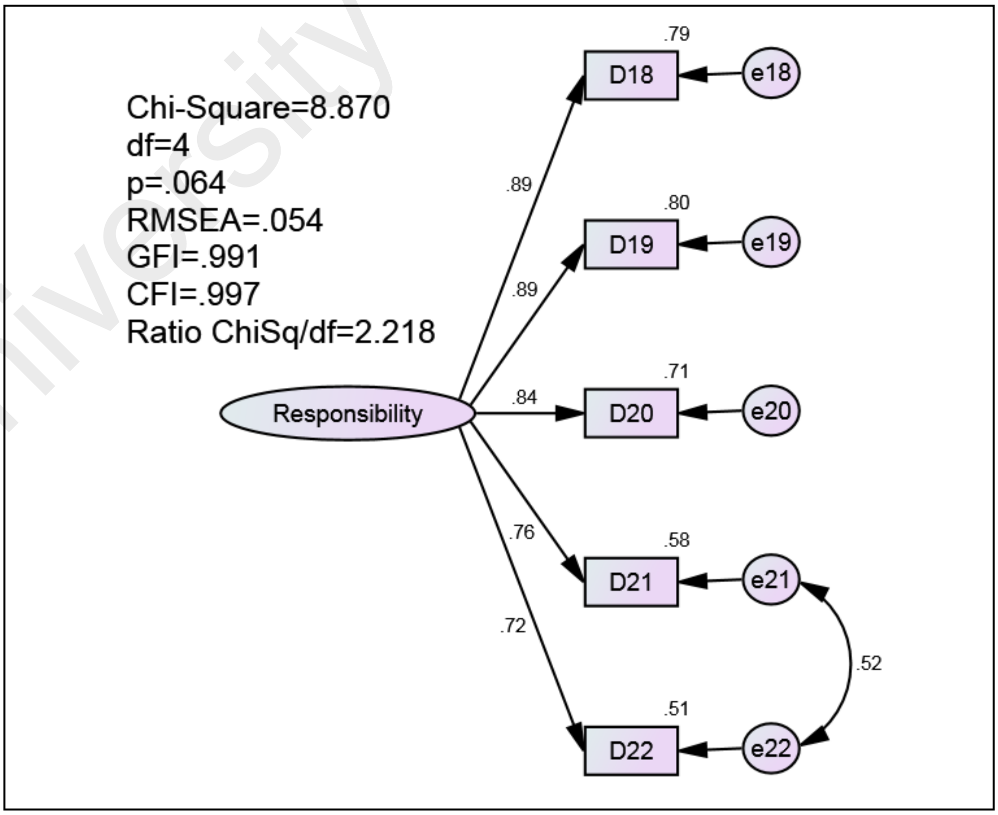


Figure 4.32: Re-specified CFA model for Digital Citizenship and Responsibility Dimension

Based on the re-specified CFA model for digital citizenship and responsibility dimension showed above (Refer Figure 4.32), all the fitness indexes [RMSEA=.054 (<.08), GFI=.991 (>.90), CFI=.997 (>.90), and Chisq/df=2.218 (<5.0)] have achieved the threshold values required according to Table 3.13. This indicated that the re-specified model for digital citizenship and responsibility dimension achieved construct validity. The results of the CFA analysis is presented in Table 4.36.

Table 4.36: CFA result of the Re-specified Model for Digital Citizenship and Responsibility Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
D18	<---	Responsibility	1.000				.888	.789
D19	<---	Responsibility	1.018	.040	25.290	***	.893	.798
D20	<---	Responsibility	1.020	.045	22.793	***	.842	.708
D21	<---	Responsibility	.928	.048	19.188	***	.763	.581
D22	<---	Responsibility	.868	.050	17.354	***	.716	.513

*** Correlation is significant at the 0.001 level

Based on the CFA result showed in Table 4.36, the convergent validity of this re-specified model for digital citizenship and responsibility dimension is achieved because all items are statistically significant and have factor loadings between .716-.893 which are greater than .50.

After the construct validity and convergent validity for digital citizenship and responsibility dimension have been established, the researcher performed the inter-item correlation analysis to check on the discriminant validity for this latent construct. The results of the inter-item correlation analysis are presented in Table 4.37.

Table 4.37: Correlation Coefficient (r value) between each of the Items in Digital Citizenship and Responsibility Dimension

Path			Estimate	S.E.	C.R.	p	r
D18	<-->	D19	1.473	.115	12.784	***	.804
D18	<-->	D20	1.430	.118	12.073	***	.734
D18	<-->	D21	1.315	.115	11.389	***	.673
D18	<-->	D22	1.221	.113	10.839	***	.627
D19	<-->	D20	1.473	.121	12.210	***	.747
D19	<-->	D21	1.312	.116	11.277	***	.664
D19	<-->	D22	1.232	.114	10.818	***	.626
D20	<-->	D21	1.418	.124	11.403	***	.674
D20	<-->	D22	1.335	.122	10.961	***	.637
D21	<-->	D22	1.641	.131	12.551	***	.781

*** Correlation is significant at the 0.001 level

Table 4.37 showed that all the five items in the digital citizenship and responsibility dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring digital citizenship and responsibility construct with the range of the correlation coefficients, r between .626-.804. These r values that represented the correlation coefficients among each of the indicators in the digital citizenship and responsibility dimension are less than .90. Thus, the discriminant validity of all the items in measuring digital citizenship and responsibility is achieved. Hence, all the indicators in measuring digital citizenship and responsibility do not have significant multicollinearity problem.

(v) Dimension 5: Professional Growth and Leadership

The last dimension in teacher ICT competency construct is professional growth and leadership dimension which comprised nine items as the observed indicators. The CFA for this dimension is presented in Figure 4.33.

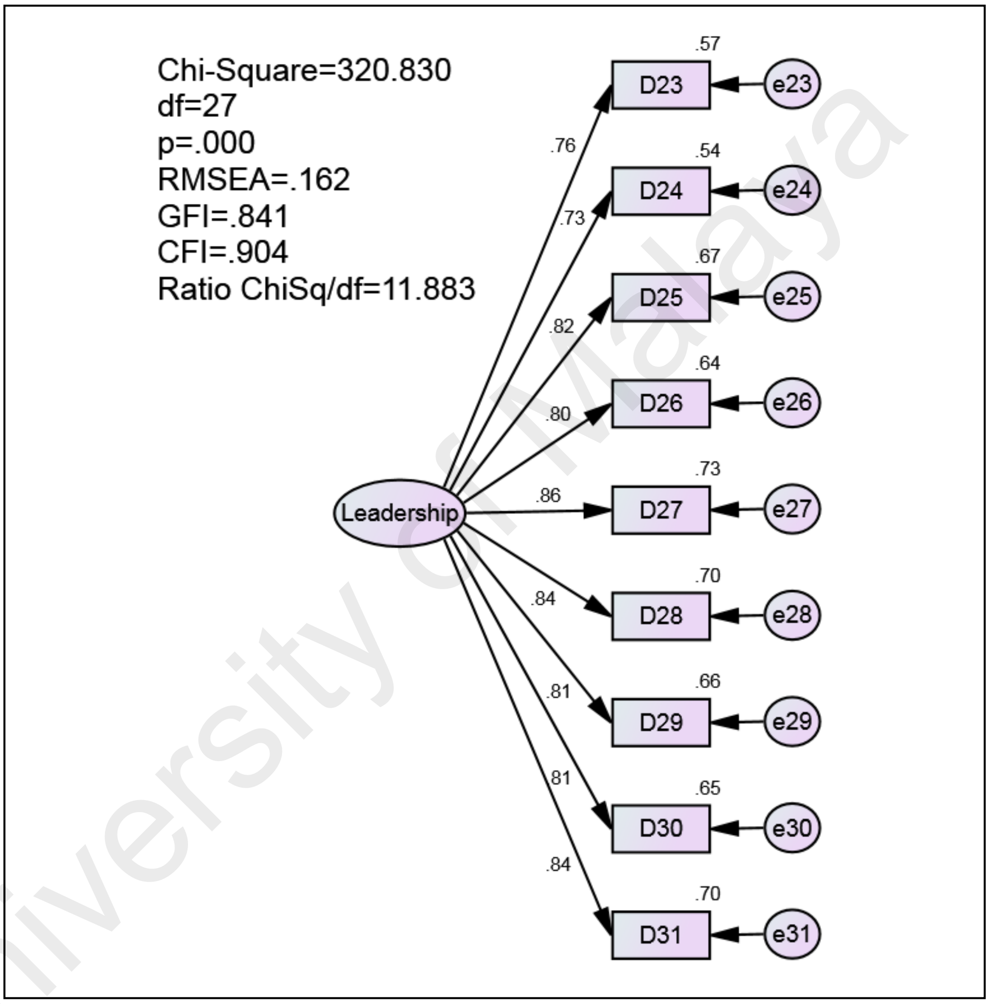


Figure 4.33: CFA model for Professional Growth and Leadership Dimension

Figure 4.33 showed that three out the four fitness indexes [RMSEA=.162 (>.08), GFI=.841 (<.90), and Ratio Chisq/df=11.883 (>5.0)] of this model do not achieve the level of fitness required. However, all the nine items have factor loadings greater than .50. This meant that the unidimensionality of the professional growth and leadership construct have been achieved and no item needs to be dropped from this model. In order to improve the fitness of the model, the researcher needs to set few of the measurement errors as "free parameter" based on the suggestion of the modification indices. The measurement errors that need to be correlated are e29 with e30 (M.I.=101.932, Par Change=.401), e23 with e24 (M.I.=56.694, Par Change=.370), e23 with e25 (M.I.=35.136, Par Change=.222), e24 with e25 (M.I.=34.383, Par Change=.232), and e24 with e26 (M.I.=11.931, Par Change=.156). After these measurement errors have been set as "free parameter", the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is displayed in Figure 4.34.

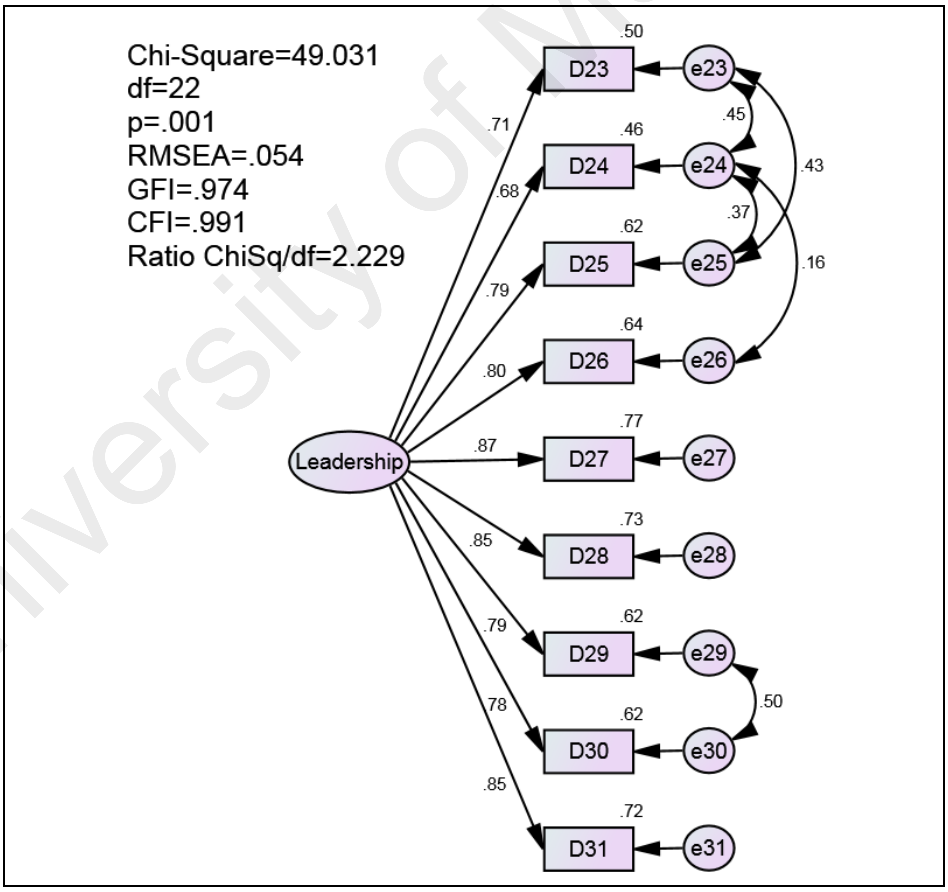


Figure 4.34: Re-specified CFA model for Professional Growth and Leadership Dimension

Based on the re-specified CFA model for professional growth and leadership dimension showed in Figure 4.34, it was found that all the fitness indexes [RMSEA=.054 (<.08), GFI=.974 (>.90), CFI=.991 (>.90), and Chisq/df=2.229 (<5.0)] have achieved the required level according to Table 3.13. This indicated that the construct validity of this re-specified model for professional growth and leadership dimension is achieved. The result of CFA analysis is presented in Table 4.38.

Table 4.38: CFA result of the Re-specified Model for Professional Growth and Leadership Dimension

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
D23	<---	Leadership	1.000				.710	.504
D24	<---	Leadership	.984	.055	17.874	***	.676	.456
D25	<---	Leadership	1.064	.052	20.450	***	.789	.623
D26	<---	Leadership	1.187	.076	15.710	***	.800	.640
D27	<---	Leadership	1.203	.070	17.139	***	.875	.765
D28	<---	Leadership	1.208	.072	16.737	***	.854	.728
D29	<---	Leadership	1.116	.072	15.477	***	.789	.622
D30	<---	Leadership	1.112	.072	15.397	***	.785	.616
D31	<---	Leadership	1.203	.072	16.613	***	.847	.717

*** Correlation is significant at the 0.001 level

Based on the CFA result showed in Table 4.38, the convergent validity of this re-specified model for professional growth and leadership dimension is achieved because all items are statistically significant and have factor loadings greater than .50 which are in the range between .676-.875.

After the construct validity and convergent validity for professional growth and leadership dimension have been established, the researcher performed the inter-item correlation analysis to determine the discriminant validity for this latent construct. The results of this analysis are presented in Table 4.39

Table 4.39: Correlation Coefficient (r value) between each of the Items in Professional Growth and Leadership Dimension

Path			Estimate	S.E.	C.R.	p	r
D23	<-->	D24	1.551	.131	11.881	***	.717
D23	<-->	D25	1.493	.122	12.213	***	.748
D23	<-->	D26	1.289	.125	10.311	***	.586
D23	<-->	D27	1.283	.118	10.865	***	.629
D23	<-->	D28	1.215	.119	10.223	***	.579
D23	<-->	D29	1.198	.118	10.117	***	.571
D23	<-->	D30	1.154	.118	9.819	***	.549
D23	<-->	D31	1.271	.121	10.542	***	.604
D24	<-->	D25	1.453	.124	11.719	***	.702
D24	<-->	D26	1.420	.132	10.783	***	.623
D24	<-->	D27	1.219	.120	10.189	***	.577
D24	<-->	D28	1.204	.122	9.879	***	.554
D24	<-->	D29	1.189	.121	9.790	***	.547
D24	<-->	D30	1.215	.122	9.936	***	.558
D24	<-->	D31	1.252	.123	10.155	***	.574
D25	<-->	D26	1.387	.124	11.228	***	.659
D25	<-->	D27	1.351	.116	11.613	***	.693
D25	<-->	D28	1.369	.119	11.496	***	.682
D25	<-->	D29	1.227	.115	10.644	***	.612
D25	<-->	D30	1.202	.115	10.470	***	.598
D25	<-->	D31	1.311	.118	11.129	***	.651
D26	<-->	D27	1.587	.131	12.120	***	.739
D26	<-->	D28	1.445	.129	11.160	***	.654
D26	<-->	D29	1.343	.127	10.598	***	.608
D26	<-->	D30	1.382	.128	10.800	***	.624
D26	<-->	D31	1.444	.130	11.133	***	.651
D27	<-->	D28	1.513	.125	12.119	***	.739
D27	<-->	D29	1.371	.121	11.347	***	.670
D27	<-->	D30	1.370	.121	11.328	***	.668
D27	<-->	D31	1.513	.125	12.093	***	.736
D28	<-->	D29	1.497	.127	11.814	***	.711
D28	<-->	D30	1.420	.125	11.386	***	.673
D28	<-->	D31	1.560	.129	12.111	***	.738
D29	<-->	D30	1.705	.133	12.821	***	.808

Path			Estimate	S.E.	C.R.	p	r
D29	<-->	D31	1.423	.125	11.394	***	.674
D30	<-->	D31	1.481	.127	11.690	***	.699

*** Correlation is significant at the 0.001 level

Table 4.39 showed that all the nine items in the professional growth and leadership dimension are statistically significant and have acceptable correlation coefficient among each of their respective indicators in measuring professional growth and leadership (latent construct) with the range of the correlation coefficients, r between .547-.808. It was found that these r values that represented the correlation coefficients among each of the indicators in the professional growth and leadership dimension are less than .90. Thus, the discriminant validity of all the items in measuring professional growth and leadership is achieved. Hence, all the indicators in measuring professional growth and leadership do not have significant multicollinearity problem.

Based on the analysis of the five measurement models of teacher ICT competency that have been performed above, it can be concluded that all the five measurement models according to each dimension of teacher ICT competency have achieved construct validity, convergent validity, and discriminant validity.

In conclusion, based on the CFA and the inter-item correlation analysis for each of the measurement models that have been presented above, the researcher found that all the items in the developed instrument have reasonable and acceptable factor loadings and coefficient correlations (r values). Hence, the researcher concluded that the construct validity in terms of convergent and discriminant validity of the developed instrument have been achieved.

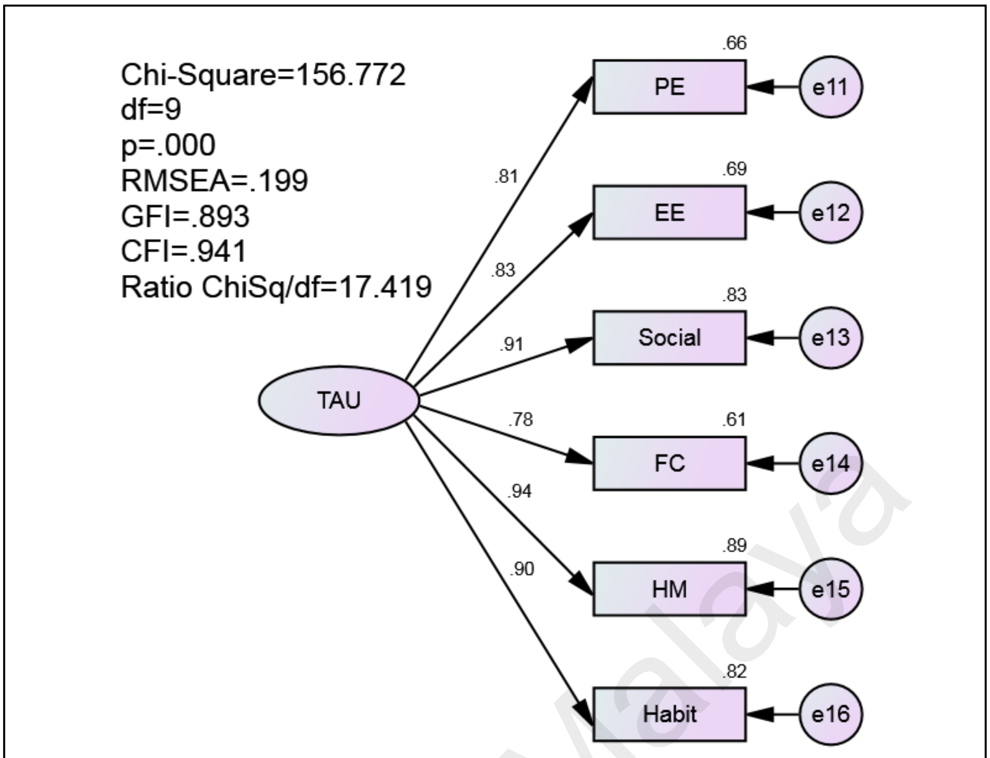
4.3.4.2 Validity of the Measurement Models

The validation of the measurement models for each of the dimensions for all the variables used in this study has been conducted in the previous section. In this section, the researcher used the computed mean for each of the dimensions as the collapsed items to run CFA for the measurement models because there are too many items and dimensions involved in measuring one construct (Zainudin Awang, 2014). In the first section, the researcher carried out the validation of the measurement models which involved the relationship between each of the collapsed items (dimensions' mean) in measuring the three latent concepts (teacher acceptance and use of SMS, principal technology leadership practices, and teacher ICT competency) in this study. After that, the reliability of the measurement models would be determined in term of internal reliability and composite reliability. The internal reliability is achieved when the Cronbach's Alpha coefficient is greater than .70 (Fraenkel et al., 2011; Johnson & Christensen, 2008; Muijs, 2011) and the composite reliability (CR) is achieved when the value of CR is greater than or equal to .50 (Zainudin Awang, 2014).

The confirmatory factor analysis (CFA) is used to assess the convergent validity of the measurement models. This validity is achieved when all the collapsed items in a measurement model are statistically significant and factor loading of .50 or above for an indicator is often a standard to use (Creswell, 2014). Additionally, the convergent validity could also be verified by computing the Average Variance Extracted (AVE) for every construct, where the value of AVE should be .50 or higher to achieve the convergent validity (Hair et al., 2010; Zainudin Awang, 2014). The discriminant validity is assessed through the correlation between the two collapsed items under the same construct and if the correlation coefficient is less than .90 this shows that the collapsed items do not have significant multicollinearity problem (Hair et al., 2010; Pallant, 2013). Finally, the overall construct validity is achieved when the Fitness Indexes for a construct achieved the required level as shown in Table 3.13 (Hair et al., 2010).

(a) ***Teacher Acceptance and Use of SMS (Endogenous Variable)***

Teacher acceptance and use of SMS is a latent construct measured by six dimensions which are (i) Performance Expectancy (PE); (ii) Effort Expectancy (EE); (iii) Social Influence (Social); (iv) Facilitating Condition (FC); (v) Hedonic Motivation (HM); and (iv) Habit (Habit). Based on the means of these six dimensions of teacher acceptance and use of SMS as the collapsed items, a CFA for teacher acceptance and use of SMS was run to assess the construct, convergent and discriminant validity of this latent construct. The CFA model for this construct is showed in Figure 4.35.

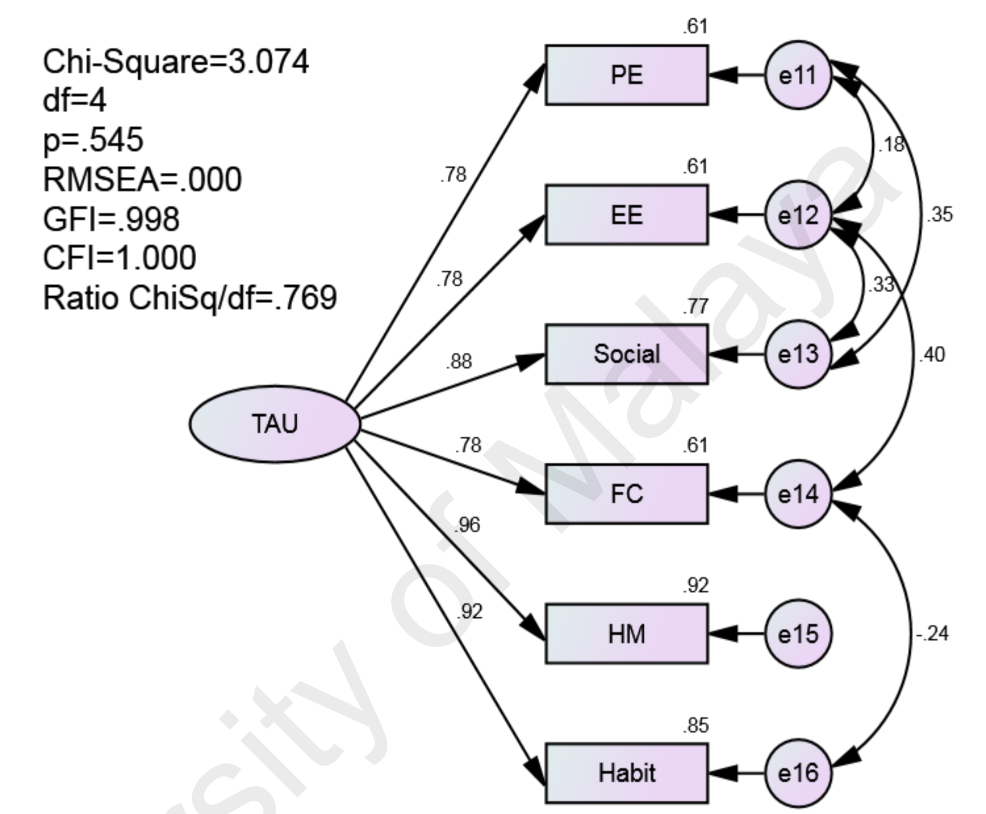


Note: TAU=Teacher acceptance and use of SMS

Figure 4.35: CFA model for teacher acceptance and use of SMS

Based on Figure 4.35, the fitness indexes of this model do not achieve the level of fitness required for RMSEA=.199 (>.08), GFI=.893 (<.90), and Ratio Chisq/df=17.419 (>5.0). However, all the six collapsed items of teacher acceptance and use of SMS displayed factor loadings greater than .50. This meant that the unidimensionality of the teacher acceptance and use of SMS construct have been achieved and no item needs to be dropped from this model. Thus, based on the suggestion of the modification indices, the researcher found that few of the measurement errors need to be set as "free parameter" to improve the fitness of the model. The measurement errors that need to be correlated are e12 with e14 (M.I.=57.394, Par Change=.271), e11 with e13 (M.I.=26.514, Par Change=.151), e12with e13 (M.I.=28.558, Par Change=.138), e14 with e16 (M.I.=13.923, Par Change=-.112), and e11 with e12 (M.I.=10.883, Par

Change=.111). After these measurement errors have been set as “free parameter”, the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.36.



Note: TAU=Teacher acceptance and use of SMS

Figure 4.36: Re-specified CFA model for teacher acceptance and use of SMS

Based on the re-specified CFA model for teacher acceptance and use of SMS showed in Figure 4.36, it was found that all the fitness indexes [RMSEA=.000 (<.08), GFI=.998 (>.90), CFI=1.000 (>.90), and Chisq/df=.769 (<5.0)] have achieved the threshold values (Refer Table 3.13). This indicated that the re-specified model for teacher acceptance and use of SMS has achieved construct validity. The CFA yield results as shown in Table 4.40.

Table 4.40: CFA result of the Re-specified Model for Teacher acceptance and use of SMS

	Path		**Estimate**	**S.E.**	**C.R.**	**p**	**Factor Loading**	**R^2**
PE	<---	TAU	1.000				.783	.613
EE	<---	TAU	.972	.050	19.521	***	.782	.612
Social	<---	TAU	1.068	.042	25.275	***	.879	.772
FC	<---	TAU	.893	.051	17.570	***	.781	.610
HM	<---	TAU	1.238	.053	23.278	***	.962	.925
Habit	<---	TAU	1.341	.061	21.927	***	.919	.845

*** Correlation is significant at the 0.001 level

Based on the result showed on Table 4.40, the convergent validity of this re-specified model for teacher acceptance and use of SMS is achieved because all items are statistically significant and have factor loadings between .781-.962 which are greater than .50. This indicated that all these six dimensions are measuring on the latent construct of teacher acceptance and use of SMS.

After the construct validity and convergent validity for teacher acceptance and use of SMS have been established, the researcher performed the inter-item correlation analysis to check on the discriminant validity for this latent construct. The results of the inter-item correlation analysis are presented in Figure 4.37.

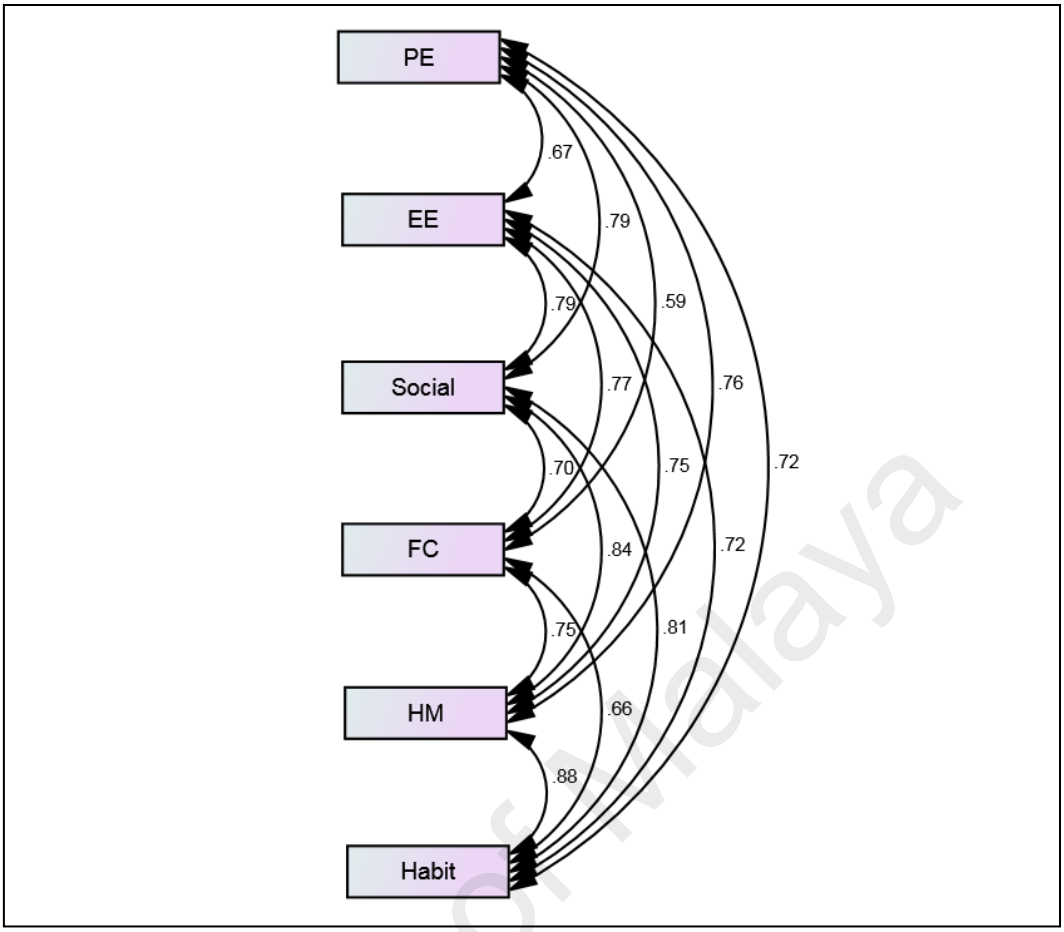
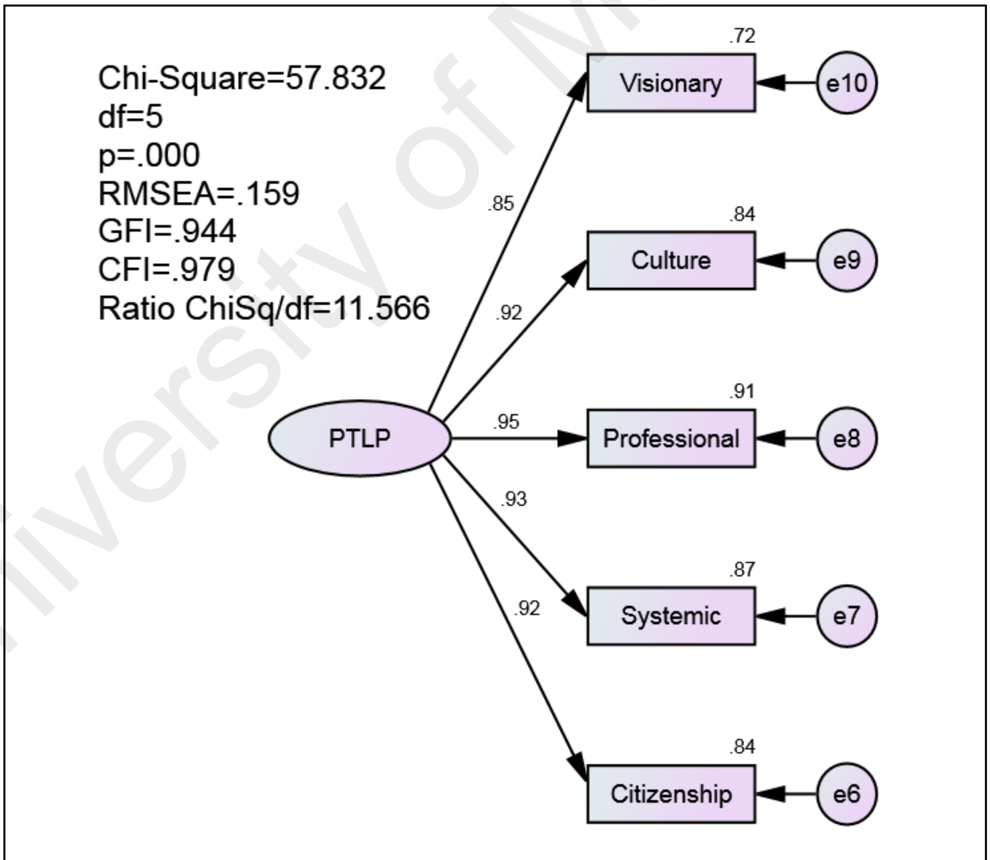


Figure 4.37: Covariance between the collapsed items in the measurement model for teacher acceptance and use of SMS

Figure 4.37 showed that all the six collapsed items (dimensions) in measuring teacher acceptance and use of SMS are statistically significant and have acceptable correlation coefficient among each of their respective dimensions with the range of the correlation coefficients between .59-.88. These r values that represented the correlation coefficients among each of the collapsed items (dimensions) in measuring teacher acceptance and use of SMS are less than .90. Thus, the discriminant validity of the measurement model on teacher acceptance and use of SMS is achieved. Hence, all the dimensions in measuring teacher acceptance and use of SMS do not have significant multicollinearity problem.

(b) ***Principal Technology Leadership Practices (Exogenous Variable)***

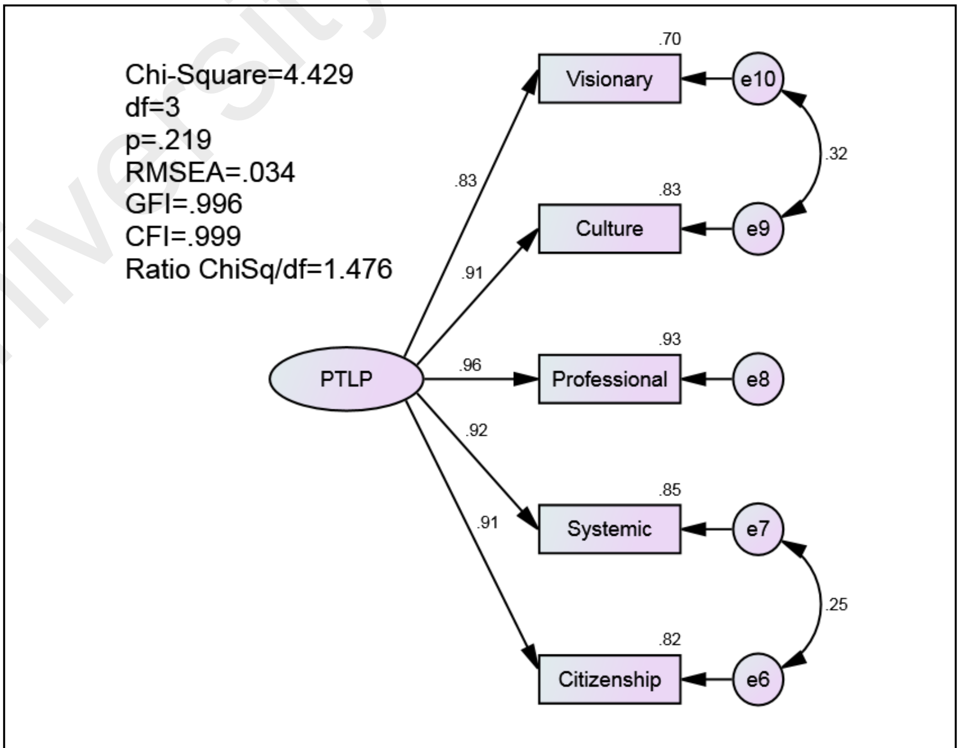
Principal technology leadership practice is a latent construct measured by five dimensions which are (i) Visionary leadership (visionary); (ii) Digital age learning culture (culture); (iii) Excellence in professional practice (professional); (iv) Systemic improvement (systemic), and (v) Digital citizenship (citizenship). Based on the means of these five dimensions of principal technology leadership practices as the collapsed items, a CFA for principal technology leadership practices was run to assess the construct, convergent and discriminant validity of this latent construct. The CFA model for this construct is showed in Figure 4.38.



Note: PTLP = Principal technology leadership practices

Figure 4.38: CFA model for principal technology leadership practices

Based on Figure 4.38, the researcher found that the fitness indexes of this model do not achieve the level of fitness required for RMSEA=.159 (>.08), and Ratio Chisq/df=11.566 (>5.0). However, all the five collapsed items of principal technology leadership practices displayed factor loadings greater than .50. This meant that the unidimensionality of the principal technology leadership practices construct have been achieved and no item needs to be dropped from this model. Thus, based on the suggestion of the modification indices, the researcher found that few of the measurement errors need to be set as "free parameter" to improve the fitness of the model. The measurement errors that need to be correlated are e9 with e10 (M.I.=37.231, Par Change=.129), and e6 with e7 (M.I.=7.976, Par Change=.043). After these measurement errors have been set as "free parameter", the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.39.



Note: PTLP = Principal technology leadership practices

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igure 4.39: Re-specified CFA model for principal technology leadership practices

Based on the re-specified CFA model for principal technology leadership practices showed in Figure 4.39, it was found that all the fitness indexes [RMSEA=.034 (<.08), GFI=.996 (>.90), CFI=.999 (>.90), and Chisq/df=1.476 (<5.0)] have achieved the threshold values (Refer Table 3.13). This indicated that the re-specified model for principal technology leadership practices has achieved construct validity. The CFA yield results as shown in Table 4.41.

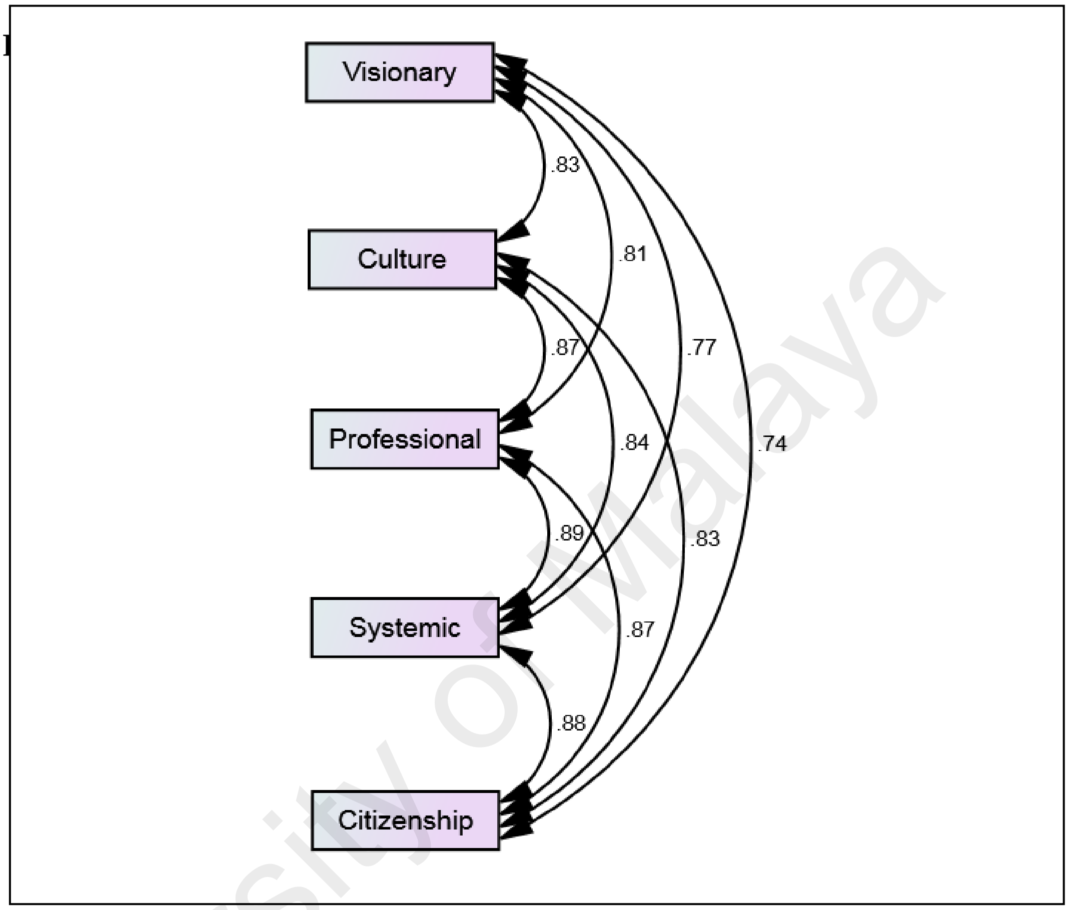
Table 4.41: CFA result of the Re-specified Model for Principal technology leadership practices

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
Visionary	<---	PTLP	1.000				.835	.697
Culture	<---	PTLP	1.106	.037	29.605	***	.908	.825
Professional	<---	PTLP	1.162	.043	27.298	***	.963	.927
Systemic	<---	PTLP	1.130	.045	25.306	***	.923	.851
Citizenship	<---	PTLP	1.127	.046	24.545	***	.908	.824

*** Correlation is significant at the 0.001 level

Based on the CFA result of the re-specified model for principal technology leadership practices showed on Table 4.40, the convergent validity is achieved because all items are statistically significant and have factor loadings between .835 - .963 which are greater than .50. This indicated that all these five dimensions are measuring on the latent construct of principal technology leadership practices.

After the construct validity and convergent validity for principal technology leadership practices have been established, the researcher carried out the inter-item correlation analysis to determine the discriminant validity for this latent construct. The results of the inter-item correlation analysis are presented in Figure 4.40.

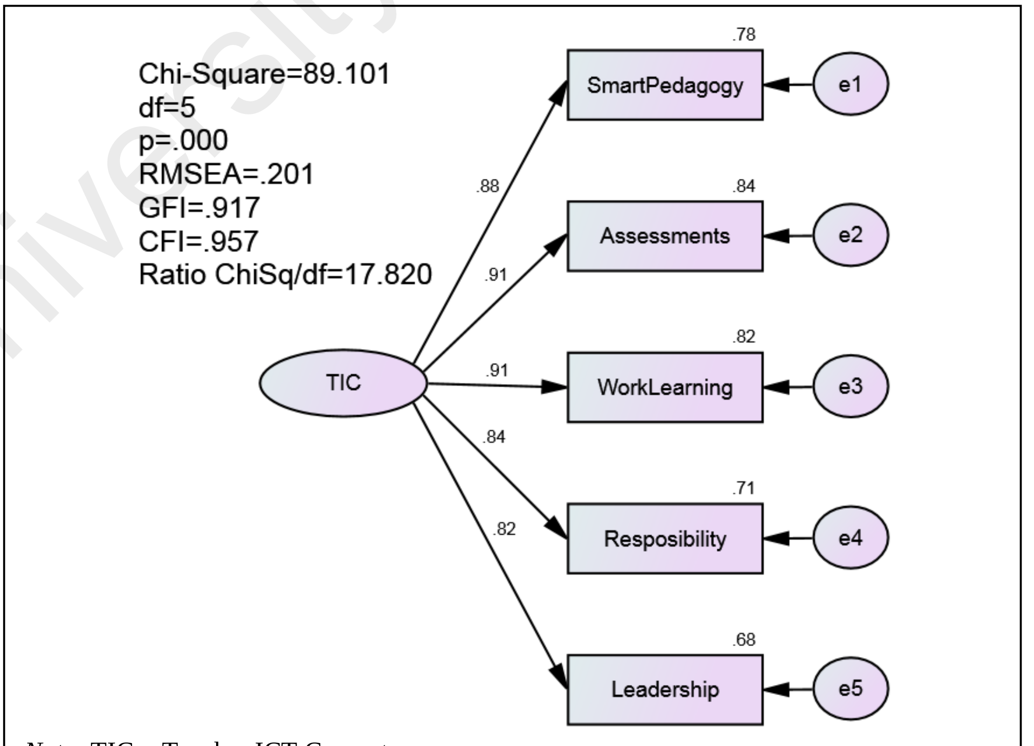


b
etween the collapsed items in the measurement model for principal technology leadership practices

Based on the results of analysis and Figure 4.40, the researcher noticed that all the five collapsed items (dimensions) in measuring principal technology leadership practices are statistically significant and have acceptable correlation coefficient among each of their respective dimensions with the range of the correlation coefficients between .74-.89. These r values that represented the correlation coefficients among each of the collapsed items (dimensions) in measuring principal technology leadership practices are less than .90. Thus, the discriminant validity of the measurement model on principal technology leadership practices is achieved. Hence, all the dimensions in measuring principal technology leadership practices do not have significant multicollinearity problem.

(c) ***Teacher ICT Competency (Mediating Variable)***

Teacher ICT competency is a latent construct measured by five dimensions which are (i) Smart Pedagogy (Smartpedagogy); (ii) Digital age learning experiences and assessments (Assessments); (iii) Digital age work and learning (Worklearning); (iv) Digital citizenship and responsibility (Responsibility); and (v) Professional growth and leadership (Leadership). Based on the means of these five dimensions of teacher ICT competency as the collapsed items, a CFA for teacher ICT competency was run to assess the construct, convergent and discriminant validity of this latent construct. The CFA model for this construct is showed in Figure 4.41.

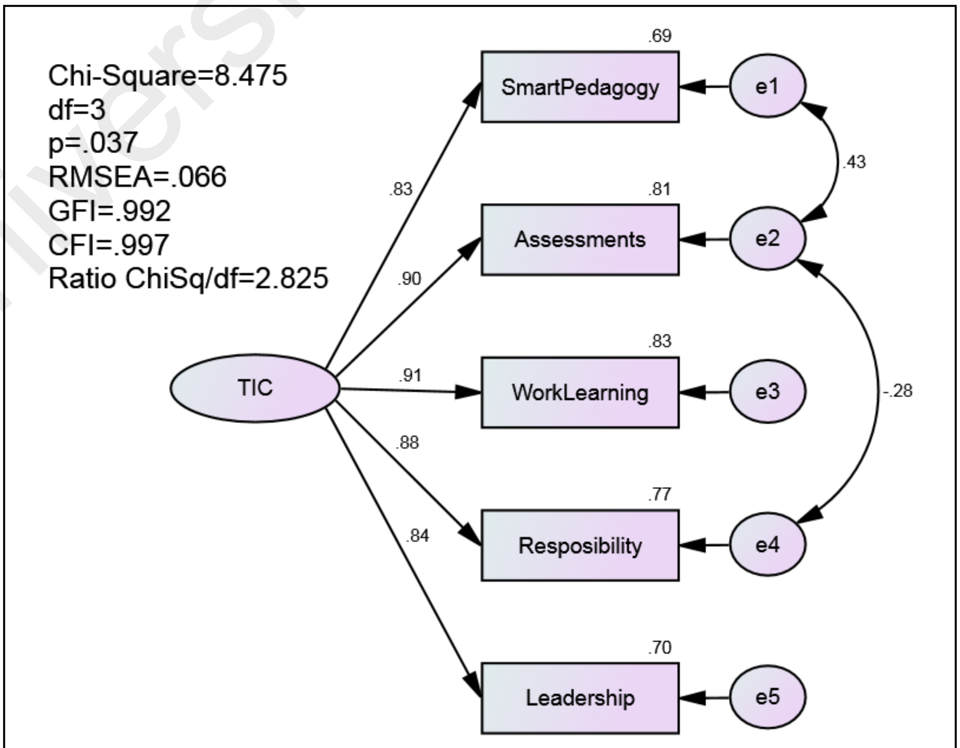


Note: TIC = Teacher ICT Competency

F

igure 4.41: CFA model for teacher ICT competency

Based on Figure 4.41, the researcher found that the fitness indexes of this model do not achieve the level of fitness required for RMSEA=.201 (>.08), and Ratio Chisq/df=17.820 (>5.0). However, all the five collapsed items of teacher ICT competency displayed factor loadings above .50. This indicated that the unidimensionality of the teacher ICT competency construct have been achieved and no item needs to be dropped from this model. Subsequently, based on the suggestion of the modification indices, the researcher found that few of the measurement errors need to be set as "free parameter" to improve the fitness of the model. The measurement errors that need to be correlated are e1 with e2 (M.I.=42.948, Par Change=.110), and e2 with e4 (M.I.=12.115, Par Change=-.063). After these measurement errors have been set as "free parameter", the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.42.



Note: TIC = Teacher ICT Competency

Figure 4.42: Re-specified CFA model for teacher ICT competency

Based on the re-specified CFA model for teacher ICT competency showed in Figure 4.42, it was found that all the fitness indexes [RMSEA=.066 (<.08), GFI=.992 (>.90), CFI=.997 (>.90), and Chisq/df=2.825 (<5.0)] have achieved the required level according to Table 3.13. This indicated that the re-specified model for teacher ICT competency has achieved construct validity. The results of the CFA is presented in Table 4.42.

Table 4.42: CFA result of the Re-specified Model for Teacher ICT competency

Path			Estimate	S.E.	C.R.	p	Factor Loading	R^2
SmartPedagogy	<---	TIC	1.000				.833	.695
Assessments	<---	TIC	1.098	.036	30.416	***	.898	.806
WorkLearning	<---	TIC	1.054	.044	23.790	***	.912	.832
Responsibility	<---	TIC	1.091	.049	22.341	***	.879	.772
Leadership	<---	TIC	1.021	.049	20.840	***	.837	.701

*** Correlation is significant at the 0.001 level

Based on the CFA result of the re-specified model for teacher ICT competency showed on Table 4.42, the convergent validity is achieved because all items are statistically significant and have factor loadings between .833-.912 which are greater than .50. This indicated that all these five dimensions are measuring on the latent construct of teacher ICT competency.

After the construct validity and convergent validity for teacher ICT competency have been established, the researcher carried out the inter-item correlation analysis to check on the discriminant validity for this latent construct. The results of the inter-item correlation analysis are displayed in Figure 4.43.

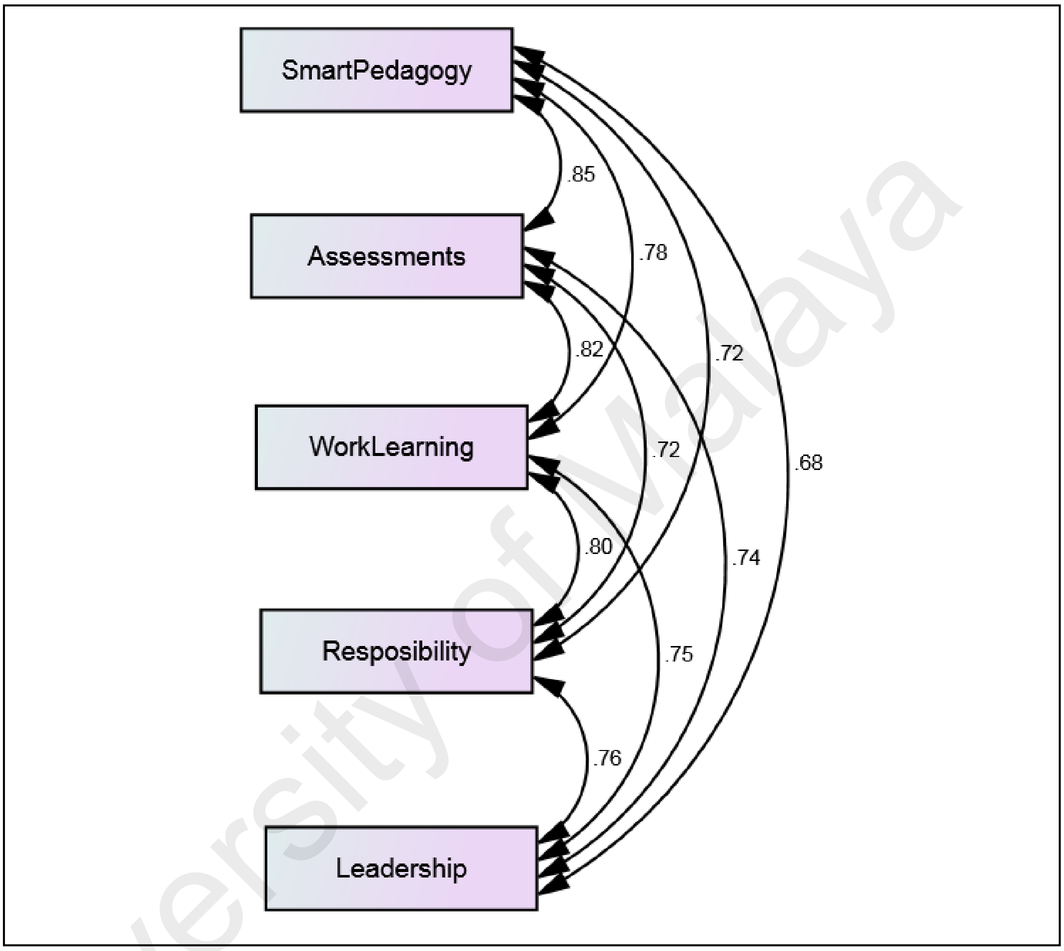


Figure 4.43: Covariance between the collapsed items in the measurement model for teacher ICT competency

Based on the results of the inter-item correlation analysis displayed in Figure 4.43, the researcher found that all the five collapsed items (dimensions) in measuring teacher ICT competency are statistically significant and have acceptable correlation coefficient among each of their respective dimensions with the range of the correlation coefficients between .68-.85. These r values that represented the correlation coefficients among each of the collapsed items (dimensions) in measuring teacher ICT competency are less than .90. Thus, the discriminant validity of the measurement model on teacher ICT competency is achieved. Hence, all the dimensions in measuring teacher ICT competency do not have significant multicollinearity problem.

Based on the CFA and the inter-item correlation analysis that have been conducted above, the researcher found that the construct, convergent and discriminant validity of the three measurement models are achieved. After the measurements models for all the three main variables used in this study have been validated, the reliability of the measurement models is determined. Table 4.43 is the results of validity and reliability of the three constructs in this study.

Table 4.43: The Validity and Reliability of the Three Measurement Models (construct)

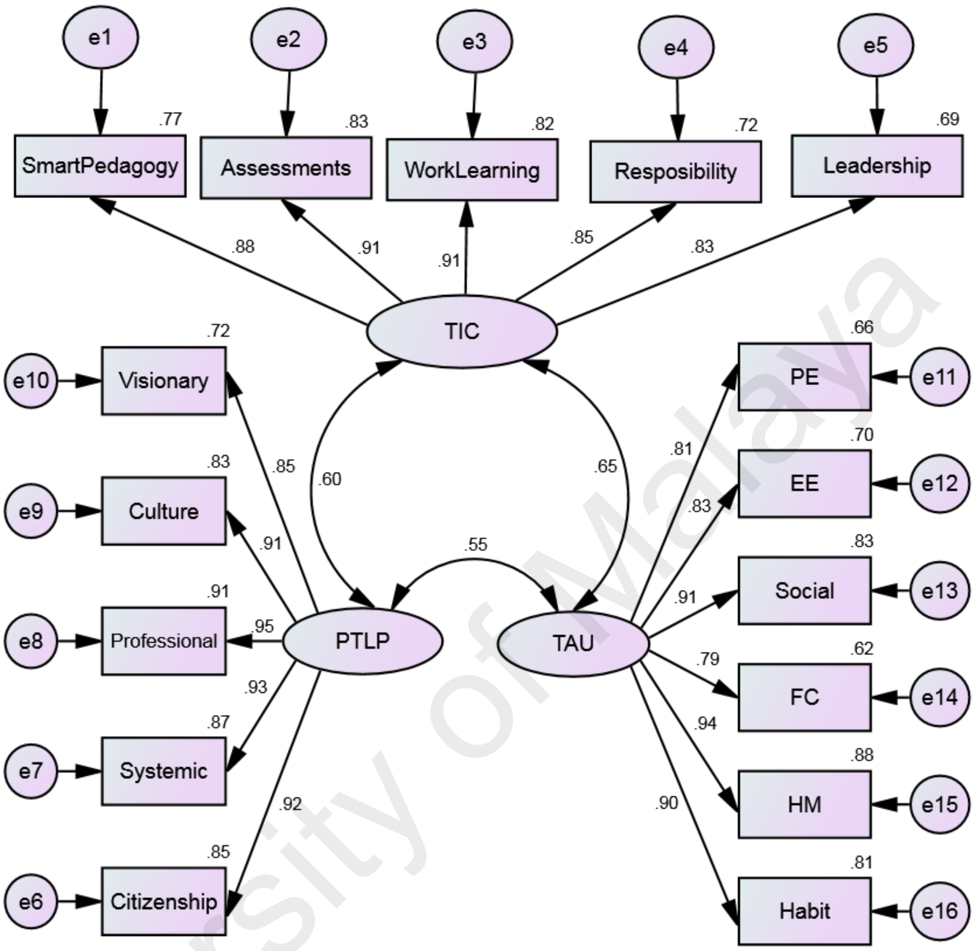
Construct	**Collapsed Item**	**Validity**		**Reliability**	
		Factor Loading (β)	**AVE**	**Cronbach Alpha (α)**	**Cumulative Reliability (CR)**
Teacher acceptance and use of SMS (TAU)	PE	.78	.73	.95	.94
	EE	.78		.95	
	Social	.88		.90	
	FC	.78		.89	
	HM	.96		.95	
	Habit	.92		.95	
Principal technology leadership practices (PTLP)	Visionary	.83	.84	.93	.90
	Culture	.91		.94	
	Professional	.96		.95	
	Systemic	.92		.92	
	Citizenship	.91		.96	
Teacher ICT competency (TIC)	SmartPedagogy	.83	.76	.93	.96
	Assessments	.90		.94	
	WorkLearning	.91		.89	
	Responsibility	.88		.92	
	Leadership	.84		.94	

Based on the results showed in Table 4.43, the values regarding the validity and reliability for TAU [β=.78-.96, AVE=.73, α=.89-.95, CR=.94], PTLP [β=.83-.96, AVE=.84, α=.92-.96, CR=.90], and TIC [β=.83-.91, AVE=.76, α=.89-.94, CR=.96] are all well above their threshold values. Thus, the researcher could conclude that the validity and reliability of all the three measurement models (constructs) used in this study were confirmed. In the next section, the researcher carried out the validation of the structural model in term of discriminant validity as the prerequisite for the model testing.

4.3.4.3 Validation of the Structural Model

The structural model is the model that demonstrated the correlational or causal dependencies among the measurement models in the study and these latent constructs are assembled into the structural model based on the hypothesized inter-relationships among them (Zainudin Awang, 2013). The structural model's assessment comprises the evaluation of the path coefficients between the model's latent variables. Therefore, the researcher should check on the path coefficient's algebraic sign, magnitude, and significance, before test for the entire model of theory in answering research question twelve.

In this section, the researcher intends to estimate the correlational relationship between the three main variables (constructs) - principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS to make sure that there are no significant multicollinearity problems exist among these latent variables under this study. The results of the correlation analysis among the three constructs are presented in Figure 4.44.



Note:
PTLP = Principal Technology Leadership Practices;
TAU = Teacher Acceptance and Use of SMS;
TIC=Teacher ICT Competency

Figure 4.44: Covariance between the three main variables (constructs) in the structural model

Based on Figure 4.44, the correlation coefficient between principal technology leadership practices and teacher acceptance and use of SMS is .55, between principal technology leadership practices with teacher ICT competency is .60, and between teacher ICT competency and teacher acceptance and use of SMS is .65. These indicate that all the three main variables (constructs) used in this study (principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS) do not have significant multicollinearity problems because their correlation coefficients are less than .90.

After the construct validity of the developed instrument, the validation of the measurement models for each construct (variable) and a structural model for this study have been carried out and confirmed. In the next section, the researcher presents the results of the present study.

4.4 Results of the Study

This section presents the results of the study according to each of the research questions proposed. Basically, there are four different types of statistical analysis that were carried out to answer these research questions. First, descriptive statistics in term of mean and standard deviation are used to answer the first three research questions. Then, inferential statistic in term of Pearson Product-Moment correlation tests were carried out to identify the relationship between variables are used to answer research questions four to six. Further, inferential statistic in term of multiple regression analysis which is an extension of the bivariate correlation was carried out to answer research questions seven to nine. This multiple regression analysis was carried out in order to identify if change in the factors (predictor/ independent variables) which contribute to change in a criterion/ dependent variable. Finally, structural equation modeling (SEM) procedures with Analysis of Moment Structures (AMOS) version 22.0 were carried out to answer research questions ten to twelve.

4.4.1 Research Question 1

What are the levels of teacher acceptance and use of SMS in Negeri Sembilan secondary schools?

Descriptive statistic was used to analyze the data collected from 417 teachers in Negeri Sembilan secondary schools. The endogenous variable, teacher acceptance and use of SMS comprised six dimensions: (i) Performance Expectancy; (ii) Effort Expectancy; (iii) Social Influence; (iv) Facilitating Condition; (v) Hedonic Motivation; and (iv) Habit. Initially, the overall mean and standard deviation of teacher acceptance and use of SMS together with the means and standard deviations for each of the teacher acceptance and use of SMS dimensions would be computed using SPSS. Then these means would be interpreted as the levels of teacher acceptance and use of SMS according to the interpretation shown in Table 3.9. The analysis yield results as shown in Table 4.44.

Table 4.44: Mean, Standard Deviation and the Level of Teacher Acceptance and Use of SMS (N=417)

Dimension	Mean	Standard Deviation	Level
1) Performance Expectancy	7.03	1.49	High
2) Effort Expectancy	7.00	1.46	High
3) Social Influence	6.55	1.42	Medium
4) Facilitating Conditions	7.23	1.34	High
5) Hedonic Motivation	6.86	1.51	High
6) Habit	6.45	1.71	Medium
Overall	**6.85**	**1.32**	**High**

Referring to Table 4.44, the overall mean for teacher acceptance and use of SMS is 6.85. This could be interpreted as high level of teacher acceptance and use of SMS in Negeri Sembilan secondary schools. The results of the analysis for each of the teacher acceptance and use of SMS dimensions indicated that four out of the six teacher acceptance and use of SMS dimensions showed high level of mean. These dimensions are performance expectancy (M=7.03, S.D.=1.49); effort expectancy (M=7.00, S.D.=1.46); facilitating condition (M=7.23, S.D.=1.34) and hedonic motivation (M=6.86, S.D.=1.51). While the other two of the teacher acceptance and use of SMS dimensions demonstrated medium level of mean, these dimensions are social influence (M=6.55, S.D.=1.42) and habit (M=6.45, S.D.=1.71).

Next, the researcher presents the means and standard deviations for each of the items according to each of teacher acceptance and use of SMS dimensions. There are 30 items in Section C of the questionnaire to measure teacher acceptance and use of SMS. The explanation in this section is based on which particular item demonstrated higher or lower mean than the mean of each teacher acceptance and use of SMS dimension. In order to compare it easily, each of the items' means is arranged and presented in descending order.

4.4.1.1 Dimension 1: Performance Expectancy

The performance expectancy dimension comprised five items. The means and standard deviations for all the five items are displayed in Table 4.45.

Table 4.45: Mean and Standard Deviation for Each of the Items in Performance Expectancy Dimension (N=417)

Item	Description	Mean	S.D.
C1	Using School Management System (SMS) improves my job performance.	7.15	1.58
C4	Using SMS enables me to accomplish tasks more quickly.	7.07	1.62
C3	Using SMS increases my job productivity.	7.03	1.60
C2	Using SMS enhances my job effectiveness.	7.00	1.55
C5	I find SMS useful in my daily work.	6.90	1.67

			Overall Mean	7.03	1.49

The descriptive statistics in Table 4.45 showed that two items have higher mean than the overall mean of performance expectancy dimension (M=7.03, S.D.=1.49). These items are item C1 (M=7.15, S.D.=1.58) and item C4 (M=7.07, S.D.=1.62). These indicated that the respondents agreed that using the SMS could improve their job performance and enables them to accomplish their tasks more quickly. However, item C5 (M=6.90, S.D.=1.67) have the lowest mean based on the respond given by the respondents. This meant that the respondents rated lowest level of agreement on the usefulness of SMS in their daily work among all items in performance expectancy dimension.

4.4.1.2 Dimension 2: Effort Expectancy

The effort expectancy dimension comprised five items. The means and standard deviations for all the five items are showed in Table 4.46.

Table 4.46: Mean and Standard Deviation for Each of the Items in Effort Expectancy Dimension (N=417)

Item	Description	Mean	S.D.
C6	Learning to operate School Management System (SMS) is easy for me.	7.08	1.53
C7	Interaction with SMS is understandable.	7.05	1.54
C9	It is easy for me to become skillful in using SMS.	7.01	1.60
C10	I find SMS is easy to use.	6.98	1.64
C8	Interaction with SMS does not require a lot of my mental effort.	6.87	1.66
	Overall Mean	**7.00**	**1.46**

Based on Table 4.46 showed above, there are three items that have higher mean than the overall mean of effort expectancy dimension (M=7.00, S.D.=1.46). These items are item C6 (M=7.08, S.D.=1.53), item C7 (M=7.05, S.D.=1.54), and item C9 (M=7.01, S.D.=1.60). These indicated that the respondents agreed that learning to operate SMS is easy, interaction with SMS is understandable, and they easily become skillful in using SMS.

4.4.1.3 Dimension 3: Social Influence

The social influence dimension comprised five items. The means and standard deviations for all the five items are presented in Table 4.47.

Table 4.47: Mean and Standard Deviation for Each of the Items in Social Influence Dimension (N=417)

Item	Description	Mean	S.D.
C13	My school's administrators think that I should use School Management System (SMS).	7.43	1.54
C11	My colleagues think that I should use SMS.	6.83	1.60
C12	My other schools colleagues think that I should use SMS.	6.42	1.71
C14	My students prefer that I use SMS.	6.12	1.77
C15	My students' parents prefer that I use SMS.	5.93	1.82
	Overall Mean	**6.55**	**1.42**

Table 4.47 showed that there are two items have higher mean than the overall mean of social influence dimension (M=6.55, S.D.=1.42). These items are item C13 (M=7.43, S.D.=1.54) and item C11 (M=6.83, S.D.=1.60). These indicated that the respondents agreed that their school administrators and colleagues think that they should use SMS. However, item C14 (M=6.12, S.D.=1.77) and item C15 (M=5.93, S.D.=1.82) have lower mean than the overall mean of social influence dimension. These meant that the respondents found that their students and their students' parents are less preferable to the use of SMS.

4.4.1.4 Dimension 4: Facilitating Conditions

The facilitating conditions dimension comprised five items. The means and standard deviations for all the five items are arranged in Table 4.48.

Table 4.48: Mean and Standard Deviation for Each of the Items in Facilitating Conditions Dimension (N=417)

Item	Description	Mean	S.D.
C16	I have the necessary tools (desktop, laptop, smartphone, etc.) to use School Management System (SMS).	7.85	1.60
C18	I have the necessary knowledge to use SMS.	7.29	1.45
C17	I have the necessary facilities (computer lab, internet access, etc.) to use SMS.	7.03	1.82
C20	I can get support (technical, expert teacher, etc.) when I have difficulties using SMS.	7.01	1.66
C19	SMS is compatible with other technologies I use.	6.95	1.45
	Overall Mean	**7.23**	**1.34**

Based on Table 4.48, there are two items that have higher mean than the overall mean of facilitating condition dimension (M=7.23, S.D.=1.34). These items are item C16 (M=7.85, S.D.=1.60) and item C18 (M=7.29, S.D.=1.45). These indicated that the respondents showed high level of agreement on the statements that they have the necessary knowledge and tools such as desktop, laptop, or smartphone to use SMS. However, item C19 (M=6.95, S.D.=1.45) have the lowest mean score based on the response given by the respondents. This meant that the respondents found that the SMS is less compatible with other technologies they are using.

4.4.1.5 Dimension 5: Hedonic Motivation

The hedonic motivation dimension comprised five items. The means and standard deviations for all the five items are showed in Table 4.49.

Table 4.49: Mean and Standard Deviation for Each of the Items in Hedonic Motivation Dimension (N=417)

Item	Description	Mean	S.D.
C23	Using School Management System (SMS) is a wise idea.	6.95	1.64
C21	Working with SMS is enjoyable.	6.91	1.70
C25	Using SMS increases my motivation for works.	6.90	1.58
C22	The actual process of using SMS is pleasant.	6.79	1.67
C24	The challenge of using SMS is interesting for me.	6.76	1.70
	Overall Mean	**6.86**	**1.51**

Table 4.49 showed that there are three items have means that are slightly higher than the overall mean of hedonic motivation dimension (M=6.86, S.D.=1.51). These items are item C23 (M=6.95, S.D.=1.64), item C21 (M=6.91, S.D.=1.70) and item C25 (M=6.90, S.D.=1.58). These indicated that the respondents found that using SMS is a wise idea and could increase their motivation for work. Besides, the respondents also found that working with SMS is enjoyable.

4.4.1.6 Dimension 6: Habit

The last dimension, habit also comprised five items. The means and standard deviations for all the five items are displayed in Table 4.50.

Table 4.50: Mean and Standard Deviation for Each of the Items in Habit Dimension (N=417)

Item	Description	Mean	S.D.
C26	I need to use School Management System (SMS) in my daily works.	6.75	1.77
C27	I make decisions based on information from SMS.	6.48	1.86
C30	The use of SMS has become a habit for me.	6.41	1.93
C29	I like using SMS in my daily work.	6.36	1.86
C28	I rely much on SMS in my daily work.	6.26	1.87
	Overall Mean	**6.45**	**1.71**

Based on Table 4.50, there are two items that have higher mean than the overall mean of habit dimension (M=6.45, S.D.=1.71). These items are item C26 (M=6.75, S.D.=1.74) and item C27 (M=6.48, S.D.=1.86). These indicated that the respondents agreed that they need to use SMS in their daily works and they also make decisions based on its information. However, the respondents rated lower level of agreement in item C29 (M=6.36, S.D.=1.86) and item C28 (M=6.26, S.D.=1.87) compare with the overall mean of habit. These meant that the respondents dislike using SMS in their daily work and seldom rely on SMS in their daily work.

In conclusion, the data of this study indicated that teachers in Negeri Sembilan secondary schools showed high level of acceptance and use of SMS. There are four out of six of the teacher acceptance and use of SMS dimensions have high level of means while another two dimensions demonstrated medium level of means. The dimension of facilitating conditions showed the highest mean, followed by performance expectancy, effort expectancy, hedonic motivation, social influence and the lowest mean was habit dimension.

4.4.2 Research Question 2

What are the levels of principal technology leadership practices in Negeri Sembilan secondary schools?

The exogenous variable, principal technology leadership practices were measured based on the five dimensions: (i) Visionary Leadership; (ii) Digital Age Learning Culture; (iii) Excellence in Professional Practice; (iv) Systemic Improvement and (v) Digital Citizenship. In answering this research question, descriptive statistics were used to analyze the data obtained from 417 respondents. The overall mean and standard deviation of principal technology leadership practices together with the means and standard deviations for each of the principal technology leadership practices dimensions would be computed using SPSS. Then these means would be interpreted as the levels of principal technology leadership practices based on the interpretation shown in Table 3.9. The analysis yield results as shown in Table 4.51.

Table 4.51: Mean, Standard Deviation and the Level of Principal Technology Leadership Practices (N=417)

Dimension	Mean	Standard Deviation	Level
1) Visionary Leadership	7.22	1.32	High
2) Digital Age Learning Culture	7.30	1.35	High
3) Excellence in Professional Practice	7.09	1.33	High
4) Systemic Improvement	7.07	1.35	High
5) Digital Citizenship	7.10	1.37	High
Overall	**7.15**	**1.26**	**High**

From Table 4.51, the overall mean of principal technology leadership practices is 7.15. This could be interpreted that majority of the respondents perceived that their principals demonstrated high level of technology leadership practices in Negeri Sembilan secondary schools. Two out of the five principal technology leadership practices dimensions have higher mean than the overall mean (M=7.15, S.D.=1.26). These dimensions are Digital Age Learning Culture (M=7.30, S.D.=1.35) and Visionary Leadership (M=7.22, S.D.=1.32). While the other three principal technology leadership practices dimensions have lower mean than the overall mean – Digital Citizenship Visionary Leadership (M=7.10, S.D.=1.37); Excellence in Professional Practice (M=7.09, S.D.=1.33); and Systemic Improvement (M=7.07, S.D.=1.35). However, all the five principal technology leadership practices dimensions have mean that are interpreted as high level. These indicated that the respondents perceived their principals to demonstrate high level of principal technology leadership practices for all the five dimensions in Negeri Sembilan secondary schools.

Subsequently, the researcher would present the means and standard deviations for each of the items according to each principal technology leadership practices dimensions. There are 32 items in Section B of the questionnaire to measure principal technology leadership practices. The explanation in this section is based on which particular item demonstrated higher or lower mean than the mean of each principal technology leadership practices dimension. Each of the items' means is arranged and presented in descending order.

4.4.2.1 Dimension 1: Visionary Leadership

The first dimension, visionary leadership comprised five items. The means and standard deviations for all the five items are showed in Table 4.52.

Table 4.52: Mean and Standard Deviation for Each of the Items in Visionary Leadership Dimension (N=417)

Item	Description	Mean	S.D.
B5	My principal advocates various activities to support implementation of technology-infused strategic plans.	7.34	1.46
B1	My principal leads the development of a shared vision that maximizes ICT usage.	7.27	1.50
B4	My principal promotes participation of school community in planning technology-infused strategic plans.	7.25	1.51
B2	My principal participates in the implementation of technology-infused strategic plans.	7.18	1.51
B3	My principal delivers comprehensive information about technology-infused strategic plans.	7.05	1.57
	Overall Mean	**7.22**	**1.32**

From the results of descriptive analysis for each of the items shown in Table 4.52, there are three items that have higher mean than the overall mean of visionary leadership dimension (M=7.22, S.D.=1.32). These three items are item B5 (M=7.34, S.D.=1.46), item B1 (M=7.27, S.D.=1.50), and item B4 (M=7.25, S.D.=1.51). These indicated that the respondents perceived that their principals lead the development of a shared vision that maximizes ICT usage in their school, advocate various activities to support the implementation of technology-infused strategic plans, and promote participation of school community in planning technology-infused strategic plans.

4.4.2.2 Dimension 2: Digital Age Learning Culture

The second dimension, digital age learning culture comprised six items. The means and standard deviations for all the six items are presented in Table 4.53.

Table 4.53: Mean and Standard Deviation for Each of the Items in Digital Age Learning Culture Dimension (N=417)

Item	Description	Mean	S.D.
B7	My principal promotes effective use of ICT for learning.	7.92	1.44
B9	My principal ensures effective practice in the ICT usage across the curriculum.	7.30	1.55
B10	My principal promotes participation in learning communities that stimulate innovation and creativity.	7.27	1.51
B6	My principal ensures instructional innovation focused on continuous improvement of digital-age learning.	7.25	1.49
B11	My principal promotes participation in learning communities that stimulate digital age collaboration.	7.16	1.52
B8	My principal provides technology learner-centered environments to meet diverse needs of learners.	6.88	1.65
	Overall Mean	**7.30**	**1.35**

Based on Table 4.53, there is only one item that has much higher mean than the overall mean of digital age learning culture dimension (M=7.30, S.D.=1.35). This item is item B7 (M=7.92, S.D.=1.44) which indicated that the respondents perceived that their principals promote effective use of ICT for learning in their school. However, item B8 (M=6.88, S.D.=1.65) have the lowest mean in digital age learning culture dimension. These meant that the respondents perceived that their principals do not provide enough of technology learner-centered environments to meet diverse needs of learners.

4.4.2.3 Dimension 3: Excellence in Professional Practice

The third dimension, excellence in professional practice comprised seven items. The means and standard deviations for all the seven items are arranged in Table 4.54.

Table 4.54: Mean and Standard Deviation for Each of the Items in Excellence in Professional Practice Dimension (N=417)

Item	Description	Mean	S.D.
B17	My principal stays abreast of emerging trends regarding effective use of technology.	7.31	1.56
B15	My principal models effective communication among school community using ICT.	7.17	1.49
B16	My principal promotes effective collaboration among school community using ICT.	7.17	1.45
B18	My principal encourages evaluation of new technologies potential to improve student learning.	7.16	1.51
B13	My principal facilitates learning communities in ICT usage among school community.	7.05	1.44
B14	My principal participates in ICT usage learning communities.	6.96	1.55
B12	My principal allocates resources (time, facilities, etc.) to ensure teacher ongoing professional development in ICT fluency.	6.78	1.60
	Overall Mean	**7.09**	**1.33**

Table 4.54 showed that there are four out of seven items in excellence in professional practice dimension have higher mean than the overall mean of excellence in professional practice dimension (M=7.09, S.D.=1.33). These four items are item B17 (M=7.31, S.D.=1.56), item B15 (M=7.17, S.D.=1.49), item B16 (M=7.17, S.D.=1.45), and item B18 (M=7.16, S.D.=1.51). These indicated that the respondents perceived that their principals stay abreast of emerging trends regarding effective use of technology; model and promote effective communication and collaboration among school community using ICT; and encourage evaluation of new technologies potential to improve student learning. However, item B12 (M=6.78, S.D.=1.60) showed lower mean than the overall mean of excellence in professional practice dimension. This indicated that the respondents perceived that their principals do not allocate enough resources (time, facilities, etc.) to ensure teacher ongoing professional development in ICT fluency.

4.4.2.4 Dimension 4: Systemic Improvement

The fourth dimension, systemic improvement comprised six items. The means and standard deviations for all the six items are showed in Table 4.55.

Table 4.55: Mean and Standard Deviation for Each of the Items in Systemic Improvement Dimension (N=417)

Item	Description	Mean	S.D.
B21	My principal collaborates with various parties (school communities, others academician, etc) to improve students' learning.	7.50	1.44
B20	My principal collaborates with various parties (school communities, others academician, etc) to improve staff performance.	7.40	1.50
B19	My principal leads purposeful change to maximize the achievement of learning goals through appropriate use of ICT resources.	7.19	1.45
B23	My principal leverages strategic partnerships to support systemic improvement.	6.97	1.55
B24	My principal provides a robust infrastructure for the use of ICT to support school operation.	6.79	1.67
B22	My principal invites highly technology competent personnel to advance school's ICT goal.	6.58	1.88
	Overall Mean	**7.07**	**1.35**

Based on Table 4.55, there are three out of six items that have higher mean than the overall mean of systemic improvement dimension (M=7.07, S.D.=1.35). These items are item B21 (M=7.50, S.D.=1.44), item B20 (M=7.40, S.D.=1.50), and item B19 (M=7.19, S.D.=1.45). These indicated that the respondents perceived that their principals are able to lead purposeful change to maximize the achievement of learning goals through appropriate use of ICT resources; collaborate with various parties (school communities, others academician, etc) to improve students' learning and staff performance. However, the lowest mean for item B22 (M=6.58, S.D.=1.88) indicated that the respondents perceived that their principals do not demonstrate very high practices in inviting highly technology competent personnel to advance school's ICT goal.

4.4.2.5 Dimension 5: Digital Citizenship

The last dimension, digital citizenship comprised eight items. The means and standard deviations for all the eight items are displayed in Table 4.56.

Table 4.56: Mean and Standard Deviation for Each of the Items in Digital Citizenship Dimension (N=417)

Item	Description	Mean	S.D.
B26	My principal promotes legal and ethical ICT usage.	7.58	1.49
B29	My principal promotes responsible social interactions related to the ICT usage.	7.28	1.45
B27	My principal models legal and ethical ICT usage.	7.24	1.65
B28	My principal establishes policies for legal and ethical ICT usage.	7.10	1.59
B30	My principal models responsible social interactions related to the ICT usage.	7.04	1.49
B31	My principal models a shared cultural understanding through the use of ICT.	6.98	1.48
B32	My principal facilitates the development of a shared cultural understanding through the use of ICT.	6.97	1.50
B25	My principal ensures equitable access to digital tools and resources to meet the needs of learners.	6.64	1.73
	Overall Mean	**7.10**	**1.37**

Table 4.56 showed that there are three out of eight items in digital citizenship dimension have higher mean than the overall mean of digital citizenship dimension (M=7.10, S.D.=1.37). These items are item B26 (M=7.58, S.D.=1.49), item B29 (M=7.28, S.D.=1.45), and item B27 (M=7.24, S.D.=1.65). These indicated that the respondents perceived that their principals promote and model legal and ethical ICT usage; and promote responsible social interactions related to the ICT usage. However, the lowest mean for item B25 (M=6.64, S.D.=1.73) indicated that the respondents perceived that their principals do not ensure equitable access to digital tools and resources to meet the needs of learners.

In conclusion, teachers in Negeri Sembilan secondary schools perceived that their principals practice high level of technology leadership. Furthermore, the data showed that all the five dimensions of principal technology leadership practices are at the high levels. These principals demonstrated highest practices in digital age learning culture dimension, followed by visionary leadership, digital citizenship, excellence in professional practice, and the lowest mean was systemic improvement dimension.

4.4.3 Research Question 3

What are the levels of teacher ICT competency in Negeri Sembilan secondary schools?

The mediator, teacher ICT competency is measured by five dimensions (i) Smart Pedagogy; (ii) Digital Age Learning Experiences and Assessments; (iii) Digital Age Work and Learning; (iv) Digital Citizenship and Responsibility; and (v) Professional Growth and Leadership. In order to answer this research question, descriptive statistics were used to analyze the data obtained from 417 respondents. The overall mean and standard deviation of teacher ICT competency together with the means and standard deviations for each of the teacher ICT competency dimensions would be computed using SPSS. Then these means would be interpreted as the levels of teacher ICT competency based on the interpretation shown in Table 3.9. The analysis yield results as shown in Table 4.57.

Table 4.57: Mean, Standard Deviation and the Level of Teacher ICT Competency (N=417)

Dimension	Mean	Standard Deviation	Level
1) Smart Pedagogy	7.42	1.19	High
2) Digital Age Learning Experience and Assessments	7.28	1.21	High
3) Digital Age Work and Learning	7.39	1.14	High
4) Digital Citizenship and Responsibility	7.19	1.23	High
5) Professional Growth and Leadership	6.87	1.21	High
Overall	**7.19**	**1.08**	**High**

The overall mean of teacher ICT competency as shown in Table 4.57 is 7.19. This could be interpreted as high level of teacher ICT competency in Negeri Sembilan secondary schools. Three out of the five teacher ICT competency dimensions have higher mean than the overall mean (M=7.19 S.D.=1.08). These dimensions are Smart Pedagogy (M=7.42, S.D.=1.19), Digital Age Learning Experience and Assessments (M=7.28, S.D.=1.21) and Digital Age Work and Learning (M=7.39, S.D.=1.14). Digital Citizenship and Responsibility dimension (M=7.19, S.D.=1.23) has similar mean as the overall mean of teacher ICT competency. While the other dimension, Professional Growth and Leadership (M=6.87, S.D.=1.12) showed lower mean than the overall mean of teacher ICT competency. However, all the five teacher ICT competency dimensions have means that are interpreted as high level. These meant that the respondents rated themselves as demonstrating high level of competent for all the five teacher ICT competency dimensions in Negeri Sembilan secondary schools.

Following that, the researcher presents the means and standard deviations for each of the items according to each teacher ICT competency dimensions. There are 31 items in Section D of the questionnaire to measure teacher ICT competency. The explanation in this section is based on which particular item demonstrated higher or lower mean than the mean of each teacher ICT competency dimension.

4.4.3.1 Dimension 1: Smart Pedagogy

The first dimension, smart pedagogy comprised six items. The means and standard deviations for all the six items are showed in Table 4.58.

Table 4.58: Mean and Standard Deviation for Each of the Items in Smart Pedagogy Dimension (N=417)

Item	Description	Mean	S.D.
D1	I use ICT to promote students' creative and innovative thinking.	7.72	1.33
D2	I use ICT to engage students in exploring real-world issues.	7.50	1.36
D4	I use ICT to promote student reflection on learning.	7.44	1.40
D3	I use ICT to engage students in solving authentic problems.	7.41	1.37
D5	I use ICT to clarify learning processes for students.	7.37	1.43
D6	I use ICT to engage in knowledge construction with school community.	7.08	1.36
	Overall Mean	**7.42**	**1.19**

From the results of descriptive analysis for each of the items shown in Table 4.58, there are three items that have higher mean than the overall mean of smart pedagogy dimension (M=7.42, S.D.=1.19). These three items are item D1 (M=7.72, S.D.=1.33), item D2 (M=7.50, S.D.=1.36), and item D4 (M=7.44, S.D.=1.40). These indicated that the respondents rated themselves as being very competent in using ICT to promote students' creative and innovative thinking; to engage students in exploring real-world issues; and to promote student reflection on learning.

4.4.3.2 Dimension 2: Digital Age Learning Experiences and Assessments

Digital age learning experience and assessment dimension comprised six items. The means and standard deviations for all the six items are arranged in Table 4.59.

Table 4.59: Mean and Standard Deviation for Each of the Items in Digital Age Learning Experiences and Assessments Dimension (N=417)

Item	Description	Mean	S.D.
D12	I use ICT to provide students with varied assessments (formative, summative, etc).	7.39	1.42
D7	I use ICT to share relevant learning experiences for students.	7.33	1.38
D10	I use ICT to customize learning activities to address students' diverse learning styles.	7.30	1.31
D9	I use ICT to develop technology-enriched learning environments.	7.25	1.38
D11	I use ICT to construct appropriate learning activities with students' ICT capabilities.	7.20	1.43
D8	I use ICT to adapt relevant learning experiences for students.	7.18	1.35
	Overall Mean	**7.28**	**1.21**

Based on Table 4.59, there are three out of six items that have higher mean than the overall mean of digital age learning experience and assessment dimension (M=7.28, S.D.=1.21). These items are item D12 (M=7.39, S.D.=1.42), D7 (M=7.33, S.D.=1.38), and item D10 (M=7.30, S.D.=1.31). These indicated that the respondents rated themselves as highly competent in using ICT to provide students with varied assessments (formative, summative, etc); to share relevant learning experiences for students; and to customize learning activities to address students' diverse learning styles.

4.4.3.3 Dimension 3: Digital Age Work and Learning

The third dimension, digital age work and learning comprised five items. The means and standard deviations for all the five items are presented in Table 4.60.

Table 4.60: Mean and Standard Deviation for Each of the Items in Digital Age Work and Learning Dimension (N=417)

Item	Description	Mean	S.D.
D17	I use ICT to facilitate learning process (e.g. locate, analyze, evaluate information etc).	7.64	1.31
D16	I use ICT to facilitate research process (e.g. locate information, analyze data etc).	7.41	1.50
D15	I use ICT to communicate effectively with school community.	7.39	1.39
D14	I use ICT to collaborate with school community to support student success.	7.31	1.30
D13	I use ICT to demonstrate fluency in new technology knowledge.	7.21	1.38
	Overall Mean	**7.39**	**1.14**

Table 4.60 showed that there are two out of five items in digital age work and learning dimension have higher mean than the overall mean of digital age work and learning dimension (M=7.39, S.D.=1.14). These items are item D17 (M=7.64, S.D.=1.31) and item D16 (M=7.41, S.D.=1.50). These indicated that the respondents are highly competent in using ICT to facilitate learning process (e.g. locate, analyze, evaluate information etc) and research process (e.g. locate information, analyze data etc). Besides, item D15 (M=7.39, S.D.=1.39) that has similar mean with the overall mean of digital age work and learning indicated that the respondents are able to communicate effectively with school community using ICT.

4.4.3.4 Dimension 4: Digital Citizenship and Responsibility

Digital citizenship and responsibility dimension comprised five items. The means and standard deviations for all the five items are showed in Table 4.61.

Table 4.61: Mean and Standard Deviation for Each of the Items in Digital Citizenship and Responsibility Dimension (N=417)

Item	Description	Mean	S.D.
D19	I use ICT to address diverse needs of learners by using learner-centered strategies.	7.39	1.36
D18	I use ICT to promote policies for legal and ethical ICT usage to my students.	7.36	1.35
D20	I use ICT to promote responsible social interactions.	7.27	1.45
D21	I use ICT to develop cultural understanding with school community of other cultures.	7.00	1.45
D22	I use ICT to develop global awareness with school community of other cultures.	6.91	1.45
	Overall Mean	**7.19**	**1.23**

Based on Table 4.61 shows above, there are three items that have higher mean than the overall mean of digital citizenship and responsibility dimension (M=7.19, S.D.=1.23). These items are item D19 (M=7.39, S.D.=1.36), item D18 (M=7.36, S.D.=1.35), and item D20 (M=7.27, S.D.=1.45). These indicated that the respondents rated themselves as highly competent in using ICT to address diverse needs of learners by using learner-centered strategies; to promote policies for legal and ethical ICT usage to their students; and to promote responsible social interactions. However, the respondents rated lower mean than the overall mean of digital citizenship and responsibility dimension for item D21 (M=7.00, S.D.=1.45) and item D22 (M=6.91, S.D.=1.45). These indicated that the respondents are less competent in using ICT to develop cultural understanding and global awareness with school community of other cultures compared with the others ICT competency in digital citizenship and responsibility dimension.

4.4.3.5 Dimension 5: Professional Growth and Leadership.

The fifth dimension, professional growth and leadership comprised nine items. The means and standard deviations for all the nine items are arranged in Table 4.62.

Table 4.62: Mean and Standard Deviation for Each of the Items in Professional Growth and Leadership Dimension (N=417)

Item	Description	Mean	S.D.
D31	I use ICT to enhance the teaching profession of my school community.	7.25	1.46
D27	I use ICT to participate in school community building.	7.10	1.41
D29	I use ICT to evaluate on effective ICT usage practices in student learning.	6.99	1.45
D23	I use ICT to participate in **local** learning communities to explore creative teaching and learning applications.	6.90	1.45
D28	I use ICT to develop other teacher's technology skills.	6.85	1.45
D30	I use ICT to reflect on effective ICT usage practices in student learning.	6.84	1.46
D26	I use ICT to participate in shared decision making.	6.68	1.52
D24	I use ICT to participate in **global** learning communities to explore creative teaching and learning applications.	6.65	1.50
D25	I use ICT to demonstrate vision of technology infusion.	6.59	1.38
	Overall Mean	**6.87**	**1.21**

Table 4.62 showed that there are four out of nine items in professional growth and leadership dimension have higher mean than the overall mean of professional growth and leadership dimension (M=6.87, S.D.=1.21). These four items are item D31 (M=7.25, S.D.=1.46), item D27 (M=7.10, S.D.=1.41), item D29 (M=6.99, S.D.=1.45), and item D23 (M=6.90, S.D.=1.45). These indicated that the respondents rated themselves as highly competent in using ICT to enhance the teaching profession of their school community; to participate in school community building; to evaluate on effective ICT usage practices in student learning; and to participate in local learning communities to explore creative teaching and learning applications. However, the respondents rated lower mean than the overall mean of professional growth and leadership dimension for item D26 (M=6.68, S.D.=1.52), item D24 (M=6.65, S.D.=1.50), and item D25 (M=6.59, S.D.=1.38). These indicated that the respondents are less competent in using ICT to participate in shared decision making; to participate

in global learning communities to explore creative teaching and learning applications; and to demonstrate vision of technology infusion compared with the others ICT competency in professional growth and leadership dimension.

Overall, the data indicated that teachers in Negeri Sembilan secondary schools showed high level of ICT competency. Besides, these teachers also demonstrated high level of ICT competency for all the five dimensions of teacher ICT competency. The highest mean was smart pedagogy dimension, followed by digital age work and learning, digital age learning experience and assessments, digital citizenship and responsibility, and the lowest mean was professional growth and leadership dimension.

4.4.4 Research Question 4

Is there a significant relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools?

Inferential statistic would be used to answer this research question. The Pearson product-moment correlation test was performed to examine the relationship between principal technology leadership practices and teacher acceptance and use of SMS. Prior to the analysis, researchers need to compute the mean for principal technology leadership practices and the mean for teacher acceptance and use of SMS using SPSS. After that, the correlation analysis was performed by comparing the means of these two variables. Table 4.63 shows the result of the analysis.

Table 4.63: Pearson Product-Moment Correlation Analysis between Principal Technology Leadership Practices and Teacher Acceptance and Use of SMS

Variable		Teacher acceptance and use of SMS
Principal technology leadership practices	Pearson Correlation	.541**
	Sig. (2-tailed)	.000
	N	417

**. Correlation is significant at the 0.01 level (2-tailed)

Table 4.63 showed that for the sample of this study (n=417), there is a statistically significant positive correlation (r=.541, p<.01) between principal technology leadership practices (M=7.15, S.D.=1.26) and teacher acceptance and use of SMS (M=6.85, S.D.=1.32). Based on the correlation coefficient, r=.541, the correlation strength between principal technology leadership practices and teacher acceptance and use of SMS is interpreted as moderately strong (Refer to Table 3.10).

Next, the researcher analyzes the relationship between each of the means of principal technology leadership practices dimensions with the mean of teacher acceptance and use of SMS. The analysis yield results as shown in Table 4.64.

Table 4.64: Inter-Correlation Analysis between Each of the Principal Technology Leadership Practices Dimensions and Teacher Acceptance and Use of SMS (N=417)

Principal technology leadership practices Dimension	Teacher acceptance and use of SMS	
	Pearson Correlation R	Significant
Visionary Leadership	.482**	.000
Digital Age Learning Culture	.470**	.000
Excellence in Professional Practice	.509**	.000
Systemic Improvement	.517**	.000
Digital Citizenship	.530**	.000

**. Correlation is significant at the 0.01 level (2-tailed)

Based on the results of inter-correlation analysis between each of the principal technology leadership practices dimensions with the mean of teacher acceptance and use of SMS showed in Table 4.64, all the five principal technology leadership practices dimensions were statistically significant positively correlated with teacher acceptance and use of SMS. Three out of the five principal technology leadership practices dimensions have statistically significant positive correlation which is moderately strong with teacher acceptance and use of SMS at significant level of $p<.01$. These dimensions are Excellence in Professional Practice ($r=.509$, $p=.000$); Systemic Improvement ($r=.517$, $p=.000$); and Digital Citizenship ($r=.530$, $p=.000$). The other two dimensions demonstrated weak but statistically significant positive correlation with teacher acceptance and use of SMS at the significant level of $p<.01$. These two dimensions are Visionary Leadership ($r=.482$, $p=.000$) and Digital Age Learning Culture ($r=.470$, $p=.000$).

In conclusion, the data showed that there is statistically significant positive correlation which is moderately strong between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Additionally, all the five principal technology leadership practices dimensions were statistically significant positive correlated with teacher acceptance and use of SMS.

4.4.5 Research Question 5

Is there a significant relationship between principal technology leadership practices and teacher ICT competency in Negeri Sembilan secondary schools?

In order to answer this research question, inferential statistic in term of Pearson product-moment correlation test was performed to examine the relationship between principal technology leadership practices and teacher ICT competency based on the data collected from 417 teachers in Negeri Sembilan secondary schools. Prior to the analysis, researchers need to compute the mean for principal technology leadership practices and the mean for teacher ICT competency using SPSS. Then, the correlation analysis was performed by comparing the means of these two variables. The analysis yields result as shown in Table 4.65.

Table 4.65: Pearson Product-Moment Correlation Analysis between Principal Technology Leadership Practices and Teacher ICT Competency

Variable		Teacher ICT competency
Principal technology leadership practices	Pearson Correlation	.590**
	Sig. (2-tailed)	.000
	N	417

**. Correlation is significant at the 0.01 level (2-tailed)

Based on the result shown in Table 4.65, there is a statistically significant positive correlation (r=.590, p<.01) between principal technology leadership practices (M=7.15, S.D.=1.26) and teacher ICT competency (M=7.19, S.D.=1.08). Based on the correlation coefficient, r=.590, the correlation strength between principal technology leadership practices and teacher ICT competency is interpreted as moderately strong (Refer to Table 3.10).

Subsequently, the researcher analyzes the relationship between each of the mean of principal technology leadership practices dimensions with the mean of teacher ICT competency. The analysis yield results as shown in Table 4.66.

Table 4.66: Inter-Correlation Analysis between Each of the Principal Technology Leadership Practices Dimensions and Teacher ICT Competency (N=417)

Principal technology leadership practices Dimension	**Teacher ICT competency**	
	Pearson Correlation R	Significant
Visionary Leadership	.492**	.000
Digital Age Learning Culture	.503**	.000
Excellence in Professional Practice	.565**	.000
Systemic Improvement	.575**	.000
Digital Citizenship	.592**	.000

**. Correlation is significant at the 0.01 level (2-tailed)

Table 4.66 above showed the results of inter-correlation analysis between each of the principal technology leadership practices dimensions with the mean of teacher ICT competency. The results showed that all the five principal technology leadership practices dimensions were statistically significant and positively correlated with teacher ICT competency. Three out of the five principal technology leadership practices dimensions have statistically significant positive correlations which are moderately strong with teacher ICT competency at significant level of $p<.01$. These dimensions are Excellence in Professional Practice ($r=.565$, $p=.000$); Systemic Improvement ($r=.575$, $p=.000$); and Digital Citizenship ($r=.592$, $p=.000$). The remaining two dimensions demonstrated weak but statistically significant positive correlation with teacher acceptance and use of SMS at the significant level of $p<.01$. These two dimensions are Visionary Leadership ($r=.492$, $p=.000$) and Digital Age Learning Culture ($r=.503$, $p=.000$).

In conclusion, the data showed that there is statistically significant positive correlation which is moderately strong between principal technology leadership practices and teacher ICT competency in Negeri Sembilan secondary schools. Additionally, all the five principal technology leadership practices dimensions were statistically significant and positively correlated with teacher ICT competency.

4.4.6 Research Question 6

Is there a significant relationship between teacher ICT competency and teacher acceptance and use of SMS in Negeri Sembilan secondary schools?

The Pearson product-moment correlation test which is one of the inferential statistics was performed to examine the relationship between principal technology leadership practices and teacher acceptance and use of SMS. Prior to the analysis, researchers need to compute the mean for teacher ICT competency and the mean for teacher acceptance and use of SMS using SPSS. Next, the correlation analysis was performed by comparing the means of these two variables. The analysis yields result as shown in Table 4.67.

Table 4.67: Pearson Product-Moment Correlation Analysis between Teacher ICT Competency and Teacher Acceptance and Use of SMS

Variable		**Teacher acceptance and use of SMS**
Teacher ICT competency	Pearson Correlation	.634**
	Sig. (2-tailed)	.000
	N	417

**. Correlation is significant at the 0.01 level (2-tailed)

By referring to Table 4.67 shows above, there is a statistically significant positive correlation ($r=.634$, $p<.01$) between teacher ICT competency ($M=7.19$, $S.D.=1.08$) and teacher acceptance and use of SMS ($M=6.85$, $S.D.=1.32$). Based on the correlation coefficient, $r=.634$, the correlation strength between teacher ICT competency and teacher acceptance and use of SMS is interpreted as moderately strong (Refer to Table 3.10).

After that, the researcher analyzes the relationship between each of the mean of the teacher ICT competency dimensions with the mean of teacher acceptance and use of SMS. The analysis yield results as shown in Table 4.68.

Table 4.68: Inter-Correlation Analysis between Each of the Teacher ICT Competency Dimensions and Teacher Acceptance and Use of SMS (N=417)

Principal technology leadership practices Dimension	**Teacher acceptance and use of SMS**

	Pearson Correlation, R	Significant
Smart Pedagogy	.591**	.000
Digital Age Learning Experience and Assessments	.580**	.000
Digital Age Work and Learning	.560**	.000
Digital Citizenship and Responsibility	.556**	.000
Professional Growth and Leadership	.564**	.000

**. Correlation is significant at the 0.01 level (2-tailed)

Based on Table 4.68 shows above, the results of inter-correlation analysis between each of the teacher ICT competency dimensions with the mean of teacher acceptance and use of SMS revealed that all the five teacher ICT competency dimensions were statistically significant and positively correlated with teacher acceptance and use of SMS. All the five dimensions showed moderately strong positive correlation with teacher acceptance and use of SMS at significant level of $p<.01$. The correlation coefficient for each of the dimensions are arranged in the descending order as followed: Smart Pedagogy ($r=.591$, $p=.000$); Digital Age Learning Experience and Assessments ($r=.580$, $p=.000$); Professional Growth and Leadership ($r=.564$, $p=.000$); Digital Age Work and Learning ($r=.560$, $p=.000$) and Digital Citizenship and Responsibility ($r=.556$, $p=.000$).

In conclusion, the data showed that there is a statistically significant positive correlation which is moderately strong between teacher ICT competency and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Additionally, all the five teacher ICT competency dimensions were statistically significant and positively correlated with teacher acceptance and use of SMS.

4.4.7 Research Question 7

Which of the principal technology leadership practices dimensions are the significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools?

After the relationship between principal technology leadership practices and teacher acceptance and use of SMS have been identified in RQ4, the researcher determined the significant predictors among principal technology leadership practices dimensions in explaining teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Hence, inferential statistic in term of multiple regression analysis which is an extension of the bivariate correlation was used to answer this research question. The step-wise multiple regression method was employed to identify which of the principal technology leadership practices dimensions contribute to the changes in the teacher acceptance and use of SMS. In this analysis, the predictor variables were the five dimensions of principal technology leadership practices. The mean score for teacher acceptance and use of SMS is the criterion variable. Table 4.69 showed the outputs of the multiple regression analysis.

Table 4.69: Multiple Regression (Stepwise) on Principal Technology Leadership Practices to Teacher Acceptance and Use of SMS (N=417)

Variable	**B (Unstad.)**	**B (Stand.) (β)**	**t**	**Sig**	**R^2**	**Contribution (%)**
Digital Citizenship	.370	.384	6.272	.000	.281	28.1
Visionary Leadership	.197	.198	3.227	.001	.299	1.8
Constant	2.798		8.867	.000		

Note: Model Summary

R	.547
R^2	.299
Adjusted R^2	.295
Standard Error	1.110

The result of multiple regression analysis showed in Table 4.69 indicated that the prediction model contained two out of the five predictors. These predictors are digital citizenship (β=.384, p=.000<.05) and visionary leadership (β=.198, and p=.001<.05). By referring to Table 3.10, the correlation strength between the criterion variable (teacher acceptance and use of SMS) and predictor variables (the two dimensions of principal technology leadership practices) is moderate with correlation coefficient, R=.547. The digital citizenship dimension (model 1) was found to contribute 28.1% of the variance in teacher acceptance and use of SMS (R^2=.281) while the combination of digital citizenship and visionary leadership dimension (model 2) accounted for 29.9% of the variance in teacher acceptance and use of SMS (R^2=.299). Based on Table 3.11, these two models demonstrated large effect size on teacher acceptance and use of SMS.

The dominant predictor for teacher acceptance and use of SMS is digital citizenship dimension of the principal technology leadership practices (β=.384, t=6.272 and p=.000). The t-test result was significant at the significant level of p<.05 with the R^2=.281, this indicated that digital citizenship dimension contributes 28.1% of the variance in teacher acceptance and use of SMS. Based on the standardized beta value, when the digital citizenship dimension of the principal technology leadership practices increase by one unit of standard deviation, teacher acceptance and use of SMS will increase by .384 unit of standard deviation. This beta value was interpreted as moderate effect size based on Table 3.12. Hence, it could be concluded that digital citizenship dimension has moderate effect size on teacher acceptance and use of SMS.

The second predictor which contributed only 1.8% of variance to teacher acceptance and use of SMS is visionary leadership dimension (β=.198, t=3.227 and p=001). The t-test result was significant at the significant level p<.05 with the combine R^2=.299, this indicated that the visionary leadership dimension contributes 1.8% (29.9% - 28.1%) of the variance in teacher acceptance and use of SMS. Based on the standardized beta value, when the visionary leadership dimension of the principal technology leadership practices increase by one unit of standard deviation, teacher acceptance and use of SMS will increase by .198 unit of standard deviation. Hence, based on this beta value, it can be concluded that the effect size of visionary leadership dimension on teacher acceptance and use of SMS is modest (Refer Table 3.12).

Table 4.70: Multiple Regression Analysis (Stepwise): ANOVA

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	217.499	2	108.750	88.234	.000
Residual	510.262	414	1.233		
Total	727.761	416			

Based on Table 4.70, the F-test result indicated that there is a significant relationship between the two predictor variables with teacher acceptance and use of SMS [F(2,414)=88.234, p=.000] at the significant level of p<.05. This multiple regression analysis results also showed that the combination of the two dimensions of principal technology leadership practices namely digital citizenship and visionary leadership accounted for 29.9% of the variance in teacher acceptance and use of SMS. This means that there are as many as 70.1% of the variance in teacher acceptance and use of SMS are unable to be predicted by principal technology leadership practices as it may be caused by other variables (other factors) that are not examined in this study.

In general, the overall contribution of two predictor variables that significantly influence the teacher acceptance and use of SMS can be established through regression equation as follows:

General equation: $TAU=Constant+B_{DC}*DC+B_{VL}*VL$
Thus, $TAU=2.798+0.370*DC+0.197*VL$
Where; TAU=Teacher acceptance and use of SMS
DC=Digital Citizenship
VL=Visionary Leadership

The above regression equation of multiple regression analysis using the 'stepwise' method indicated that dimensions of digital citizenship and visionary leadership, among principal technology leadership practices, are the two significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

4.4.8 Research Question 8

Which of the principal technology leadership practices dimensions are the significant predictors of teacher ICT competency in Negeri Sembilan secondary schools?

The relationship between principal technology leadership practices and teacher ICT competency have been confirmed in RQ5. Subsequently, the researcher determined the significant predictors among principal technology leadership practices dimensions in explaining teacher ICT competency in Negeri Sembilan secondary schools. In order to answer this research question, inferential statistic in term of step-wise multiple regression method was employed to identify which of the principal technology leadership practices dimensions contribute to the changes in the teacher ICT competency. In this analysis, the predictor variables were the five dimensions of principal technology leadership practices. The mean score for teacher ICT competency is the criterion variable. Table 4.71 is the outputs of the multiple regression analysis.

Table 4.71: Multiple Regression (Stepwise) on Principal Technology Leadership Practices to Teacher ICT competency (N=417)

Variable	B (Unstad.)	B (Stand.) (β)	t	Sig	R^2	Contribution (%)
Digital Citizenship	.300	.382	4.655	.000	.350	35.0
Systemic Improvement	.190	.239	2.918	.004	.364	1.4
Constant	3.716		16.12	.000		

Note: Model Summary

R	.603
R^2	.364
Adjusted R^2	.360
Standard Error	.861

The result of multiple regression analysis shows in Table 4.71 indicated that the prediction model contained two out of the five predictors. These predictors are digital citizenship (β=.382, p=.000<.05) and systemic improvement (β=.239, and p=.004<.05). By referring to Table 3.10, the correlation strength between the criterion variable (teacher ICT competency) and predictor variables (the two dimensions of principal technology leadership practices) is moderate with correlation coefficient, R=.603. The digital citizenship dimension (model 1) was found to contribute 35.0% of the variance in teacher acceptance and use of SMS (R^2=.350) while the combination of digital citizenship and systemic improvement dimension (model 2) accounted for 36.4% of the variance in teacher acceptance and use of SMS (R^2=.364). These two models demonstrated large effect size on teacher ICT competency (Refer to Table 3.11).

The dominant predictor for teacher ICT competency is digital citizenship dimension of the principal technology leadership practices (β=.382, t=4.655 and p=.000). The t-test result was significant at the significant level of p<.05 with the R^2=.350, this indicated that digital citizenship dimension contributes 35.0% of the variance in teacher ICT competency. Based on the standardized beta value, when the digital citizenship dimension of the principal technology leadership practices increase by one unit of standard deviation, teacher ICT competency increase by .382 unit of standard deviation. This beta value was interpreted as moderate effect size based on Table 3.12. Hence, it could be concluded that digital citizenship dimension has moderate effect size on teacher ICT competency.

The second predictor which contributed only 1.4% of the variance in teacher ICT competency is systemic improvement dimension (β=.239, t=2.918 and p=.004). The t-test result was significant at the significant level p<.05 with the combine R^2=.364, this indicated that the systemic improvement dimension contributes 1.4% (36.4% - 35.0%) of the variance in teacher ICT competency. Based on the standardized beta value, when the systemic improvement dimension of the principal technology leadership practices increase by one unit of standard deviation, teacher ICT competency will increase by .239 unit of standard deviation. Hence, it can be concluded that the effect size of systemic improvement dimension on teacher ICT competency is modest (Refer Table 3.12).

Table 4.72: Multiple Regression Analysis (Stepwise): ANOVA

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	175.245	2	87.622	118.238	.000
Residual	306.801	414	.741		
Total	482.046	416			

Based on Table 4.72, the F-test result indicated that there is a significant relationship between the two predictor variables with teacher ICT competency [F(2,414)=118.238, p=.000] at the significant level of p<.05. This multiple regression analysis results also showed that the combination of the two dimensions of principal technology leadership practices namely digital citizenship and systemic improvement accounted for 36.4% of the variance in teacher ICT competency. This means that there are as many as 63.6% of the variance in teacher ICT competency are unable to be predicted by principal technology leadership practices as it may be caused by other variables (other factors) that are not examined in this study.

In general, the overall contribution of two predictor variables that significantly influence the teacher ICT competency can be established through regression equation as follows:

General equation: $TIC=Constant+B_{DC}*DC+B_{SI}*SI$
Thus, $TIC=3.716+0.300*DC+0.190*VL$

Where;
TIC=Teacher ICT competency
DC=Digital Citizenship
SI=Systemic Improvement

The above regression equation of multiple regression analysis using the 'stepwise' method indicated that dimensions of digital citizenship and systemic improvement, among principal technology leadership practices, are the two significant predictors of teacher ICT competency in Negeri Sembilan secondary schools.

4.4.9 Research Question 9

Which of the teacher ICT competency dimensions are the significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools?

After the relationship between teacher ICT competency and teacher acceptance and use of SMS have been identified in RQ6, the researcher determined the significant predictors among teacher ICT competency dimensions in explaining teacher acceptance and use of SMS in Negeri Sembilan secondary schools. The inferential statistic in term of multiple regression analysis which is an extension of the bivariate correlation was used to answer this research question. The step-wise multiple regression method was employed to identify which of the teacher ICT competency dimensions contribute to the changes in the teacher acceptance and use of SMS. In this analysis, the predictor variables were the five dimensions of teacher ICT competency. The mean score for teacher acceptance and use of SMS is the criterion variable. The outputs of the multiple regression analysis are presented in Table 4.73.

Table 4.73: Multiple Regression (Stepwise) on Teacher ICT Competency to Teacher Acceptance and Use of SMS (N=417)

Variable	B (Unstad.)	B (Stand.) (β)	t	Sig	R^2	Contribution (%)
Smart Pedagogy	.368	.330	5.762	.000	.349	34.9
Professional Growth and Leadership	.248	.226	3.716	.000	.397	4.8
Digital Citizenship and Responsibility	.159	.148	2.315	.021	.405	0.8
Constant	1.274		3.781	.000		

Note: Model Summary

R	.636
R^2	.405
Adjusted R^2	.401
Standard Error	1.024

Based on the result of multiple regression analysis showed in Table 4.73, the researcher found that the prediction model contained three out of the five predictors. These predictors are smart pedagogy (β=.330, p=.000<.05), professional growth and leadership (β=.226, p=.000<.05), and digital citizenship and responsibility (β=.148, and p=.021<.05). By referring to Table 3.10, the correlation strength between the criterion variable (teacher acceptance and use of SMS) and predictor variables (the three dimensions of teacher ICT competency) is moderate with correlation coefficient, R=.636. The smart pedagogy dimension (model 1) was found to contribute 34.9% of the variance in teacher acceptance and use of SMS (R^2=.349), the combination of smart pedagogy, and professional growth and leadership dimension (model 2) accounted for 39.7% of the variance in teacher acceptance and use of SMS (R^2=.397) while the combination of smart pedagogy, professional growth and leadership, and digital citizenship and responsibility dimension (model 3) accounted for 40.5% of the variance in teacher acceptance and use of SMS (R^2=.405). Based on the interpretation showed in Table 3.11, these three models demonstrated large effect size on teacher acceptance and use of SMS.

The dominant predictor for teacher acceptance and use of SMS is smart pedagogy dimension of the teacher ICT competency (β=.330, t=5.762 and p=.000). The t-test result was significant at the significant level of $p<.05$ with the R^2=.349, this indicated that smart pedagogy dimension contributes 34.9% of the variance in teacher acceptance and use of SMS. Based on the standardized beta value, when the smart pedagogy dimension of the teacher ICT competency increase by one unit of standard deviation, teacher acceptance and use of SMS increase by .330 unit of standard deviation. This beta value was interpreted as moderate effect size based on Table 3.12. Hence, it could be concluded that smart pedagogy dimension has moderate effect size on teacher acceptance and use of SMS.

The second predictor which contributed 4.8% of the variance in teacher acceptance and use of SMS is professional growth and leadership dimension (β=.226, t=3.716 and p=.000). The t-test result was significant at the significant level $p<.05$ with the combine R^2=.397, this indicated that the professional growth and leadership dimension contributes 4.8% (39.7% - 34.9%) of the variance in teacher acceptance and use of SMS. Based on the standardized beta value, when the professional growth and leadership dimension of the teacher ICT competency increase by one unit of standard deviation, teacher acceptance and use of SMS will increase by .226 unit of standard deviation. Hence, it can be concluded that the effect size of professional growth and leadership dimension in teacher acceptance and use of SMS is modest (Refer Table 3.12).

The third predictor which contributed only 0.8% of the variance in teacher acceptance and use of SMS is digital citizenship and responsibility dimension (β=.148, t=2.315 and p=.021). The t-test result was significant at the significant level $p<.05$ with the combine R^2=.405, this indicated that the digital citizenship and responsibility dimension contributes 0.8% (40.5% - 39.7%) of the variance in teacher acceptance and use of SMS. Based on the standardized beta value, when the digital citizenship and responsibility dimension of the teacher ICT competency increase by one unit of standard deviation, teacher acceptance and use of SMS will increase by .148 unit of standard deviation. Hence, it can be concluded that the effect size of digital citizenship and responsibility dimension in teacher acceptance and use of SMS is modest (Refer Table 3.12).

Table 4.74: Multiple Regression Analysis (Stepwise): ANOVA

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	294.726	3	98.242	93.697	.000
Residual	433.035	413	1.049		
Total	727.761	416			

Based on Table 4.74, the F-test result indicated that there is a significant relationship between the three predictor variables with teacher acceptance and use of SMS

[F(3,413)=93.697, p=.000] at the significant level of p<.05. This multiple regression analysis results also showed that the combination of the three dimensions of teacher ICT competency – smart pedagogy, professional growth and leadership, and digital citizenship and responsibility accounted for 40.5% of the variance in teacher acceptance and use of SMS. This means that there are as many as 59.5% of the variance in teacher acceptance and use of SMS are unable to be predicted by teacher ICT competency as it may be caused by other variables (other factors) that are not examined in this study.

In general, the overall contribution of three predictor variables that significantly influence the teacher acceptance and use of SMS can be established through regression equation as follows:

General equation: $TAU=Constant+B_{SP}*SP+B_{GL}*GL+B_{CR}*CR$
Thus, $TAU=1.274+.368*SP+.248*GL+.159*CR$
Where;
TAU=Teacher acceptance and use of SMS
SP=Smart Pedagogy
GL=Professional Growth and Leadership
CR=Digital Citizenship and Responsibility

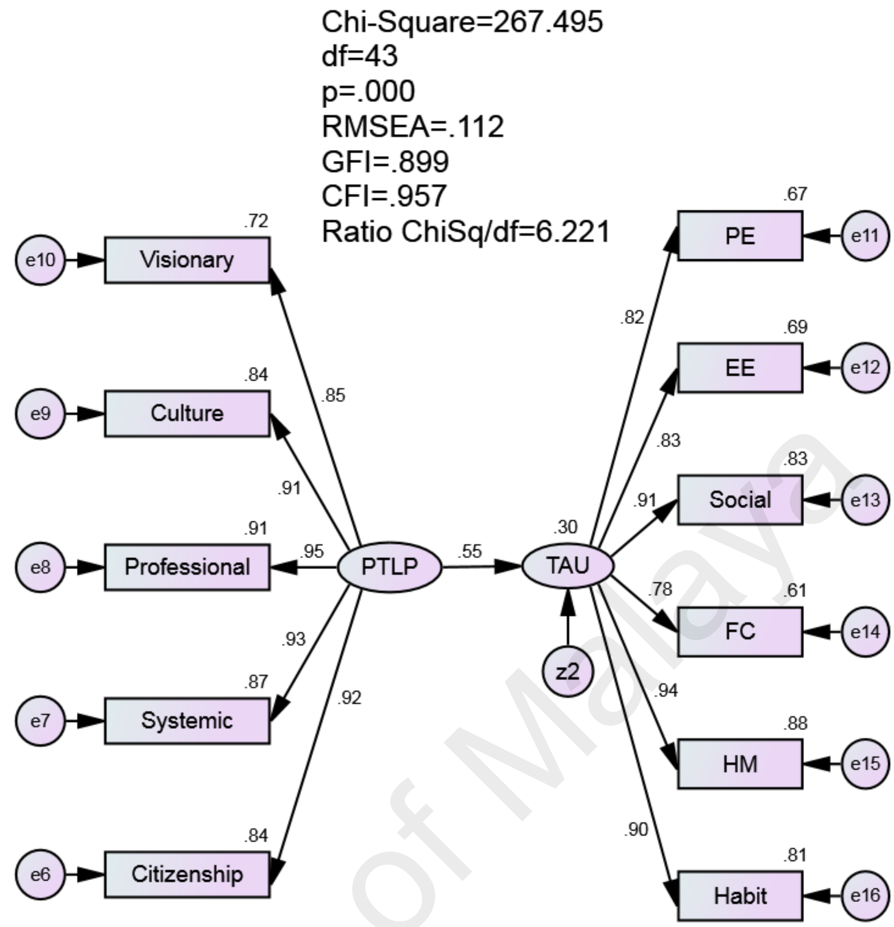
The above regression equation of multiple regression analysis using the 'stepwise' method indicated that dimensions of smart pedagogy, professional growth and leadership, and digital citizenship and responsibility, among teacher ICT competency, are the three significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

4.4.10 Research Question 10

Is teacher ICT competency a mediator for the relationship between principal technology leadership practices and teacher acceptance and use of SMS?

This research question intended to address the effect of teacher ICT competency as a mediating variable in the relationship between principal technology leadership practices (exogenous variable) and teacher acceptance and use of SMS (endogenous variable) in a model. Thus, Structural Equation Modeling (SEM) analysis was used to test the mediation model and examine if the proposed model fit with data collected from Negeri Sembilan secondary schools.

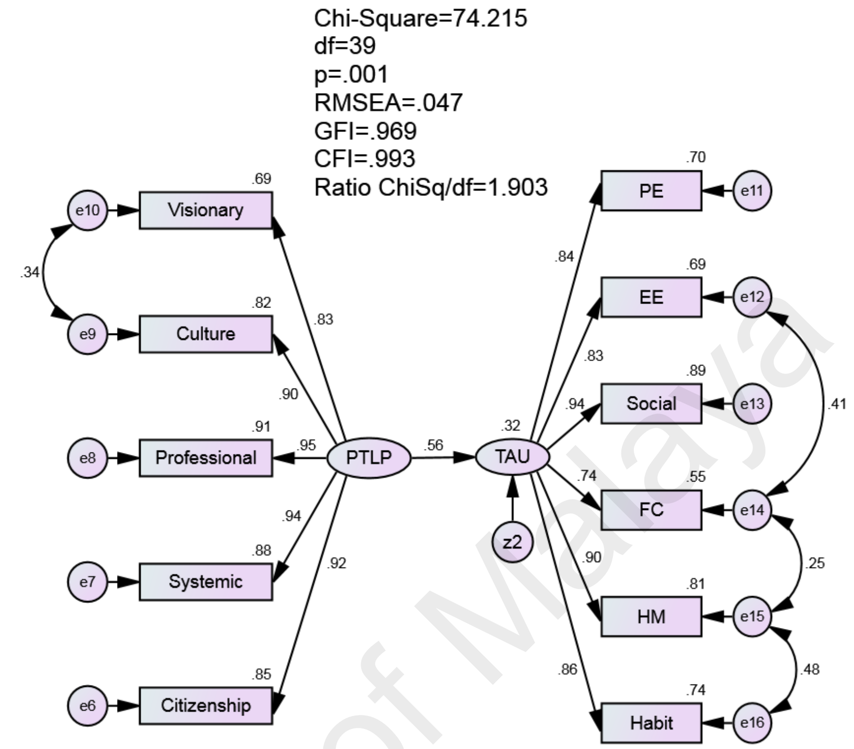
In mediation analysis, SEM which is a powerful statistical tool was utilized to test the direct and indirect relationship between principal technology leadership practices and teacher acceptance and use of SMS; including teacher ICT competency as mediating variable in this study. AMOS was used to perform this analysis. In order to assess the direct and indirect relationships among the variables, a two-step procedures which involve test for the direct effect model and mediation model using SEM were performed. Initially, the researcher needs to show that the direct effect of principal technology leadership practices on teacher acceptance and use of SMS is significant. The direct effect is measured through beta coefficient. Figure 4.45 illustrated the direct effect model of principal technology leadership practices on teacher acceptance and use of SMS.



Note:
PTLP = Principal Technology Leadership Practices;
TAU = Teacher Acceptance and Use of SMS

Figure 4.45: The direct effect model for principal technology leadership practices on teacher acceptance and use of SMS

The output showed in Figure 4.45 indicated that the beta coefficient is .55 and it has a significant effect on teacher acceptance and use of SMS at the significant level of p=.000. However, the fitness indexes of this model do not achieve the level of fitness required for RMSEA=.112 (>.08), GFI=.899 (<.90), and Ratio Chisq/df=6.221 (>5.0). Thus, based on the suggestion of the modification indices, the researcher found that few of the measurement errors need to be set as "free parameter" to improve the fitness of this model. The measurement errors that need to be correlated are e12 with e14 (M.I.=56.198, Par Change=.266), e9 with e10 (M.I.=37.774, Par Change=.130), e15 with e16 (M.I.=28.441, Par Change=.121), and e14 with e15 (M.I.=35.654, Par Change=.141). After these measurement errors have been set as "free parameter", the researcher run the re-specified direct effect model to check on the fitness indexes. The re-specified measurement model is presented in Figure 4.46.

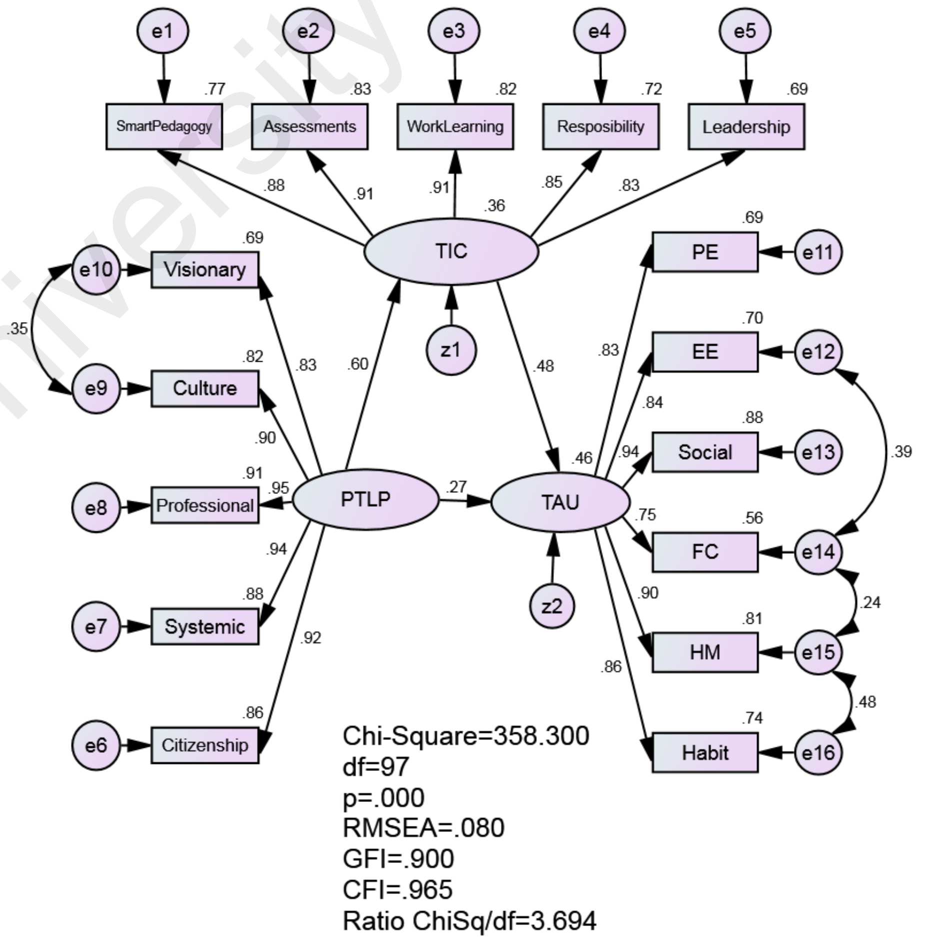


Note:
PTLP = Principal Technology Leadership Practices;
TAU = Teacher Acceptance and Use of SMS

Figure 4.46: Re-specified direct effect model for principal technology leadership practices on teacher acceptance and use of SMS

Based on the re-specified direct effect model for principal technology leadership practices on teacher acceptance and use of SMS showed in Figure 4.46, it was found that all the fitness indexes [RMSEA=.047 (<.08), GFI=.969 (>.90), CFI=.993 (>.90), and Chisq/df=1.903 (<5.0)] have achieved the threshold values (Refer Table 3.13). This indicated that this re-specified direct effect model for principal technology leadership practices on teacher acceptance and use of SMS have achieved construct validity.

Then, the researcher enters the mediating variable (teacher ICT competency) into the



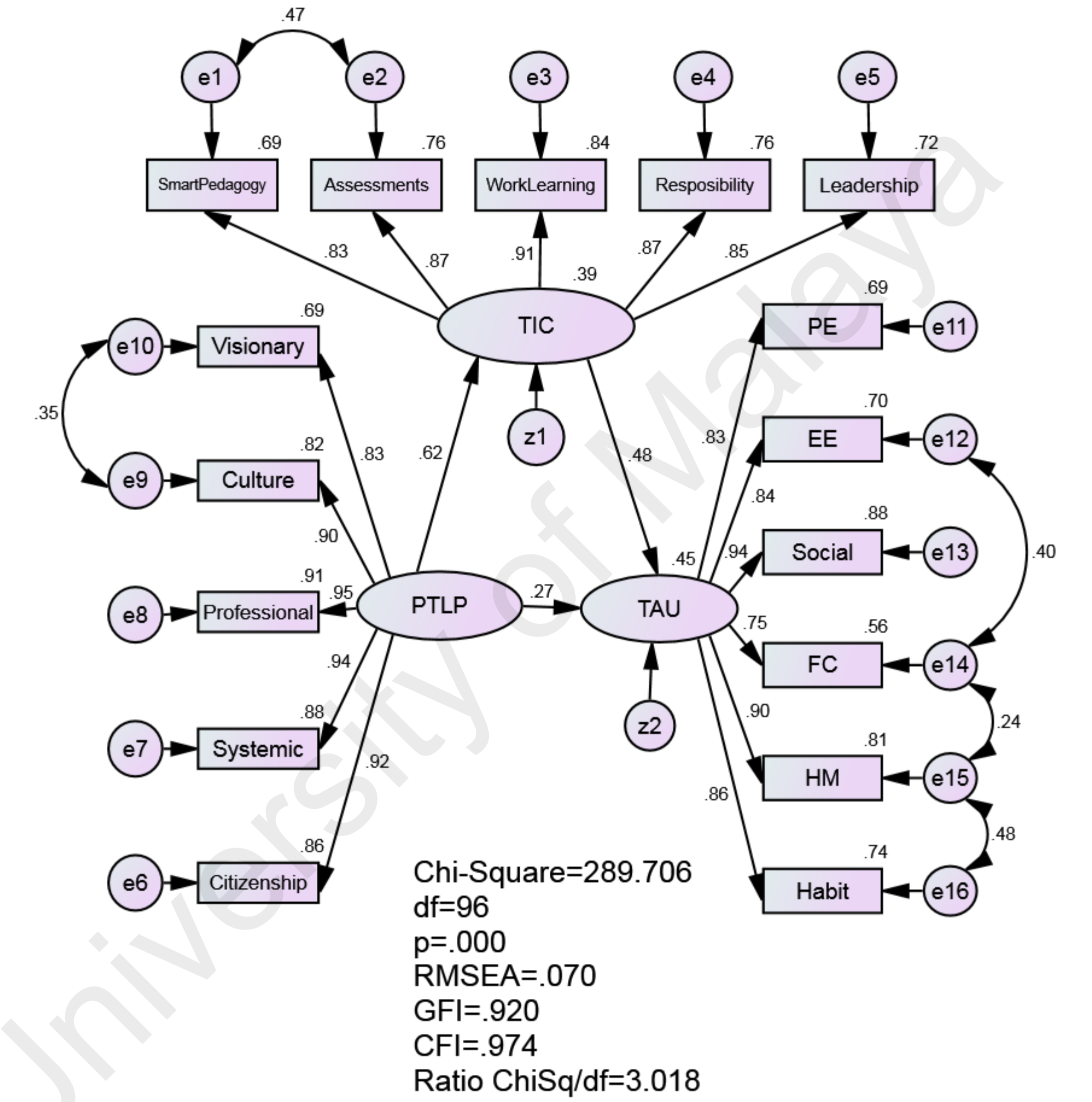
Note:
PTLP = Principal Technology Leadership Practices;
TAU = Teacher Acceptance and Use of SMS;
TIC = Teacher ICT Competency

model and obtained an output as shown in Figure 4.47.

Figure 4.47: Mediation model for teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS

The output shown in Figure 4.47 indicated that the beta coefficient of the direct effect of principal technology leadership practices on teacher acceptance and use of SMS is reduced from .56 to .27 when teacher ICT competency entered the model. According to Zainudin Awang (2014), when a mediating variable enters the model, the direct effect would be reduced since some of the effects have shifted through the mediator. Based on this statement, teacher ICT competency is a mediator in the relationship between principal technology leadership practices and teacher acceptance and use of SMS.

Based on the output shown in Figure 4.47, the fitness indexes of this model have achieved the minimum level of fitness required for RMSEA=.08 (=.08) and GFI=.90 (=.90), and above the threshold for CFI=.965 (>.90) and Ratio Chisq/df=3.694 (<5.0). However, based on the suggestion of the modification indices, the researcher found that correlation between two of the measurement errors demonstrated very high M.I. (M.I.=52.474 > 15.0) and parameter change (PAR=.125>.10). Thus, the researcher decided to improve the fitness of this model by setting these two measurement errors as “free parameter”. The measurement errors that need to be correlated are e1 with e2. After these measurement errors have been set as “free parameter”, the researcher run the re-specified model to check on the fitness indexes. The re-specified model is presented in Figure 4.48.



Note:
PTLP = Principal Technology Leadership Practices;
TAU = Teacher Acceptance and Use of SMS;
TIC = Teacher ICT Competency

Figure 4.48: Re-specified mediation model for teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS

Based on the re-specified mediation model for teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS shown in Figure 4.48, it was found that all the fitness indexes [RMSEA=.070 (<.08), GFI=.920 (>.90), CFI=.974 (>.90), and Chisq/df=3.018 (<5.0)] have been improved. This indicated that the re-specified mediation model for teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS have achieved construct validity. The text output for the re-specified mediation model of teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS is presented in Table 4.75.

Table 4.75: The Standardized Regression Weights for the Re-specified Mediating Model

Path			Estimate	S.E.	C.R.	p	Result	Beta
TIC	<---	PTLP	.563	.045	12.406	***	Significant	.623
TAU	<---	PTLP	.302	.061	4.986	***	Significant	.266
TAU	<---	TIC	.598	.072	8.358	***	Significant	.475

*** Correlation is significant at the 0.001 level

From Table 4.75, the C.R. values for all the individual path are greater than 1.96 and the inter-correlation among principal technology leadership practices (PTL), teacher ICT competency (TIC) and teacher acceptance and use of SMS (TAU) are all yields statistically significant results at the level of p<.001. Thus, it can be concluded that there is a partial mediating effect of teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS.

Besides, it was found that the standardized indirect effect of PTL-TIC-TAU is greater than the standardized direct effect of PTL-TAU in this re-specified mediation model (indirect=.296; direct=.266, p<.001). This indicated that there is a positive mediating effect of teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS.

Furthermore, based on the standardized total effect which is equal to .562 (.296+.266) at significant level of $p<.001$, it can be concluded that principal technology leadership practices and teacher ICT competency have a strong effect on teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

Thus, the data suggested that there is a positive and partial mediating effect of teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS.

4.4.11 Research Question 11

Do teacher demographic variables moderate the relationship between principal technology leadership practices and teacher acceptance and use of SMS?

Moderating variable is the variable that "moderates the effect" of an independent variable on its dependent variable. Similar to the mediation analysis, before introducing a moderator into the model, the effects of independent variable on its dependent variable must exist and significant. Based on the mediation analysis that have been carried out in the previous section, the researcher decided to use the re-specified mediation model of teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS (Figure 4.48) to perform the moderating effect of teacher demographic variables on the relationship between principal technology leadership practices and teacher acceptance and use of SMS. According to Zainudin Awang (2014), when a moderator enters the model, the causal effect would change due to some "interaction effect" between the independent variable and the moderating variable. As a result, the effect could either increase or decrease.

Moreover, modelling the moderating effect of the latent constructs is very complicated and the multi-group path analysis (R. Ho, 2014) has been suggested as an alternative method for assessing the effect of the moderating variable in the model. The procedure would estimate two models separately – one is the constrained model while the other one is the unconstrained model (Chua, 2009). Initially, the moderating variables were first categorized into groups as suggested by Byrne (2010) and Hair et al. (2010). Then, the researcher needs to assume that, in the constrained model, all the groups have the same effects on the tested causal path, while in the unconstrained model, the inequality exists between groups. Comparison between these two models would be carried out. From the Nested Model Comparisons statistic, if the result showed a significant change in the chi-square value between the constrained and unconstrained models, it signified that the moderating variable demonstrated difference effect on the tested causal path. Hence, it could be concluded that the moderating effect exists and that variable could be confirmed as a moderator. In this study, the researcher aims to investigate the moderating effect of the teacher demographic variables in term of gender, age, educational level, teaching experience, and experience in using computer on the relationship between principal technology leadership practices and teacher acceptance and use of SMS. Each of the teacher demographic variables would be analyzed as follow:

(a) Gender

Gender variable consisted of two groups which are male and female. The assumption that researcher made are; (i) in the constrained model, the effect of the male is equal to female, while (ii) in the unconstrained model, the inequality exists between male and female. Then the comparison between these two models would be carried out. The analysis yields result as shown below.

Table 4.76: Model Fit Summary for CMIN (Gender)

Model	NPAR	CMIN	DF	p	CMIN/DF
Constrained	79	440.896	193	.000	2.284
Unconstrained	80	440.617	192	.000	2.295

Table 4.76 showed the results of Chi-Square Goodness-of-Fit test for both models [Constrained: x^2(df=193)=440.896, p<.05; Unconstrained: x^2(df=192)=440.617, p<.05]. The statistically significant results indicated that both of the models did not fit with the data collected for this study. This might due to the sample size (N=417) used in this study is greater than 200.

Table 4.77: Model Fit Summary for Baseline Comparisons and RMSEA (Gender)

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI	RMSEA
Constrained	.943	.930	.967	.959	.967	.056
Unconstrained	.943	.929	.967	.959	.967	.056

However, based on the Baseline Comparisons fitness indexes shown in Table 4.77, it was found that all the fitness indexes: NFI (Normed Fit Index), RFI (Relative Fit Index), IFI (Incremental Fit Index), TLI (Tucker Lewis Index) and CFI (Comparative Fit Index) are above .90 for both models. Besides, the RMSEA fit indexes for both models are less than .08. These indicated that both models fit with the data collected from Negeri Sembilan secondary schools. These results confirmed the reliability of both models.

Table 4.78: Maximum Likelihood Estimates for Gender (Regression Weights)

Gender	Path			Unstand. β				Stand. β
				Estimate	**S.E.**	**C.R.**	**p**	
Male	TAU	<---	PTLP	.358	.144	2.489	.013	.302
Female				.274	.066	4.125	***	.245

Note: TAU = Teacher Acceptance and Use of SMS;
PTLP = Principal Technology Leadership Practices
*** Correlation is significant at the 0.001 level

Furthermore, based on the Maximum Likelihood Estimates results shown in Table 4.78, both gender (male and female) demonstrated statistically significant critical ratio for the regression weights between the latent variables - principal technology leadership practices and teacher acceptance and use of SMS [Male: C.R.=2.489, β=.30, p<.05; Female: C.R.=4.125, β=.25, p<.05). These indicated that both gender groups fit with the data collected for this study.

Table 4.79: Nested Model Comparisons (Gender)
Assuming model Unconstrained Model to be correct:

Model	DF	CMIN	p	Result
Constrained	1	.278	.598	Not Significant

Finally, based on the Nested Model Comparisons analysis which compares the equivalence of both models based on gender shown in Table 4.79, it was found that the difference in the chi-square Goodness-of-Fit between these two models is very small [CMIN(df=1)=.278<3.84] and not significant at the .05 level (p>.05). Thus, the two models do not differ significantly in their goodness-of-fit.

This indicated that there were no statistically significant differences between male and female groups. Hence, gender is not a moderator for the relationship between principal technology leadership practices and teacher acceptance and use of SMS.

(b) ***Age***

There are four age groups for the age variable. These four groups are age below 31 years old, 31-40 years old, 41-50 years old, and above 50 years old. The assumption that researcher made are; (i) in the constrained model, the effects of all the four age groups are equal, while (ii) in the unconstrained model, the inequality exists between all the four age groups. Then the comparison between these two models would be carried out. The analysis yields result as shown below.

Table 4.80: Model Fit Summary for CMIN (Age)

Model	NPAR	CMIN	DF	p	CMIN/DF
Constrained	157	761.402	387	.000	1.967
Unconstrained	160	759.853	384	.000	1.979

Based on the results of Chi-Square Goodness-of-Fit test showed in Table 4.80, it was found that both of the models were statistically significant at p<.05 [Constrained: x^2(df=387)=761.402, p<.05; Unconstrained: x^2(df=384)=759.853, P<.05]. The statistically significant results indicated that both of the models did not fit with the data collected for this study.

Table 4.81: Model Fit Summary for Baseline Comparisons and RMSEA (Age)

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI	RMSEA
Constrained	.907	.885	.952	.940	.952	.048
Unconstrained	.907	.884	.952	.939	.951	.049

However, based on the Baseline Comparisons fitness indexes shown in Table 4.81, it was found that nearly all the fitness indexes: NFI, RFI, IFI, TLI and CFI are close to or above .90 for both models. Besides, the RMSEA fit indexes for both models are less than .08. These indicated that both models fit with the data collected from Negeri Sembilan secondary schools. These results confirmed the reliability of both models.

Table 4.82: Maximum Likelihood Estimates for Age Group (Regression Weights)

Age Group	Path	Unstand. β				Stand. β
		Estimate	S.E.	C.R.	p	
< 31 years old	TAU <--- PTLP	.367	.176	2.084	.037	.231
31 - 40 years old		.290	.154	1.887	.059	.250
41 - 50 years old		.232	.075	3.110	.002	.252
> 50 years old		.109	.131	.831	.406	.121

Note: TAU = Teacher Acceptance and Use of SMS;
PTLP = Principal Technology Leadership Practices
*** Correlation is significant at the 0.001 level

Next, based on the Maximum Likelihood Estimates results shown in Table 4.82, it was found that only two out of four age groups demonstrated statistically significant critical ratio for the regression weights between principal technology leadership practices and teacher acceptance and use of SMS [Group below 31 years old: C.R.=2.084, $\beta=.23$, $p<.05$; Group 41-50 years old: C.R.=3.110, $\beta=.25$, $p<.05$). These indicated that only two of these age groups fit with the data collected for this study.

Table 4.83: Nested Model Comparisons (Age)
Assuming model Unconstrained Model to be correct:

Model	DF	CMIN	p	Result
Constrained	3	1.549	.671	Not Significant

Finally, based on the Nested Model Comparisons analysis which compares the equivalence of both models (Constrained and Unconstrained Model) based on age groups shown in Table 4.83, it was found that the difference in the chi-square Goodness-of-Fit between these two models is small [CMIN(df=3)=1.549<7.82] and not significant at the .05 level (p>.05). Thus, the two models do not differ significantly in their goodness-of-fit. This showed that that there were no statistically significant differences between the four age groups. Hence, age is not a moderator for the relationship between principal technology leadership practices and teacher acceptance and use of SMS.

(c) ***Educational level***

Educational level variable which represented the highest level of academic qualification of the respondents consisted of three groups. These three groups are certificate or diploma, first degree, and postgraduate. The assumption that researcher made are; (i) in the constrained model, the effects of all the three educational level groups are equal, while (ii) in the unconstrained model, the inequality exists between all the three educational level groups. Then the comparison between these two models would be carried out. The analysis yields result as shown below.

Table 4.84: Model Fit Summary for CMIN (Educational Level)

Model	NPAR	CMIN	DF	p	CMIN/DF
Constrained	118	599.537	290	.000	2.067
Unconstrained	120	598.896	288	.000	2.079

The results of Chi-Square Goodness-of-Fit test for both models [Constrained: x^2(df=290)=599.537, p<.05; Unconstrained: x^2(df=288)=598.896, p<.05] are presented in Table 4.84. The statistically significant results indicated that both of the models did not fit with the data collected for this study.

Table 4.85: Model Fit Summary for Baseline Comparisons and RMSEA (Educational Level)

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI	RMSEA
Constrained	.925	.907	.960	.950	.960	.051
Unconstrained	.925	.907	.960	.949	.959	.051

However, based on the Baseline Comparisons fitness indexes shown in Table 4.85, it was found that all the fitness indexes: NFI, RFI, IFI, TLI, and CFI are above .90 for both models. Besides, the RMSEA fit indexes for both models are less than .08. These indicated that both models fit with the data collected from Negeri Sembilan secondary schools. These results confirmed the reliability of both models.

Table 4.86: Maximum Likelihood Estimates for Educational Level (Regression Weights)

Educational Level	Path			Unstand. β				Stand. β
				Estimate	S.E.	C.R.	p	
Cert./ Dip.				.553	.334	1.656	.098	.431
First Degree	TAU	<---	PTLP	.286	.071	4.046	***	.249
Postgraduate				.317	.102	3.100	.002	.321

Note: TAU = Teacher Acceptance and Use of SMS;
PTLP = Principal Technology Leadership Practices
*** Correlation is significant at the 0.001 level

Based on the Maximum Likelihood Estimates results shown in Table 4.86, it was found that only two out of three educational level groups demonstrated statistically significant critical ratio for the regression weights between principal technology leadership practices and teacher acceptance and use of SMS [First Degree Group: C.R.=4.046, β=.25, $p<.05$; Postgraduate Group: C.R.=3.100, β=.32, $p<.05$). These indicated that only two of these educational level groups fit with the data collected for this study.

Table 4.87: Nested Model Comparisons (Educational Level)
Assuming model Unconstrained Model to be correct:

Model	DF	CMIN	p	Result
Constrained	2	.642	.725	Not Significant

Finally, based on the Nested Model Comparisons analysis which compares the equivalence of both models (Constrained and Unconstrained Model) based on educational level groups shown in Table 4.87, it was found that the difference in the chi-square Goodness-of-Fit between these two models is very small [CMIN(df=2)=.642<5.99] and not statistically significant at the .05 level ($p>.05$). Thus, the two models do not differ significantly in their goodness-of-fit. This showed that there were no statistically significant differences between the three educational level groups. Hence, respondents' educational level is not a moderator for the relationship between principal technology leadership practices and teacher acceptance and use of SMS.

(d) ***Teaching Experience***

Respondents' years of teaching experience were categorized into three groups. These three groups are under five years, five to ten years, and above ten years. The assumption that researcher made are; (i) in the constrained model, the effects of all the three teaching experience groups are equal, while (ii) in the unconstrained model, the inequality exists between all the three teaching experience groups. Then the comparison between these two models would be carried out. The analysis yields result as shown below.

Table 4.88: Model Fit Summary for CMIN (Teaching Experience)

Model	NPAR	CMIN	DF	p	CMIN/DF
Constrained	118	621.673	290	.000	2.144
Unconstrained	120	617.230	288	.000	2.143

Based on the results of Chi-Square Goodness-of-Fit test in Table 4.88, it showed that both of the models were statistically significant at $p<.05$ [Constrained: x^2(df=290)=621.673, $p<.05$; Unconstrained: x^2(df=288)=617.230, $p<.05$]. The statistically significant results indicated that both of the models did not fit with the data collected for this study.

Table 4.89: Model Fit Summary for Baseline Comparisons and RMSEA (Teaching Experience)

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI	RMSEA
Constrained	.923	.904	.957	.946	.957	.053
Unconstrained	.923	.904	.958	.947	.957	.053

However, based on the Baseline Comparisons fitness indexes shown in Table 4.89, it was found that all the fitness indexes: NFI, RFI, IFI, TLI, and CFI are above .90 for both models. Besides, the RMSEA fit indexes for both models are less than .08. These indicated that both models fit with the data collected from

Negeri Sembilan secondary schools. These results confirmed the reliability of both models.

Table 4.90: Maximum Likelihood Estimates for Teaching Experience (Regression Weights)

Educational Level	Path			Unstand. β				Stand. β
				Estimate	S.E.	C.R.	p	
Under 5 years	TAU	<---	PTLP	.696	.204	3.417	***	.435
5 – 10 years				.293	.160	1.836	.066	.241
Above 10 years				.252	.065	3.872	***	.254

Note: TAU = Teacher Acceptance and Use of SMS;
PTLP = Principal Technology Leadership Practices
*** Correlation is significant at the 0.001 level

Table 4.90 showed the Maximum Likelihood Estimates results for teaching experience, it indicated that only two out of three of the teaching experience groups demonstrated statistically significant critical ratio for the regression weights between principal technology leadership practices and teacher acceptance and use of SMS [Under 5 years Group: C.R.=3.417, β=.44, p<.05; Above 10 years Group: C.R.=3.872, β=.25, p<.05). These indicated that only two of these teaching experience groups fit with the data collected for this study.

Table 4.91: Nested Model Comparisons (Teaching Experience)
Assuming model Unconstrained Model to be correct:

Model	DF	CMIN	p	Result
Constrained	2	4.443	.108	Not Significant

Finally, based on the Nested Model Comparisons analysis which compares the equivalence of both models (Constrained and Unconstrained Model) based on educational level groups shown in Table 4.91, it was found that the difference in the chi-square Goodness-of-Fit between these two models is not significant at the .05 level [CMIN(df=2)=4.443<5.99, p>.05]. Thus, the two models do not differ significantly in their goodness-of-fit. This indicated that there were no statistically significant differences between the three teaching experience groups. Hence, respondents' teaching experience is not a moderator for the relationship between principal technology leadership practices and teacher acceptance and use of SMS.

(e) ***Experience in using computer.***

Respondents' years of experience in using computer were categorized into three groups. These three groups are under five years, five to ten years, and above ten years. The assumption that researcher made are; (i) in the constrained model, the effects of all the three groups are equal, while (ii) in the unconstrained model, the inequality exists between all the three groups. Then the comparison between these two models would be carried out. The analysis yields result as shown below.

Table 4.92: Model Fit Summary for CMIN (Experience in Using Computer)

Model	**NPAR**	**CMIN**	**DF**	**p**	**CMIN/DF**
Constrained	118	540.081	290	.000	1.862
Unconstrained	120	539.350	288	.000	1.873

The results of Chi-Square Goodness-of-Fit test shown in Table 4.92, indicated that both of the models were statistically significant at p<.05 [Constrained: x^2(df=290)=540.081, p<.05; Unconstrained: x^2(df=288)=539.350, p<.05]. The statistically significant results indicated that both of the models did not fit with the data collected for this study.

Table 4.93: Model Fit Summary for Baseline Comparisons and RMSEA (Experience in Using Computer)

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI	RMSEA
Constrained	.932	.916	.968	.959	.967	.046
Unconstrained	.932	.916	.967	.959	.967	.046

However, based on the Baseline Comparisons fitness indexes shown in Table 4.93, it was found that all the fitness indexes: NFI, RFI, IFI, TLI, and CFI are above .90 for both models. Besides, the RMSEA fit indexes for both models are less than .08. These indicated that both models fit with the data collected from Negeri Sembilan secondary schools. These results confirmed the reliability of both models.

Table 4.94: Maximum Likelihood Estimates for Experience in Using Computer (Regression Weights)

Experience in Using Computer	Path			Unstand. β				Stand. β
				Estimate	S.E.	C.R.	p	
Under 5 years				.198	.123	1.620	.105	.180
5 – 10 years	TAU	<---	PTLP	.312	.121	2.577	.010	.262
Above 10 years				.323	.077	4.184	***	.286

Note: TAU = Teacher Acceptance and Use of SMS;
PTLP = Principal Technology Leadership Practices
*** Correlation is significant at the 0.001 level

The Maximum Likelihood Estimates results shown in Table 4.94 indicate that two out of three groups demonstrated statistically significant critical ratio for the regression weights between principal technology leadership practices and teacher acceptance and use of SMS [5-10 years Group: C.R.=2.577, β=.26, p<.05; Above 10 years Group: C.R.=4.184, β=.29, p<.05). These indicated that only two of these groups fit with the data collected for this study.

Table 4.95: Nested Model Comparisons (Experience in Using Computer)
Assuming model Unconstrained Model to be correct:

Model	DF	CMIN	p	Result
Constrained	2	.731	.694	Not Significant

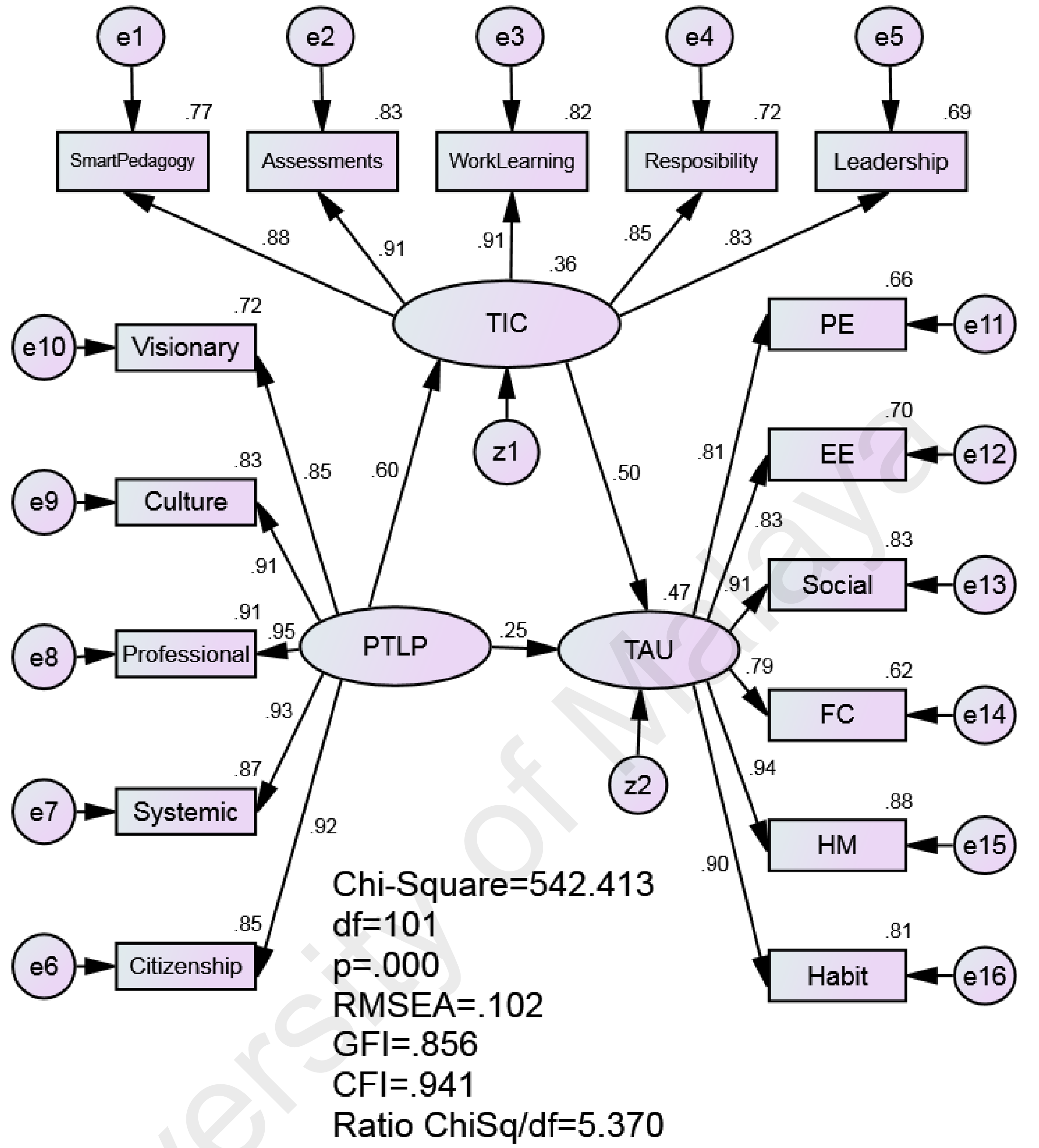
Finally, based on the Nested Model Comparisons analysis which compares the equivalence of both models (Constrained and Unconstrained Model) based on experience in using computer groups shown in Table 4.95, it was found that the difference in the chi-square Goodness-of-Fit between these two models is very small [CMIN(df=2)=.731<5.99] and not significant at the .05 level (p>.05). Thus, the two models do not differ significantly in their goodness-of-fit. This indicated that there were no statistically significant differences between these three experiences in using computer groups. Hence, respondents' years of experience in using computer is not a moderator for the relationship between principal technology leadership practices and teacher acceptance and use of SMS.

Based on the results of the multi-group path analysis for each of the teacher demographic variables that have been conducted above, it can be concluded that all the five teacher demographic variables in term of gender, age, educational level, teaching experience, and experience in using computer are not moderating the relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

4.4.12 Research Question 12

Does the proposed model of principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS fit with the data collected from Negeri Sembilan secondary school teachers?

The proposed structural model for this study is postulated based on the related theories, empirical research in the area of the study, and literature reviews conducted in chapter two. Once the model is specified, the researcher then tests its plausibility based on the data collected from the fields (Negeri Sembilan Secondary Schools). Prior to the analysis of the proposed structural model for this study, the issues of unidimensionality, validity, and reliability of all the measurement models have been addressed in the preliminary analysis section (Refer section 4.3.4). The primary task in this model-testing procedure is to determine the goodness-of-fit between the proposed model and the sample data (Byrne, 2010). The analysis yield results as presented in Figure 4.49.



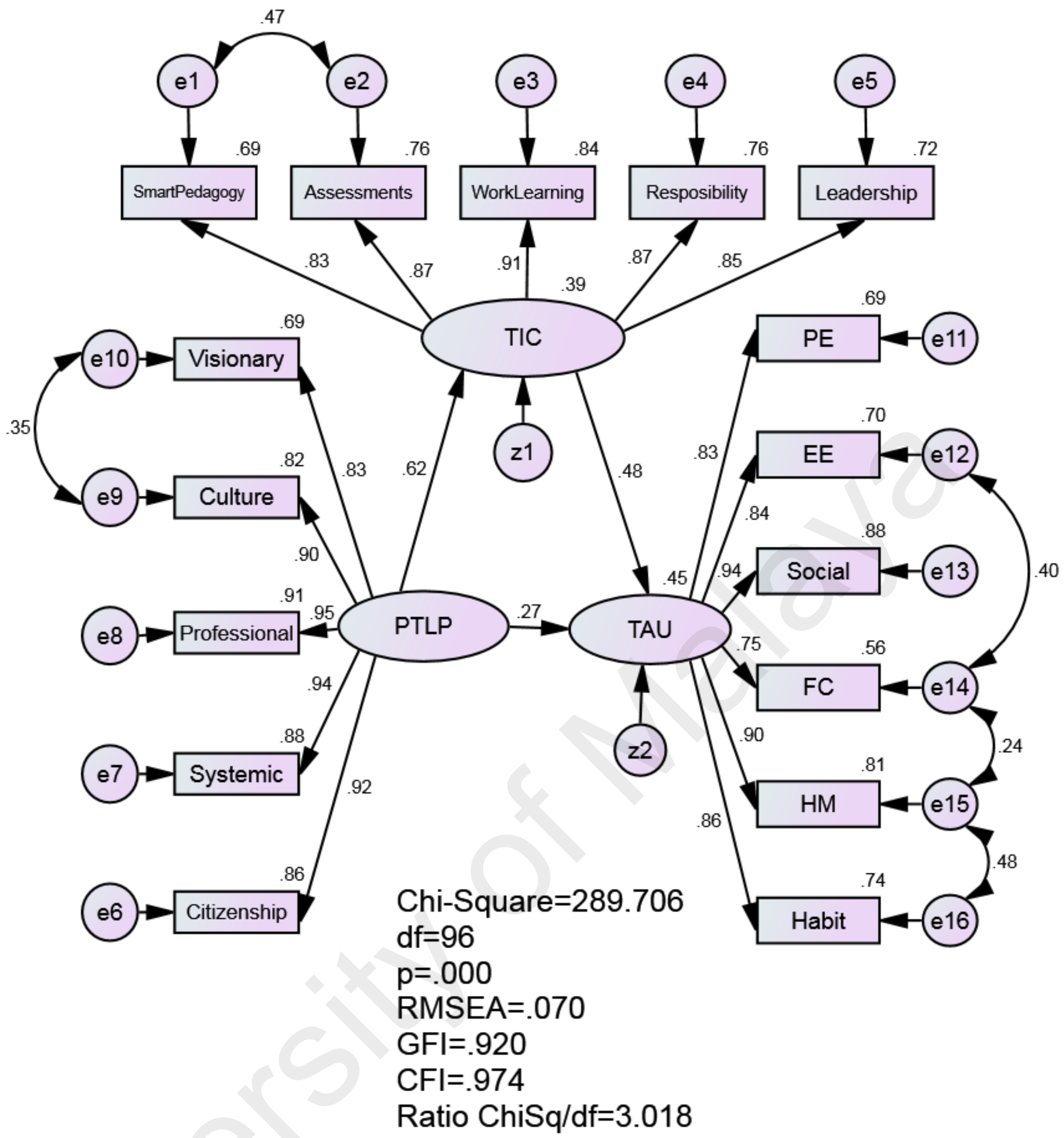
Note:
PTLP = Principal Technology Leadership Practices;
TAU = Teacher Acceptance and Use of SMS;
TIC = Teacher ICT Competency

Figure 4.49: The Proposed Structural Model

Based on Figure 4.49, the fitness indexes of the proposed structural model does not achieve the level of fitness required for RMSEA=.102 (>.08), GFI=.856 (<.90), and Ratio Chisq/df=5.370 (>5.0).

According to Byrne (2010), the re-specification procedure is the model-generating scenario where the researcher, having postulated and rejected a theoretically derived model on the basis of its poor fit to the sample data, proceeds in an exploratory fashion to modify and re-estimate the model. The primary focus, in this instance, is to locate the source of misfit in the model and to determine a model that better describes the sample data. The ultimate objective is to find a model that is both substantively meaningful and statistically well fitting.

Thus, based on the suggestion of the modification indices, few of the measurement errors need to be set as "free parameter" to improve the fitness of the model. The measurement errors that need to be correlated are e12 with e14 (M.I.=51.434, Par Change=.250), e1 with e2 (M.I.=51.816, Par Change=.124), e9 with e10 (M.I.=39.499, Par Change=.134), e15 with e16 (M.I.=30.526, Par Change=.126), and e14 with e15 (M.I.=30.167, Par Change=.127). After these measurement errors have been set as "free parameter", the researcher run the re-specified measurement model to check on the fitness indexes. The re-specified structural model is presented in Figure 4.50.



Note:
PTLP = Principal Technology Leadership Practices;
TAU = Teacher Acceptance and Use of SMS;
TIC = Teacher ICT Competency

Figure 4.50: Re-Specified Structural Model

Based on the re-specified structural model shown in Figure 4.50, it was found that all the fitness indexes [RMSEA=.070 (<.08), GFI=.920 (>.90), CFI=.974 (>.90), and Chisq/df=3.018 (<5.0)] have achieved the threshold values. This indicated that the re-specified structural model fits with the data collected from Negeri Sembilan secondary schools. The analysis yields text outputs as shown in Table 4.96 and Table 4.97.

Table 4.96: The Unstandardized and Standardized Regression Weights for the Re-specified Structural Model

Path			Unstand. β				Stand. β
			Estimate	S.E.	C.R.	p	
TAU	<---	PTLP	.261	.052	5.031	***	.266
TAU	<---	TIC	.598	.072	8.358	***	.475
TIC	<---	PTLP	.486	.037	13.155	***	.623

*** Correlation is significant at the 0.001 level

Based on the results showed on Table 4.96, the C.R. values for all the individual path are greater than 1.96 and statistically significant at p<.001. Furthermore, the standardized beta value for the PTLP→TAU path (β=.266), indicated that when principal technology leadership practices (PTLP) increase by one standard deviation, teacher acceptance and use of SMS (TAU) would increase .27 standard deviations. For the PTLP→TIC path, the standardized beta=.623, this meant that when principal technology leadership practices (PTLP) increase by one standard deviation, teacher ICT competency (TIC) would increase .62 standard deviations. Finally, for the TIC→TAU path with the beta value=.475 showed that when teacher ICT competency (TIC) increase by one standard deviation, teacher acceptance and use of SMS (TAU) would increase .48 standard deviations

Table 4.97: Squared Multiple Correlations for the Re-specified Structural Model

Construct	Estimate
TIC	.389
TAU	.454

Table 4.97 showed the values of squared multiple correlations for the two dependent constructs in the structural model. The squared multiple correlation for the first dependent construct, teacher ICT competency (TIC) is .389. This indicated that 38.9% of the variance in teacher ICT competency could be predicted by principal technology leadership practices. This means that there are as many as 61.1% of the variance in

teacher ICT competency acceptance are unable to be predicted by principal technology leadership practices as it may be caused by other variables (other factors) that are not examined in this study. The squared multiple correlation for the second dependent construct, teacher acceptance and use of SMS (TAU) is .454. This indicated that 45.4% of the variance in teacher acceptance and use of SMS could be predicted by principal technology leadership practices and teacher ICT competency. This means that there are as many as 54.6% of the variance in teachers' teacher acceptance and use of SMS are unable to be predicted by principal technology leadership practices and teacher ICT competency as it may be caused by other variables (other factors) that are not examined in this study.

In conclusion, data collected showed that the proposed structural model does not achieve the level of fitness required. This meant that the proposed structural model does not fit with the data collected from Negeri Sembilan secondary schools. Hence, a re-specified structural model (Figure 4.50) comprising principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS was established for this study.

4.5 Summary

This chapter presents the findings of the data collected from 417 secondary school teachers in Negeri Sembilan. Both descriptive and inferential statistics were used to analyze the data collected in order to answer the twelve research questions proposed for this study. The findings for each of the research questions are summarized in Table 4.98.

Table 4.98: Summary of the Research Findings

Research Question	Finding
1. What are the levels of teacher acceptance and use of SMS in Negeri Sembilan secondary schools?	Teachers in Negeri Sembilan secondary schools showed high level (M=6.85, S.D.=1.32) acceptance and use of School Management System.
2. What are the levels of principal technology leadership practices in Negeri Sembilan secondary schools?	Principals in Negeri Sembilan secondary schools showed high level (M=7.15, S.D.=1.26) of technology leadership practices.
3 What are the levels of teacher ICT competency in Negeri Sembilan secondary schools?	Teachers in Negeri Sembilan secondary schools showed high level of ICT competency.
4 Is there a significant relationship between the principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools?	There is statistically significant positive correlation which is moderately strong between principal technology leadership practices and teacher acceptance and use of SMS.
5 Is there a significant relationship between the principal technology leadership practices and teacher ICT competency in Negeri Sembilan secondary schools?	There is statistically significant positive correlation which is moderately strong between principal technology leadership practices and teacher ICT competency.
6. Is there a significant relationship between teacher ICT competency and teacher acceptance and use of SMS in Negeri Sembilan secondary schools?	There is statistically significant positive correlation which is moderately strong between teacher ICT competency and teacher acceptance and use of SMS.
7. Which of the principal technology leadership practices dimensions are the significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools?	Digital citizenship and visionary leadership are the two principal technology leadership practices dimensions that are statistically significant predictors of teacher acceptance and use of SMS.
8. Which of the principal technology leadership practices dimensions are the significant predictors of teacher ICT competency in Negeri Sembilan secondary schools?	Digital citizenship and systemic improvement are the two principal technology leadership practices dimensions that are statistically significant predictors of teacher ICT competency.
9. Which of the teacher ICT competency dimensions are the significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools?	Smart pedagogy, professional growth and leadership, and digital citizenship and responsibility are the three teacher ICT competency dimensions that are statistically significant predictors of teacher acceptance and use of SMS.
10 Is teacher ICT competency a mediator for the relationship between principal technology leadership practices and teacher acceptance and use of SMS?	There is a positive and partial mediating effect of teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS.
11 Do teacher demographic variables moderate the relationship between principal technology leadership practices and teacher acceptance and use of SMS?	All teacher demographic variables were not found to be statistically significant as moderators in the relationship between principal technology leadership practices and teacher acceptance and use of SMS.
12 Does the proposed model of principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS fit with the data collected from Negeri Sembilan secondary school teachers	The fitness indexes of the proposed structural model do not achieve the level of fitness required for RMSEA, GFI, and Ratio Chisq/df. Thus, a re-specified structural model was established for this study.

CHAPTER 5: DISCUSSIONS, IMPLICATIONS, AND CONCLUSIONS

5.1 Introduction

This chapter begins with a summary of the entire study. More specifically, it reviews the purpose of the study, theoretical and conceptual framework of the study, research design, population and sampling procedures, data analysis, and summary of major findings. It also provides a discussion on the results of the study in the light of relevant literature by interpreting the results drawn from data analysis in chapter four. The discussions are based on the objectives of the study that have been presented in chapter one. Further, the accomplishment of the research objectives is outlined as the summary of the findings. The next section explores the implications of the study, both theoretically and practically, in the fields of teacher acceptance and use of SMS, principal technology leadership practices, and teacher ICT competency, in particular, the relationship between these three variables. Then, the contributions of the findings drawn from this study to the body of knowledge are enlisted. Eventually, recommendations for further research are addressed before conclusions are made.

This study aims to investigate teachers' perception on the level of principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. The objectives of this study are as follows:

1) To analyze the level of:

    (i) teacher acceptance and use of SMS,

    (ii) principal technology leadership practices, and

(iii) teacher ICT competency in Negeri Sembilan secondary schools.

2) To examine the relationship between:

   (i) principal technology leadership practices and teacher acceptance and use of SMS,

   (ii) principal technology leadership practices and teacher ICT competency, and

   (iii) teacher ICT competency and teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

3) To analyze which of the principal technology leadership practices dimensions are the significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

4) To analyze which of the principal technology leadership practices dimensions are the significant predictors of teacher ICT competency in Negeri Sembilan secondary schools.

5) To analyze which of the teacher ICT competency dimensions are the significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

6) To assess the mediating effect of the teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

7) To assess the moderating effect of teacher demographic variables on the relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

8) To evaluate if the proposed model involving principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS fit with the data collected from Negeri Sembilan secondary school teachers.

Based on the objectives mentioned above, twelve research questions were formulated for this study. The data analysis in chapter four were conducted based on the research questions.

5.2 Summary of the Study

The main purpose of this study is to investigate whether principal technology leadership practices have a direct relationship with teacher acceptance and use of SMS or it is mediated by the teacher ICT competency. Hence, teachers' perception on the level of principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS were measured and the relationships between these variables in Negeri Sembilan secondary schools were identified.

The conceptual framework of this study was developed based on the Organizational Behavior Theory - Sociotechnical System Theory (Owens & Valesky, 2007), two leadership theories - Transformational Leadership Theory (Leithwood & Jantzi, 1999, 2006) and Path-Goal Theory (House, 1971, 1996; Northouse, 2013), and three technology acceptance and use theories - Theory of Reasoned Actions (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), Theory of Planned Behavior (Ajzen, 1991), and Social Cognitive Theory (Bandura, 1986, 1997). The development of this conceptual framework was further strengthened by the evidence of the relationships that exist between variables in literature reviews. In this framework, there are four main variables; (i) teacher acceptance and use of SMS; (ii) principal technology leadership practices; (iii) teacher ICT competency; and (iv) teacher demographic variables.

The first variable, teacher acceptance and use of SMS was based on UTAUT2 Model (Venkatesh et al., 2012), which comprised six dimensions: (i) Performance Expectancy; (ii) Effort Expectancy; (iii) Social Influence; (iv) Facilitating Condition; (v) Hedonic Motivation; and (iv) Habit.

The second variable, principal technology leadership practices comprised five dimensions according to the ISTE Standards•A (2009), these dimensions are: (i) Visionary leadership; (ii) Digital age learning culture; (iii) Excellence in professional practice; (iv) Systemic improvement; and (v) Digital citizenship.

The third variable, teacher ICT competency comprised five dimensions according to ISTE Standards•T (2008). These dimensions are (i) Smart Pedagogy; (ii) Digital age learning experiences and assessments; (iii) Digital age work and learning; (iv) Digital citizenship and responsibility; and (v) Professional growth and leadership.

Lastly, teacher demographic variables include gender, age, teaching experience, educational level, and experience in using computer. In this framework, teacher acceptance and use of SMS is the endogenous (dependent) variable in relationship with principal technology leadership practices as the exogenous (independent) variable, and teacher ICT competency as mediating variable while teachers' demographic variables as the moderating variables.

This is a non-experimental quantitative research using survey technique through the administration of a set of questionnaire that was developed for data collection. A cross-sectional and self-administered questionnaire was the data collection tool for this research design. The targeted population for this study comprised all public secondary day school teachers in Negeri Sembilan, Malaysia. There are 6499 teachers within 89 schools located in six different districts in Negeri Sembilan. The minimum number of respondents needed for this study at the significance level p=.05 is 362 teachers (Krejcie & Morgan, 1970). The selection of samples for this study was conducted in several stages using probability sampling procedure which involved proportional stratified random sampling, simple random sampling, and systematic random sampling. A total of 450 questionnaires were distributed to the respondents and a total of 417 valid questionnaires were returned and analyzed, representing a valid response rate of 92.7%.

The questionnaire was developed by the researcher to obtain information needed for the study. The instrument comprised scales which measured respondent demographic variables, principal technology leadership practices, teacher acceptance and use of SMS, and teacher ICT competency.

The developed instrument was pilot tested using 57 secondary school teachers in some secondary schools located in the states of Selangor, Perak, and Johor. Data gathered were analyzed using Statistical Package for Social Sciences (SPSS) version 22.0 for internal consistency of the instrument. The results of the analysis showed that the instrument achieved a good level of internal consistency.

Numerical data gathered were analyzed quantitatively using SPSS and AMOS version 22.0. Basically, there are four different types of statistical analysis that were carried out to answer the research questions. First, descriptive statistics in terms of mean and standard deviation were used to answer the first three research questions. Then, inferential statistic in terms of Pearson product-moment correlation tests were carried out to identify the relationship between variables and answer research questions four to six. Further, inferential statistic in terms of multiple regression analysis which is an extension of the bivariate correlation was carried out to answer research questions seven to nine. This multiple regression analysis was carried out in order to identify if change in the factors (predictor/ independent variables) contribute to change in the criterion/ dependent variable. Finally, SEM procedures with AMOS version 22.0 were carried out to answer research questions ten to twelve.

5.2.1 Summary of the Major Findings

The major findings of this study are summarized below.

The descriptive analysis indicated that teachers in Negeri Sembilan secondary schools showed high level of acceptance and use of SMS. Four out of the six teacher acceptance and use of SMS dimensions have high level of means while the other two dimensions demonstrated medium level of means. The dimension of facilitating conditions showed the highest mean, followed by performance expectancy, effort expectancy, hedonic motivation, social influence and the lowest mean was habit dimension.

The data indicated that teachers in Negeri Sembilan secondary schools perceived that their principals practice high level of technology leadership. Furthermore, the data showed that all the five dimensions of principal technology leadership practices are at the high level. These principals demonstrated highest practices in digital age learning culture dimension, followed by visionary leadership, digital citizenship, excellence in professional practice, and the lowest mean was systemic improvement dimension.

The descriptive analysis indicated that teachers in Negeri Sembilan secondary schools showed high level of ICT competency. Besides, these teachers also demonstrated high level of ICT competency for all the five dimensions of teacher ICT competency. The highest mean was recorded for smart pedagogy dimension, followed by digital age work and learning, digital age learning experience and assessments, digital citizenship and responsibility, and the lowest mean was professional growth and leadership dimension.

The Pearson product-moment correlation analysis showed that there is a statistically significant positive correlation which is moderately strong between principal technology leadership practices with teacher acceptance and use of SMS, and teacher ICT competency in Negeri Sembilan secondary schools. Additionally, all the five principal technology leadership practices dimensions are statistically significant and positively correlated with teacher acceptance and use of SMS and teacher ICT competency.

Furthermore, the Pearson product-moment correlation analysis also showed that there is a statistically significant positive correlation which is moderately strong between teacher ICT competency and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Additionally, all the five teacher ICT competency dimensions are statistically significant and positively correlated with teacher acceptance and use of SMS.

Multiple regression analysis revealed that dimensions of digital citizenship and visionary leadership, among the principal technology leadership practices, are the two significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools. On the other hand, dimensions of digital citizenship and systemic improvement, among the principal technology leadership practices, are found to be the two significant predictors of teacher ICT competency.

From the multiple regression analysis, it was found that dimensions of smart pedagogy, professional growth and leadership, and digital citizenship and responsibility, among the teacher ICT competency, are the three significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

The data suggested that there is positive and partial mediating effect of teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS.

From the multi-group path analysis for each of the teachers' demographic variables which included gender, age, educational level, teaching experience, and experience in using computer, it was found that all the five teacher demographic variables are not moderating the relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

Data collected was analyzed to see if it fits the proposed model of principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS. The analysis showed that the proposed structural model does not achieve the level of fitness required. This meant that the proposed structural model does not fit with the data collected from Negeri Sembilan secondary schools. Hence, a re-specified structural model comprising principal technology leadership, teacher ICT competency,and teacher acceptance and use of SMS was established for this study. This model will be discussed further in the next section.

5.3 Discussions

The discussion of the findings in this chapter is based on the objectives of this study that have been presented in chapter one. In addition, the researcher also provides an analytical discussion and compares with previous research from the literature in chapter two. The discussions are intended to provide answers to the research questions proposed and answers to the research questions would lead to the achievement of the objectives of the study. Finally, the strength of the established structural model of this study is reviewed and discussed.

5.3.1 The Level of Teacher Acceptance and Use of SMS

The results of this study indicated that Negeri Sembilan secondary school teachers showed high level of acceptance and use of SMS. This could be interpreted as teachers in Negeri Sembilan secondary schools demonstrated very positive attitudes toward the acceptance and use of SMS. This was supported by Albirini (2006), Demirci (2009), Teo (2008), and Pynoo and van Braak (2014) who also found that teachers' positive attitude towards ICT is the key factor for enhancing teacher acceptance and use of ICT. Besides, this finding is also an excellent indicator of where these teachers have the confidence, desire and ready to accept and use SMS in carrying out their routine work.

This was further supported by Madiha Shah (2014) who stated that the main objective of SMS is to implement and design the routine school's procedures and processes that able to provide suitable detailed reports in a consistent, accurate and timely manner. Thus, the researcher concluded that the use of information technology in school management have shown some progress. In fact, these could be said that the usage of information system in school management is increasingly popular among teachers (Madiha Shah, 2014).

Based on the analysis, four out of six dimensions of teacher acceptance and use of SMS showed high level of means while the other two dimensions demonstrated medium level of means. This reflected that teachers found that performance expectancy, effort expectancy, facilitating conditions, and hedonic motivation are more important factors regarding their acceptance and use of SMS compared with social influence and habit. This was supported by Wozney et al. (2006), who found that technology innovations are most likely to be accepted by teachers if the perceived value of the innovation usage and its' expectancy of success are high. They revealed that perceived value of innovation usage and expectancy of success was the most crucial issues in differentiating teachers' computer acceptance and usage level.

The result further revealed that facilitating conditions dimension showed the highest mean, followed by performance expectancy, effort expectancy, hedonic motivation, social influence and the lowest mean was habit dimension. In facilitating conditions dimension, the respondents showed high level of agreement on the statements that they have the necessary knowledge, tools such as desktop, laptop, or smartphone, and facilities such as computer lab and internet access to use SMS. However, the respondents found that the SMS is less compatible with other technologies they are using. One possible explanation for this might be due to the SMS was implemented to teachers without special training to expose them to the setting of SMS. Hence, these teachers are unfamiliar with the SMS setting and just use by “try and error” effort. This was supported by Omoogun et al. (2013) who found that regardless of the amount of ICT infrastructure and its sophistication, it will not be used unless practitioners have the necessary skills and knowledge to infuse it into their daily practices.

As for the second dimension of performance expectancy, the respondents agreed that using the SMS could improve their job performance; enables them to accomplish their tasks more quickly; and increase their productivity. These findings were consistent with the studies conducted by Kripanont (2006) and Mas Nida et al. (2011) who found that the use of internet and laptop could help to improve their work quality. However, the respondents rated the lowest level of agreement on the usefulness of SMS in their daily work. This could be due to the fact that during data collection duration (July to August 2015), the SMS is a newly developed system implemented to all Malaysian secondary schools and not much of it functions have been fully utilized yet. Thus, teachers only used it for several student management purposes only. This was supported by Straub (2009) who found that individual’s beliefs and attitudes toward an innovation are formed over time and this could influence their decision on innovation adoption behavior.

The third dimension is effort expectancy, the respondents agreed that learning to operate SMS is easy; interaction with SMS is understandable; and they easily become skillful in using SMS. This finding indicated that these teachers have the necessary knowledge to deal with SMS which was supported by facilitating conditions finding presented earlier. However, teachers need training and guideline to be familiar with the

SMS setting. Furthermore, this findings were supported by many previous studies (Hussin et al., 2011; Pynoo et al., 2011; Raman, 2011; Teo, 2010b, 2011; Teo & Noyes, 2014) who found that perceived ease of use is one of the determinants of teacher acceptance and use of an information system.

The fourth highest ranking dimension is hedonic motivation. The respondents found that using SMS is a wise idea and could increase their motivation for work. This finding could reaffirm and support by the previous dimensions where teachers found themselves have the necessary knowledge, tools, and facilities to use SMS, felt that the use of SMS could enhance their quality of work, and did not face any difficulties in using SMS. Besides, the respondents also found that working with SMS is enjoyable. Additionally, this finding was supported by the empirical studies conducted by Bruner II and Kumar (2005), H.-M. Lai and Chen (2011), Liaw et al. (2007), Teo and Noyes (2011), Thong et al. (2006) who found that perceived enjoyment is a significant predictor of teacher acceptance and use of technology. This was further supported by Phua et al. (2012) who found that perceived enjoyment showed the strongest positive correlation with teacher intention to use internet as a teaching-learning tool.

Based on analysis of the social influence dimension which showed medium level of it overall mean, the respondents agreed that their school administrators and colleagues think that they should use SMS. This finding was supported by Franklin (2007) who found that importance other opinions or suggestions within the school setting influence teacher acceptance and use of instructional technology. Besides, many previous studies (Hussin et al., 2011; Oye et al., 2011; Pynoo et al., 2011; Raman & Yahya Don, 2013; Teo, 2010b, 2011; Teo & Noyes, 2014; W.-T. Wang & Wang, 2009) showed that social influence or subjective norm is a significant predictor of teacher acceptance and use of ICT. On contrary, Ma et al. (2005) found that social influence did not have any direct or indirect significant effects on teachers' intention towards technology acceptance and use. In line with Ma et al.'s finding, the respondents in this study found that their students and their students' parents are less preferable to the use of SMS. As mentioned earlier, this might due to the SMS is a newly developed system implemented and not much of it functions have been utilized yet. Although school administrators and teachers have been exposed to its uses, but students and their parents might not be able to use it at the moment when the data were collected.

Habit dimension showed the lowest mean among all the six dimensions of teacher acceptance and use of SMS. Although the respondents agreed that they need to use SMS in their daily works and they also make decisions based on its information, but the respondents seldom rely on SMS in their daily work. As explained earlier, this might due to the fact that the limited utilization of SMS as it was just implemented mandatory from January 2015 which is less than half a year during the data were collected.

In conclusion, the data indicated that Negeri Sembilan secondary school teachers showed high level of acceptance and use of SMS and they perceived that performance expectancy, effort expectancy, facilitating conditions and hedonic motivation are more important factors regarding their acceptance and use of SMS compared with social influence and habit. In addition, the findings also revealed that these teachers have the necessary knowledge, tools, and facilities to use SMS; felt that the use of SMS could enhance their quality of work; require less of their effort in using SMS; and felt motivated and enjoyable in using SMS. Hence, in order to promote teacher acceptance and use of SMS in Malaysian secondary schools, the concerned authorities must take into consideration about the factors that influence teacher acceptance and use of SMS that emerged from the findings of this study.

5.3.2 The Level of Principal Technology Leadership Practices

In this study, principal technology leadership practices were measured based on ISTE Standards•A (2009) which comprised five dimensions; (i) Visionary Leadership; (ii) Digital Age Learning Culture; (iii) Excellence in Professional Practice; (iv) Systemic Improvement and (v) Digital Citizenship. The results of this study indicated that teachers in Negeri Sembilan secondary schools perceived their principals demonstrated high level of principal technology leadership practices for all the five dimensions. This finding was in line with Alan Seay (2004) who found that the principals in Texas High School demonstrated a high mean score for all the ISTE Standards•A dimensions. Similar findings were also reported by Alkrdem (2014), Eren and Kurt (2011), Faridah (2011) and Moktar (2011). This finding reflected that principals in Negeri Sembilan secondary schools have realized their role as technology leaders and they are capable of playing technology leadership role in their daily practices as observed by their teachers. This implied that the principal roles have changed from technology administrator to technology leader in which technology usage is moving towards acculturation. This was supported by Lecklider et al. (2009) who found that school administrators are attempting to create a culture at their school that promotes learning-centered environments and instructional innovation. The high level of principal technology leadership might be due to Malaysian principals have been exposed to the smart school concept and attended numerous technology training programs. This was supported by the findings of Dawson and Rakes (2003) and Jackson (2009) who found that the technology training for principals influences ICT integration in schools. On contrary, this finding rejected Rossafri and Balakrishnan (2007) findings who found that most of the principals were at low level of technology leadership. This could be explained by the fact that after more than twenty years the smart school program has been initiated, and currently, in the 21st century, the principals have shown aggressive transformation and commitment toward their role as technology leaders. In other words, they are moving into the fourth wave of the Smart Schools Roadmap (2011-2020) which is called as the consolidation and stabilization phase according to the Policy on ICT in Education for Malaysia (Ministry of Education Malaysia, 2010). In this phase, technology would become an integral part of the nation's learning process.

The result further revealed that these principals demonstrated highest practices in digital age learning culture dimension, followed by visionary leadership, digital citizenship, excellence in professional practice, and the lowest mean was systemic improvement dimension. In digital age learning culture dimension, the respondents perceived that their principals promote effective use of ICT for learning in their school; ensure effective practice in the ICT usage across the curriculum; and promote participation in learning communities. This showed that the principals are concerned about students' learning outcome and pedagogical quality through technology usage (Tan, 2010). According to Chang et al. (2008), school leaders must understand the importance of ICT for students as well as to provide technology enriched environment for student learning. However, in this study, the respondents perceived that their principals do not provide enough of technology learner-centered environments to meet diverse needs of learners. This might be due to lack of resources which is one of the five main obstacles faced by the school principals in practicing technology leadership (Sincar, 2013).

The second dimension is visionary leadership, the respondents perceived that their principals advocate various activities to support the implementation of technology-infused strategic plans; lead the development of a shared vision that maximizes ICT usage in their school; and promote participation of school community in planning technology-infused strategic plans. These findings showed that the principals are aware of their responsibility as technology leader which is to implement and develop a clearly understand school technology vision and technology-infused strategic plans together with their school community. These findings were supported by Chang et al. (2008) who found that principals need to implement and develop a visionary long-range technology strategic plan to be an effective technology leader. This was further supported by Richardson et al. (2013) who found that successful technology leader should be able to inspire a shared vision for the comprehensive technology integration and at the same time able to foster a culture and conducive environment for the realization of this vision.

The third dimension is digital citizenship, the respondents perceived that their principals promote and model legal and ethical ICT usage; and promote responsible social interactions related to the ICT usage. These findings indicated that the principals are able to display greatest awareness on social, ethical and legal issues regarding the use of ICT among their school community. These findings were supported by Garland (2009) and Ribble and Miller (2013) who found that school leaders as technology leaders have to promote safe internet use policies, protect student privacy, and adhere to copyright law to reduce technology abuse and misuse among their school community. According to Flanagan and Jacobsen (2003) and Garland (2009), school principals as technology leaders should ensure equity of access in order to facilitate school technology reform initiatives. On contrary, the respondents in this study perceived that their principals do not ensure equitable access to digital tools and resources to meet the needs of learners. This finding could reaffirm the previous finding on digital age learning culture dimension, where the respondents perceived that their principals do not provide enough technology learner-centered environments to meet diverse needs of learners. As mentioned earlier, this might be due to lack of resources faced by the school principals in practicing technology leadership (Sincar, 2013).

The fourth dimension is excellence in professional practice, the respondents perceived that their principals stay abreast of emerging trends regarding effective use of technology; model and promote effective communication and collaboration among school community using ICT; and encourage evaluation of new technologies potential to improve student learning. These findings indicated that the principals are concerned about the latest technology development trends and become role models for their school community in using ICT. These findings were supported by Kozloski (2006) and Sathiamoorthy et al. (2012) who found that the best strategy used by principals in leading technology integration among their teacher is modelling. Besides, Kozloski (2006) also found that being a technology leader, principals must ensure that their teachers receive adequate professional development, technical support, and resources to realize the benefits of instructional technology usage. This was further supported by Chang et al. (2008) and Sharija and Watters (2012) who found that principals as technology leader need to provide opportunities for school development and must ensure that the technology infrastructure in their school is well prepared. On contrary, the respondents in this study perceived that their principals do not allocate enough resources (time, facilities, etc.) to ensure teacher ongoing professional development in ICT fluency. This finding further confirmed the two previous findings, where the respondents perceived that their principals do not provide enough technology learner-centered environments and do not ensure equitable access to digital tools and resources to meet the needs of learners. As explained earlier, this could be due to lack of resources faced by the school principals in practicing technology leadership (Sincar, 2013).

The lowest mean was systemic improvement dimension, the respondents perceived that their principals are able to lead purposeful change to maximize the achievement of learning goals through appropriate use of ICT resources; and collaborate with various parties (school communities, others academician, etc) to improve students' learning and staff performance. These findings showed that the principals believed that the use of ICT could improve students' learning as well as improve their staff performance. This might be due to the principals were briefed and disclosured about the importance of ICT in instructional and school management in various training programs they have attended. These findings were supported by Chang et al. (2008) who found that principals as effective technology leader should provide necessary training and professional development programs for their teachers and students. Meanwhile, school leaders should encourage, empower and collaborate with experts to support technology integration. This was further supported by Yee (2000) who found that principals should display a passionate commitment to provide appropriate professional staff development to enhance their teacher' ICT skills by utilizing social network to locate expertise for technology integration, Thus, it is important for principals to seek advice and assistance from a technology experts for the betterment of their schools (Afshari et al., 2008). However, the respondents in this study perceived that their principals do not demonstrate very high practices in inviting highly technology competent personnel to advance school's ICT goal. This might be due to most of these expert teachers have their own duties in school. Because of the heavy workloads, they do not have time to attend other school programs to help teachers in technology integration.

Overall, teachers in Negeri Sembilan secondary schools perceived their principals practice high level of technology leadership. Furthermore, the data showed that all the five dimensions of principal technology leadership practices are at the high levels. This indicated that these principals have realized their role as technology leaders and they are capable of playing technology leadership role in their daily works. Besides, these principals demonstrated highest practices in digital age learning culture dimension, followed by visionary leadership, digital citizenship, excellence in professional practice, and the lowest mean was systemic improvement dimension. This study revealed that in order to act as an effective technology leader, principals need to concern about students' learning outcome and pedagogical quality through technology usage; implement and develop a shared vision and technology-infused strategic plans with school community; display greatest awareness on social, ethical and legal issues regarding the use of ICT; concern about the latest technology development trends and become role models in using ICT; and believe that the use of ICT could improve students' learning as well as improve their staff performance. In addition, as an effective technology leader, the principal must also be accountable for providing technology learner-centered environments; ensuring equitable access to digital tools and resources to meet the needs of learners; allocating enough resources (time, facilities, etc.) to ensure teacher ongoing professional development in ICT fluency; and desperately trying to cope with its insufficiency.

5.3.3 The Level of Teacher ICT Competency

In this study, teacher ICT competency were measured according to the ISTE Standards•T (2008) which comprised five dimensions: (i) Smart Pedagogy; (ii) Digital age learning experiences and assessments; (iii) Digital age work and learning; (iv) Digital citizenship and responsibility; and (v) Professional growth and leadership. Data indicated that teachers in Negeri Sembilan secondary schools showed high level of ICT competency for all the five dimensions of teacher ICT competency. This finding was consistent with the findings of the studies conducted by Harin Hafian (2011), Tasir et al. (2012), and Umar and Mohd Yusoff (2014), who also found that Malaysian teachers demonstrated high level of ICT competency. The high level of teacher ICT competency could imply that various training programs that have been implemented by the Malaysian government throughout the years have proved to be beneficial because majority of the secondary school teachers who have attended such programs have begun to be more computer literate. Besides, the level of principal technology leadership practices also showed similar finding, this imply that Malaysian principals and teachers are moving into the fourth wave of the Smart Schools Roadmap (2011-2020) which is the consolidation and stabilization phase according to the Policy on ICT in Education for Malaysia (Ministry of Education Malaysia, 2010) where technology usage has become an integral part of the nation's learning process.

The results further revealed that the highest mean was smart pedagogy dimension, followed by digital age work and learning, digital age learning experience and assessments, digital citizenship and responsibility, and the lowest mean was professional growth and leadership dimension. In smart pedagogy dimension, the respondents rated themselves as being very competent in using ICT to promote students' creative and innovative thinking; to engage students in exploring real-world issues; and to promote student reflection on learning. These findings reflected that the teachers are embedded with the use of ICT in their instructional practices. On top of that, this also implies that the investment and policies in getting Malaysian teachers to embed with the ICT usage have shown some progress. This might be due to the fact that these teachers are well-trained on how to effectively use instructional technology in their teaching training colleges as one of the compulsory courses. This was supported by W. Chen et al. (2010) and K.-T. Wong et al. (2012) who found that in order to ensure that teachers are able to integrate technology into the curriculum to enhance students' learning, the groundwork must be laid at the pre-service teachers' level. Furthermore, Franklin (2007) found that teacher must possess certain amount of technology competency and technology must be rooted in curriculum goal and integrated with subject matter content. This was further supported by Knezek and Christensen (2002) and Varol (2013) who found that teacher ICT competency is the principle determinant to influence teacher effective use of ICT in their classroom practices.

The second dimension is digital age work and learning. The respondents rated themselves as highly competent in using ICT to facilitate learning process (e.g. locate, analyze, evaluate information etc) and research process (e.g. locate information, analyze data etc). Besides, the respondents are able to communicate effectively with school community using ICT. This finding is consistent with the study conducted by Yusuf and Balogun (2011) who found that the use of ICT as a tool within the school context includes use for school management and administration; teaching and learning of ICT related skills for enhancing the instructional presentation, teaching and learning repetitive tasks, teaching and learning thinking, intellectual and problem-solving skills, stimulating creativity and innovative; for teachers and students research; and as a communication tool. According to Pynoo et al. (2011) teachers need to be constantly adapted with new technology competency in order to keep pace with the acceleration rate of technological advancement. On contrary, in this study, the respondents rated themselves as being less competent in using ICT to demonstrate fluency in new technology knowledge. This might due to the limited access to appropriate ongoing professional development for the teacher. This was supported by Archibong et al. (2010) and Flanagan and Jacobsen (2003) who found that teachers have lacked meaningful opportunities to acquire the latest technology skills to meet the ICT outcome.

The third dimension is digital age learning experiences and assessments. The respondents rated themselves as highly competent in using ICT to provide students with varied assessments (formative, summative, etc); to share relevant learning experiences for students; and to customize learning activities to address students' diverse learning styles. These findings revealed that teachers are using ICT to prepare exercise or examination papers which is one of their core duties and able to use ICT as presentation tools such as powerpoint, and audio and video files in their classroom practices. This was supported by Kozloski (2006) who found that the key component in the ideal technology learning environment is to engage student learning and authentic performance assessments. This was further supported by W. Chen et al. (2010) who found that teachers are very familiar with presentation software and communication tools for teaching.

In the fourth dimension digital citizenship and responsibility. The respondents rated themselves as highly competent in using ICT to address diverse needs of learners by using learner-centered strategies; to promote policies for legal and ethical ICT usage to their students; and to promote responsible social interactions. This finding reflected that the teachers are concerned about the social, ethical and legal issues regarding the use of ICT among their students. The researcher found this might be due to the growing rate of the cyberbullying incidents that have been reported in the social media require proactive action from the school teachers to enlighten their students about the importance of maintaining the ethical use of ICT. According to Ribble and Miller (2013), the extensive use of technology by today's students has caused the cyberbullying potential to grow exponentially. Hence, teachers must focus on safety, legal, and ethical behaviors as they pertain to use instructional technology (Raob et al., 2012). According to Raob et al. (2012), global awareness is one of the competencies needed for successful educational technology integration in the 21st century. However, the respondents are less competent in using ICT to develop cultural understanding and global awareness with school community of other cultures. This could be due to not many Malaysian teachers have the opportunity the deal with school-related activities at the international level. Hence, teachers are not exposed to develop their cultural understanding and global awareness.

The lowest mean dimension is professional growth and leadership. In this dimension, the respondents rated themselves as highly competent in using ICT to enhance the teaching profession of their school community; to participate in school community building; to evaluate on effective ICT usage practices in student learning; and to participate in local learning communities to explore creative teaching and learning applications. These findings showed that the teachers continuously strived to improve their professional practices by promoting and demonstrating effective use of ICT. This was supported by Sa'ari et al. (2005b) who found that teachers should be encouraged to create or design more technology-based activities, and share information and strategies dealing with instructional technology among their communities so that they will collectively gain a better understanding of the new digital era technology. However, the respondents rated themselves as being less competent in using ICT to participate in shared decision making; to participate in global learning communities to explore creative teaching and learning applications; and to demonstrate vision of technology infusion. This reflected that the teachers are not competence in leadership skills and dealing with international activities. As mentioned earlier, this could be due to not many Malaysian teachers have the opportunity to participate in the international level activities. Furthermore, teachers are not much exposed to leadership skills as their professional training programs normally focus on technology integration in their instructional practices.

In conclusion, the data indicated that teachers in Negeri Sembilan secondary schools showed high level of competency in all the five teacher ICT competency dimensions. This implies that various training programs that have been implemented by the Malaysian government throughout the years have proved to be beneficial. The results further revealed that these teachers were highly competence in using ICT to promote students learning and assessment; to facilitate learning and research process; to communicate effectively with school community; to promote policies for legal and ethical ICT usage, and responsible social interactions; to enhance professional development of school community; and to participate in local learning communities to explore creative teaching and learning applications but less competence in in using ICT to demonstrate fluency in new technology knowledge; to develop cultural understanding and global awareness with school community of other cultures; to participate in shared decision making; to participate in global learning communities to explore creative teaching and learning applications; and to demonstrate vision of technology infusion. The researcher believes this may be due to teachers have limited access to appropriate ongoing professional development, limited opportunity the deal with the international level of school-related activities and are not exposed to leadership skills as their professional training program. Hence, in order to ensure teachers' ICT competency development, concerned authorities must provide ongoing professional development to cope with the issues that emerge from the findings of this study.

5.3.4 Relationship between Principal Technology Leadership Practices and Teacher Acceptance and Use of SMS

The result of the Pearson product-moment correlation test showed that there is statistically significant positive correlation which is moderately strong between principal technology leadership practices and teacher acceptance and use of SMS. This positive correlation revealed that if the principal practices higher level of technology leadership, the level of teacher acceptance and use of SMS will be increased as well. Thus, principal technology leadership practices variable is confirmed as one of the factors that influence teacher acceptance and use of SMS. The relationship that exist between principal technology leadership practices and teacher acceptance and use of

SMS could be supported by many leadership theories (Bass & Bass, 2008; Bush, 2011; Leithwood & Jantzi, 2006; Northouse, 2013; Owens & Valesky, 2007; Robbin & Judge, 2013; Yukl, 2013) that have been presented earlier in chapter two, who found that leadership is a process of influence through social interaction. This finding was further supported by the empirical study findings conducted by Fisher (2013), Franklin (2007), Hatlevik and Arnseth (2012), Jackson (2009), Leong (2010), Mohd Jamil (2011), Tan (2010), Ting (2007), and C.-h. Wang (2010) who found that principal technology leadership practices significantly influence teachers' technology usage.

On contrary, this finding rejected the results of the study conducted by Lafont (2011), and Page-Jones (2008) who found no significant relationship between principal technology leadership with teacher technology usage and the study conducted by Smith (2011), and Watts (2009) who found that principal technology leadership was not a predictor of teacher technology usage. This could be explained by the fact that these researchers are correlating two different set of responses which are from the principals and teachers. As explained earlier, the influence of a leader towards his/her followers should be measured from the perceptions of the follower towards the leader leadership behavior, because how the followers perceive their leader leadership behaviors will directly influence them in term of behavior and attitudes in the usage of technology (Luo, 2004; Sharma, 2011; Sharma et al., 2012).

An overall moderately strong correlation may be due to the principals could not provide adequate ICT facilities and resources to help teachers to access it when needed. This can be shown by the lowest correlation between digital age learning culture dimension with teacher acceptance and use of SMS. Furthermore, this could be supported by the findings on the level of principal technology leadership practices in

Section 5.3.2, where the respondents perceived that their principals do not allocate enough resources (time, facilities, etc.) to ensure teacher ongoing professional development in ICT fluency, and do not ensure equitable access to digital tools and resources to meet the needs of learners.

Further inter-correlation analysis between each of the principal technology leadership dimensions with teacher acceptance and use of SMS indicated that there are three out of five of the principal technology leadership dimensions (excellence in professional practice, systemic improvement, and digital citizenship) have statistically significant positive correlation that is moderately strong with teacher acceptance and use of SMS and two dimensions (visionary leadership, and digital age learning culture) demonstrated weak but statistically significant correlation with teacher acceptance and use of SMS.

In conclusion, the findings of this study clearly showed that there is a statistically significant correlation between principal technology leadership practices with teacher acceptance and use of SMS among teachers in Negeri Sembilan secondary schools. Based on this finding, the researcher argues that in order to increase the level of acceptance and use of SMS among teachers, the fundamental requirement that need to be implemented by the concerned authorities is to increase the awareness of school leaders about their role as technology leaders. This was supported by Afshari, Kamariah, et al. (2009b) who found that principals' awareness, understanding, and use of ICT are essential for effective use of ICT in school. Furthermore, this study revealed that principals who act as successful technology leaders should continuously strive to enhance teacher acceptance and use of SMS in school management to achieve greater efficiency and effectiveness.

5.3.5 Relationship between Principal Technology Leadership Practices and Teacher ICT Competency

Pearson product-moment correlation analysis showed that there is statistically significant positive correlation which is moderately strong between principal technology leadership practices and teacher ICT competency. This positive correlation revealed that if the principal practices higher level of technology leadership, the level of teacher ICT competency will be increased as well. This finding confirmed that principal technology leadership practices variable is one of the factors that influence teacher ICT competency. The relationship that exist between principal technology leadership practices and teacher ICT competency could be supported by many leadership theories (Bass & Bass, 2008; Bush, 2011; Leithwood & Jantzi, 2006; Northouse, 2013; Owens & Valesky, 2007; Robbin & Judge, 2013; Yukl, 2013) who found that leadership is a process of influence through social interaction. In addition, Yukl (2013) portrayed that the leader influence is usually in terms of how the leader causes the subordinate to be more motivated and more capable of performing the designated task. In order to be more capable of performing the designated task, the leader should provide the necessary knowledge and skills for the teacher. In the context of this study, the principal needs to provide teachers with ICT competency so that they can carry out their daily work by using SMS. This finding was further supported by the empirical study findings conducted by Harin Hafian (2011) and Moktar (2011), who found that there was a significant relationship between principal technology leadership practices with teacher ICT competency.

On top of that, inter-correlation analysis between each of the principal technology leadership dimensions with teacher ICT competency showed that there are three out of the five of the principal technology leadership practices dimensions (excellence in professional practice; systemic improvement; and digital citizenship) have statistically significant positive correlation that is moderately strong with teacher ICT competency while two dimensions (visionary leadership, and digital age learning culture) demonstrated weak but statistically significant correlation with teacher ICT competency.

In conclusion, this study found that there is a statistically significant correlation between principal technology leadership practices with teacher ICT competency among teachers in Negeri Sembilan secondary schools. Based on this finding, the researcher argues that in order to increase the level of teacher ICT competency, the fundamental requirement that needs to be implemented by the concerned authorities is to increase the awareness of school leaders about their role as a technology leader. This was supported by Afshari, Kamariah, et al. (2009b) who found that principals' awareness, understanding, and use of ICT are essential for effective use of ICT in school. Furthermore, this study revealed that principals who act as successful technology leaders should continuously strive to enhance teacher ICT competency and this could influence teacher acceptance and use of SMS in school management.

5.3.6 Relationship between Teacher ICT Competency and Teacher Acceptance and Use of SMS

The result of the Pearson product-moment correlation analysis showed that there is a statistically significant positive correlation which is moderately strong between teacher ICT competency and teacher acceptance and use of SMS. The positive correlation revealed that teacher with a higher level of ICT competency will demonstrate a higher level of acceptance and use of SMS. Furthermore, the inter-correlation analysis between each of the teacher ICT competency dimensions with teacher acceptance and use of SMS also showed a statistically significant positive correlation that is moderately strong with teacher acceptance and use of SMS. Based on these findings, teacher ICT competency is confirmed as one of the factors that influence teacher acceptance and use of SMS. This was supported by the empirical study findings conducted by Buabeng-Andoh (2012a), Chai (2010), Hsu (2010), Jegede et al. (2007), B. T. Lau and Sim (2008), Sa'ari et al. (2005b), and Ting (2007), who found a significant relationship between teacher ICT competency with their attitudes towards computer, level of computer usage, and more specifically, acceptance and use of ICT. This was further supported by Varol (2013) who stated that teacher ICT competency has been viewed as the critical factor that affects teachers' decision about their classroom practices.

In conclusion, this study found that there is a statistically significant correlation between teacher ICT competency with teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Based on this finding, the researcher argues that teacher ICT competency is another important factor that influences teacher acceptance and use of SMS in addition to the principal technology leadership practices. The findings of this study showed that both teacher ICT competency and principal technology leadership practices have significant influences on teacher acceptance and use of SMS. Furthermore, the positive correlation between teacher ICT competency with teacher acceptance and use of SMS revealed that regular professional development to improve teacher ICT competency would help to enhance their level of acceptance and use of SMS. Hence, in order to enhance teacher acceptance and use of SMS, there is an urgent need for the teacher to acquire a higher level of ICT competency for the betterment of school management by using SMS in Malaysian secondary schools.

5.3.7 Effects of Principal Technology Leadership Practices on Teacher Acceptance and Use of SMS

The discussion in section 5.3.4 revealed that there is a statistically significant relationship between principal technology leadership practices with teacher acceptance and use of SMS. However, the analysis did not provide any information about which of the principal technology leadership dimensions influence teacher acceptance and use of SMS. Hence, the researcher carried out further analysis (step-wise multiple regression) to determine which of the principal technology leadership practices dimensions are the significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

Based on the result of the multiple regression analysis, it was found that digital citizenship and visionary leadership are the two principal technology leadership practices dimensions that are statistically significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Similar findings were also reported by Leong (2010) and Mohd Jamil (2011), who also found that visionary leadership and digital citizenship are the significant predictors of teachers' ICT application. Besides, this finding implies that the level of teacher acceptance and use of

SMS will be increased when teachers perceived that their principal concerns about social, ethical and legal issues regarding the use of ICT among their school community, and implement and develop a clearly understand school technology vision and technology-infused strategic plans together with their school community.

Digital citizenship dimension is the dominant predictor of teacher acceptance and use of SMS. This showed that the teachers are concerned about whether their principals are able to model and facilitate understanding of social, ethical and legal issues, and responsibilities related to SMS usage. The researcher argues that this may be due to the increasing rate of cyberbullying incidents that have been reported in the social media in recent years has caused the teachers to require proactive action from school principals to enlighten their school community about the importance of maintaining the ethical SMS usage. This was consistent with the findings reported by Garland (2009) and Ribble and Miller (2013) who found that school leaders as technology leaders have to promote safe internet use policies, protect student privacy, and adhere to copyright law to reduce technology abuse and misuse among their school community.

Visionary leadership dimension is the second predictor of teacher acceptance and use of SMS. This may be due to the fact that the teachers are concerned about whether their principals are able to inspire and lead the development and implementation of a shared vision for comprehensive integration of information technology to promote excellence and support transformation throughout the school. This finding was supported by Chang et al. (2008) who found that principals need to implement and develop a visionary long-range technology strategic plan to be an effective technology leader, and Richardson et al. (2013) who found that successful technology leader should be able to inspire a shared vision for the comprehensive technology integration and at the same time able to foster a culture and conducive environment for the realization of this vision.

In conclusion, digital citizenship and visionary leadership are the two principal technology leadership practices dimensions that are statistically significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools. This finding implies that the level of teacher acceptance and use of SMS will be increased when teachers perceived that their principal concerns about social, ethical and legal issues regarding the use of ICT among their school community, and implement and develop a clearly understand school technology vision and technology-infused strategic plans together with their school community. Hence in order to enhance teacher acceptance and use of SMS, there is a need to promote principal technology leadership practices according to the dimensions which have higher impact on teacher acceptance and use SMS that emerged from the findings of this study. Based on these findings, it is hoped that the proposed technology leadership model can be developed into a module to provide guidance to school principals in order to improve their level of technology leadership practices according to the dimensions that have higher impact on teacher acceptance and use of SMS.

5.3.8 Effects of Principal Technology Leadership Practices on Teacher ICT Competency

Based on the discussion in section 5.3.5, there is a statistically significant relationship between principal technology leadership practices with teacher ICT competency. While the analysis did not provide any information about which of the principal technology leadership dimensions influence teacher ICT competency. Hence, the researcher carried out further analysis (step-wise multiple regression) to determine which of the principal technology leadership practices dimensions are the significant predictors of teacher ICT competency in Negeri Sembilan secondary schools.

Based on the result of the multiple regression analysis, it was found that digital citizenship and systemic improvement are the two principal technology leadership practices dimensions that are statistically significant predictors of teacher ICT competency in Negeri Sembilan secondary schools. This finding implies that the level of teacher ICT competency will be increased when teachers perceived that their principal concerns about social, ethical, and legal issues regarding the use of ICT among their school community, and believed that the use of ICT could improve students' learning as well as improve their staff performance.

Digital citizenship dimension is the dominant predictor on teacher ICT competency. This showed that the teachers are concerned about whether their principals are able to model and facilitate understanding of social, ethical, and legal issues, and responsibilities related to ICT usage. As explained in the previous section (section 5.3.7), this may be due to the increasing rate of cyberbullying incidents that have been reported in the social media in recent years has caused the teachers to require proactive action from school principals to enlighten their school community about the importance of maintaining the ethical use of ICT.

Systemic improvement dimension is the second predictor on teacher ICT competency. This could be due to teachers being concerned about whether their principals are able to provide digital age leadership and management to continuously improve the school through the effective use of ICT. This finding was supported by Chang et al. (2008) who found that effective technology leader should provide necessary training and professional development programs for their teachers and students.

In conclusion, digital citizenship and systemic improvement are the two principal technology leadership practices dimensions that are statistically significant predictors of teacher ICT competency in Negeri Sembilan secondary schools. This finding implies that the level of teacher ICT competency will be increased when teachers perceived that their principal concerns about social, ethical and legal issues regarding the use of ICT among their school community, and believed that the use of ICT could improve students' learning as well as improve their staff performance. Hence in order to enhance teacher ICT competency, there is a need to promote principal technology leadership practices according to the dimensions which have higher impact on teacher ICT competency that emerged from the findings of this study.

5.3.9 Effects of Teacher ICT Competency on Teacher Acceptance and Use of SMS

The discussion in section 5.3.6 revealed that there is a statistically significant relationship between teacher ICT competency with teacher acceptance and use of SMS. However, the analysis did not provide any information about which of the teacher ICT competency influence teacher acceptance and use of SMS. Hence, the researcher carried out further analysis (step-wise multiple regression) to determine which of the teacher ICT competency dimensions are the significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

Multiple regression analysis found that smart pedagogy, professional growth and leadership, and digital citizenship and responsibility are the three teacher ICT competency dimensions that are statistically significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools. This finding implies that the level of teacher acceptance and use of SMS will be increased when teachers are embedded with the use of ICT in their instructional practices, continuously strived to improve their professional practices by promoting and demonstrating effective use of ICT, and concerned about the social, ethical and legal issues regarding to the use of ICT among their students.

Smart pedagogy dimension is the dominant predictor of teacher acceptance and use of SMS. This could be due to teachers having the ability to use their knowledge of subject matter, pedagogy, and technology to facilitate experiences that advance student learning, creativity, and innovation in virtual environments. This finding is supported by Franklin (2007) who found that teacher must possess certain amount of technology competency and technology must be rooted in curriculum goal and integrated with subject matter content. This is further supported by Knezek and Christensen (2002) and Varol (2013) who found that teacher ICT competency is the principle determinant to influence teacher effective use of ICT in their classroom practices.

Professional growth and leadership dimension is the second predictor of teacher acceptance and use of SMS. This reflected that the teachers are concerned whether they could continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources. This is supported by Sa'ari et al. (2005b) who found that teachers should be encouraged to create or design more technology-based activities, and share information and strategies dealing with instructional technology among their communities so that they will collectively gain a better understanding of the new digital era technology.

Digital citizenship and responsibility dimension is the third predictor of teacher acceptance and use of SMS. This could be due to teachers being concerned whether they could understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practices. Similar with this, Raob et al. (2012) also found that teachers must focus on safety, legal, and ethical behaviors as they pertain to use instructional technology.

In conclusion, smart pedagogy, professional growth and leadership, and digital citizenship and responsibility are the three teacher ICT competency dimensions that are statistically significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools. This finding implies that the level of teacher acceptance and use of SMS will be increased when teachers are embedded with the use of ICT in their instructional practices, continuously strived to improve their professional practices by promoting and demonstrating effective use of ICT, and concerned about the social, ethical and legal issues regarding to the use of ICT among their students. Hence in order to enhance teacher acceptance and use of SMS, there is a need to promote teacher ICT competency according to the dimensions which have higher impact on teacher acceptance and use SMS that emerged from the findings of this study besides principal technology leadership dimension that have been presented in the earlier section (Section 5.3.7).

5.3.10 The Mediating Effect of Teacher ICT Competency on the Relationship between Principal Technology Leadership Practices and Teacher Acceptance and Use of SMS

Based on the Pearson product-moment correlation that has been presented in the earlier section, there was statistically significant relationship between principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS. Furthermore, the multiple regression analysis revealed that principal technology leadership practices influence teacher ICT competency and teacher acceptance and use of SMS, and teacher ICT competency influence teacher acceptance and use of SMS. These revealed that principal technology leadership practices may directly influence teacher acceptance and use of SMS or indirectly through teacher ICT competency. Hence, teacher ICT competency was tested if it is a mediator for the relationship between principal technology leadership practices and teacher acceptance and use of SMS in this study.

The mediation analysis using SEM showed that there is a positive and partial mediating effect of teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS. This reflected that the indirect effect through teacher ICT competency is greater than the direct effect of principal technology leadership on teacher acceptance and use of SMS.

Furthermore, the analysis also revealed that principal technology leadership practices and teacher ICT competency have a strong total effect on teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Similarly, Chang (2012) also found that principals' technological leadership significantly improved teachers' technological literacy and directly encourages teachers to integrate technology into their teaching. This finding reinforces the Leithwood and Jantzi (2006) transformation leadership theory, who found that "*transformational school leadership practices have both direct and indirect effects on teachers' practices, the indirect effects being realized through leaders' influence on teachers' motivation, capacity, and work settings*" (p. 204). This is further supported by the path-goal leadership theory (House, 1971, 1996; Northouse, 2013) which focuses on how leaders motivate followers to accomplish designated goals. According to Northouse (2013), followers (teachers) will be motivated if they think they are capable or felt competent in performing their task. Hence, leader (principal) needs to provide support in term of the necessary skills and competence to their subordinates (teachers) for work-goal attainment (the acceptance and use of SMS).

In conclusion, this study revealed that teacher ICT competency possessed a positive and partial mediation effect on the relationship between principal technology leaders and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Therefore, improving teacher ICT competency enhances the relationship between principal technology leadership practices and teacher acceptance and use of SMS.

5.3.11 The Moderating Effect of Teacher demographic Variables on the Relationship between Principal Technology Leadership Practices and Teacher Acceptance and Use of SMS

Many previous studies (Afshari, Kamariah, et al., 2009a; Buabeng-Andoh, 2012b; Nagamani & Muthuswamy, 2013; Norhayati, 2000; Schiller, 2003; Venkatesh et al., 2003) reported that teacher demographic variables such as gender, age, teaching experience, educational level and experience in using computer could influence teacher acceptance and use of information system. Besides, there are few studies (Chang et al., 2008; Mohd Tahir et al., 2010) that reported teacher demographic variables could influence teachers' perception on their principals' technology leadership. However, there is limited literature reporting on the effect of teacher demographic variables as the moderator on the relationship between principal technology leadership practices and teacher acceptance and use of SMS. Hence, this study was carried out to assess the moderating effects of teacher demographic variables on the relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

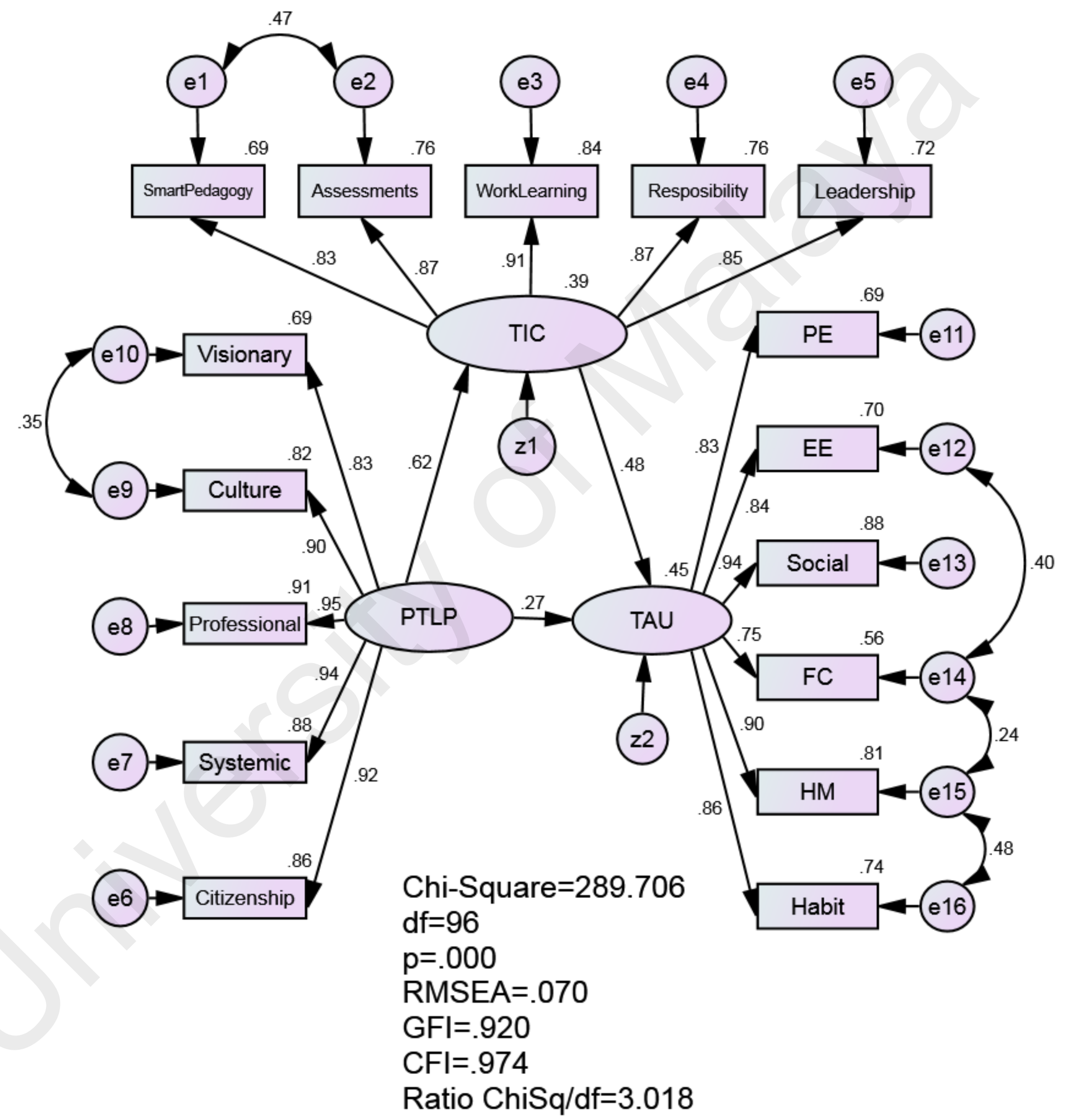
The moderating effect analysis revealed that teacher demographic variables in terms of gender, age, educational level, teaching experience, and experience in using computer are not statistically significant moderators on the relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. This finding implies that teachers' perception whether their principals are able to demonstrate technology leadership practices to enhance their level of acceptance and use of SMS are not affected by their demographic variables (gender, age, educational level, teaching experience and experience in using computer). The researcher argues that this might be due to the fact that usage of information system in school management is increasingly popular among teachers. This was supported by Madiha Shah (2014) who found that the online information system usage in educational management has increased due to its effectiveness and efficiency.

This finding contradicts with some of the previous findings that there were significant differences in teachers' perception of all principals' technology leadership dimensions according to age, teaching experience and position held by the teacher (Chang et al., 2008). Besides, Mohd Tahir et al. (2010) found that there were significant differences based on teachers demographic variables such as gender, age, and teaching experiences in their assessment towards principals' technology leadership role. However, one of the findings reported by Mohd Tahir et al. (2010) is similar to the finding of this present study, where there was no significant difference based on teachers' academic qualifications in their assessment towards principals' technology leadership role.

In conclusion, this finding revealed that teachers' perception whether their principals are able to demonstrate technology leadership practices to enhance their level of acceptance and use of SMS are not affected by their demographic variables in terms of gender, age, educational level, teaching experience, and experience in using computer.

5.3.12 Principal Technology Leadership Practices, Teacher ICT Competency, and Teacher Acceptance and Use of SMS Model

The analysis of data showed that the proposed structural model does not achieve the level of fitness required for some of the fitness indexes. This reflected that the proposed structural model does not fit well with the data collected from Negeri Sembilan secondary school teachers. Hence, a re-specified structural model, as shown



Note:
PTLP = Principal Technology Leadership Practices;
TAU = Teacher Acceptance and Use of SMS;
TIC = Teacher ICT Competency

in Figure 5.1 has been established.

Figure 5.1: Re-Specified Structural Model

Based on this re-specified structural model, a new model comprising principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS have been established from the findings of this present study, as shown in Figure 5.2.

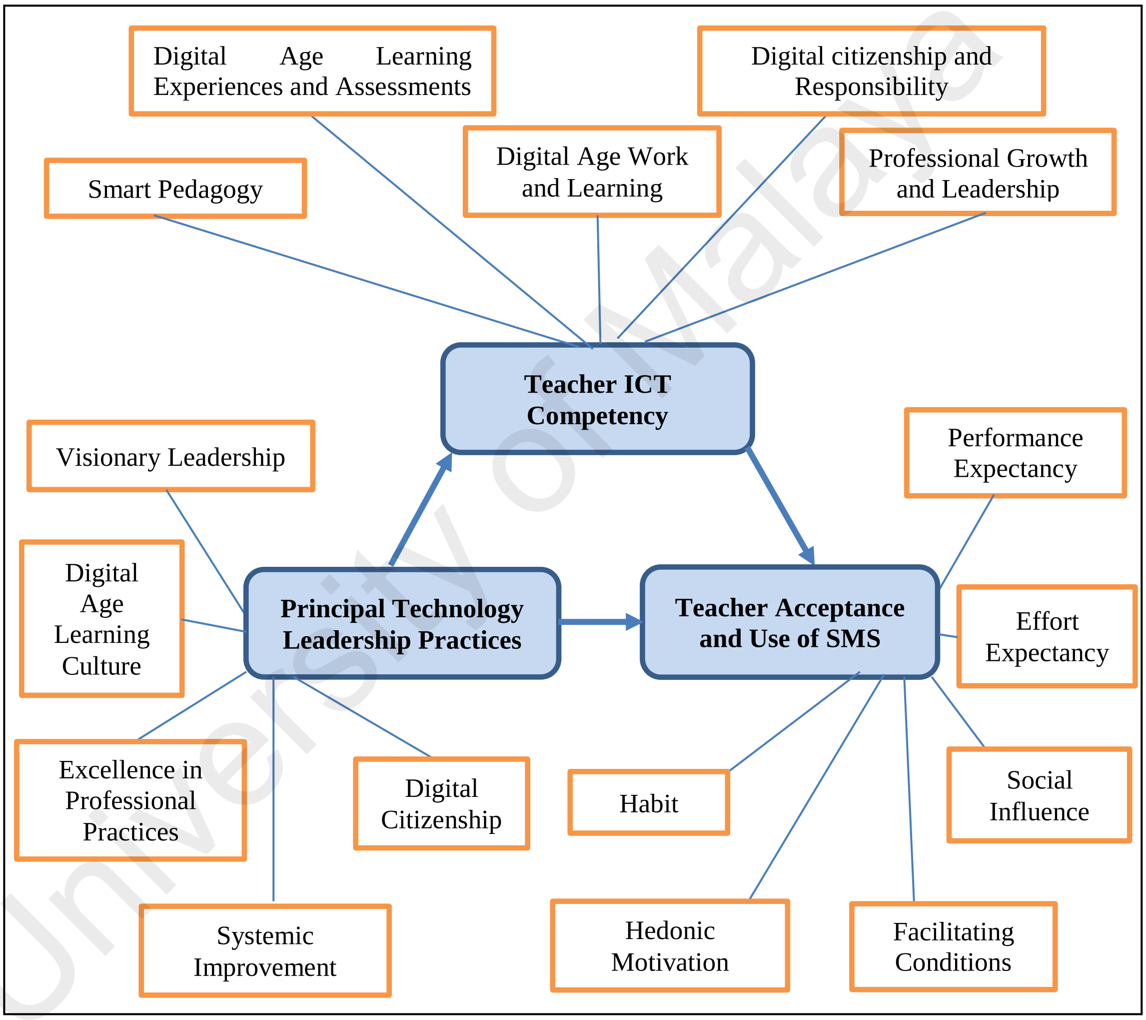


Figure 5.2: The New Model of Principal Technology Leadership Practices, Teacher ICT Competency, and Teacher Acceptance and Use of SMS.

Based on the model displayed in Figure 5.2, teacher acceptance and use of SMS is the endogenous (dependent) variable in relationship with principal technology leadership practices as the exogenous (independent) variable and teacher ICT competency as mediating variable has been confirmed.

This model shows that teacher acceptance and use of SMS (dependent variable) comprises six dimensions; (i) Performance Expectancy; (ii) Effort Expectancy; (iii) Social Influence; (iv) Facilitating Condition; (v) Hedonic Motivation; and (iv) Habit while principal technology leadership practices (independent variable) consists five dimensions; (i) Visionary leadership; (ii) Digital age learning culture; (iii) Excellence in professional practice; (iv) Systemic improvement; and (v) Digital citizenship. Finally, teacher ICT competency (mediating variable) comprises five dimensions; (i) Smart Pedagogy; (ii) Digital age learning experiences and assessments; (iii) Digital age work and learning; (iv) Digital citizenship and responsibility; and (v) Professional growth and leadership.

This model also shows that principal technology leadership practices and teacher ICT competency influenced teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Hence, in order to enhance teacher acceptance and use of SMS, there is a need to promote principal technology leadership practices and teacher ICT competency simultaneously.

In conclusion, the findings from this study are consistent with some previous research findings and reports while contradictory to some. The new model that has been established from the findings of this present study also highlights the paucity of data on current state of understanding and information pertaining to principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Hence, the findings of this study are unique to the subjects of the study at the time of data collection, the organizational culture and various environmental contexts. Therefore, conclusions and comparison of the research findings should be interpreted taking into consideration the methodologies and background of the study.

5.4 Implications and Contributions

This section explores the implications of the study both theoretically and practically, in the fields of teacher acceptance and use of SMS, principal technology leadership practices, and teacher ICT competency especially the relationship between these three variables. Followed by, the contributions to the body of knowledge in the educational field. Thus, several invaluable implications and contributions for academics and practitioners are revealed in this study.

5.4.1 Theoretical Implications

The main theoretical implication of this study is the establishment of an empirical based framework by integrating two of the human factors - principal technology leadership practices and teacher ICT competency with six of the teacher acceptance and use of SMS dimensions according to UTAUT 2 model (Venkatesh et al., 2012). The setting of this framework which focuses on the human subsystem in Negeri Sembilan secondary schools that involves principals and teachers could be explained by Organizational Behavior Theory or more specifically Sociotechnical System Theory

(Owens & Valesky, 2007). Besides, few studies have developed the linkages between the dependent or independent factors but none has ever looked at the linkages as outlined by the framework developed in this study. Clearly, this study does not attempt to extend the UTAUT 2 model (Venkatesh et al., 2012) but rather tries to explore other causes that influence teacher acceptance and use of SMS. This contribution is in line with the suggestion by Venkatesh et al. (2007), who found that the study of key antecedents and various interventions are key indicators of scientific progress and practical applicability in the information system acceptance and use research.

This study applied the UTAUT 2 model (Venkatesh et al., 2012) to understand teacher acceptance and use of SMS towards Negeri Sembilan secondary school teachers. The UTAUT2 model is a parsimonious, theoretically and empirically justified model and has high degree of reliability and validity. This study was able to develop a new model that can provide useful information on teacher acceptance and use of SMS among Negeri Sembilan secondary school teachers, while at the same time maintaining the UTAUT2 model's theoretical and psychometric rigor. Hence, this study would be useful for future researchers who are seeking directions to further examine the determinants of teacher acceptance and use of any new technology based on UTAUT2 model.

Furthermore, the results of this study have evidenced substantive relationships that exist between principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS. This study provides evidence that leadership is a process of influence through social interaction when significant relationship exists between principal technology leadership practices with teacher ICT competency and teacher acceptance and use of SMS. For the direct and indirect effects of principals technology leadership practices on teacher acceptance and use of SMS, this finding was predicted by the transformational leadership theory (Leithwood & Jantzi, 1999, 2006) that emphasized "*transformation school leadership practices have both direct and indirect effects on teachers' practices, the indirect effects being realized through leaders' influence on teachers' motivation, capacity, and work settings*" (p. 204). This is further supported by the path-goal leadership theory (House, 1971, 1996; Northouse, 2013) which focuses on how leaders motivate followers to accomplish designated goals. According to Northouse (2013), followers (teachers) will be motivated if they think they are capable or felt competent in performing their task. Generally, the findings of this study pointed to a relatively high overall consistency with the existing theories and models. Hence, the theoretical framework of the variables used in this study that has been presented in Figure 2.6 is verified.

5.4.2 Practical Implications

The findings of this study will be valuable in terms of practical significance. First, practitioners should pay particular attention to the inclusion of individual (teacher ICT competency) and contextual (principal technology leadership practices) factors when using these models to predict teacher acceptance and use of SMS. Practitioners should realize that existing models (UTAUT2) are conditional and therefore simply provide a basis for understanding user technology acceptance. To predict user acceptance of a specific system like school management system in this study, individual and contextual factors should be taken into account.

Second, the findings of this study will provide information for the concerned authorities to identify the antecedent factors that influence teacher acceptance and use of a new information system (SMS). These have implications in the area of Human Resource Management for designing training programs. Particularly, these training programs should highlight the influence of individual (teacher ICT competency) and contextual (principal technology leadership practices) factors.

There are two individual factors that need to be considered. First, school authorities need to account for the teachers' perceptions towards the new or existing systems in evaluating teacher acceptance and use. The findings of this study revealed that teachers in Negeri Sembilan secondary schools perceived that performance expectancy, effort expectancy, facilitating conditions and hedonic motivation are more important factors regarding their acceptance and use of SMS compared with social influence and habit. Second, this study also highlighted the relationship between teacher ICT competency and teacher acceptance and use of SMS. This implied that technology-related training plays a crucial role in developing teacher ICT competency as well as influencing teacher acceptance and use of SMS. Thus, to ensure teacher acceptance and use of this new technology, adequate training is equally crucial.

Meanwhile, the results indicated that the respondents are less competent in using ICT to demonstrate fluency in new technology knowledge due to limited access to appropriate ongoing professional development. This may adversely affect the successful implementation of the education policies, and in the long run, the attainment of the goal of vision 2020. To overcome this problem, the Malaysian Government should embark on intensifying ICT training programs for teachers to ensure that they have the adequate competency in dealing with the latest technology. Furthermore, training should not be one-shot workshops, but rather ongoing experiences so that teachers can keep abreast with ever-changing technologies. In other words, teachers need follow-up training sessions to ensure that they keep abreast with the current technologies. This is supported by Tasir et al. (2012) who found that teachers need to require new knowledge and skills to be mastered frequently since the rapid technological development. Hence, teacher training is crucial and these programs must adequately prepare teachers with the skills necessary to integrate information system in school management. This is supported by Badau and Sakiyo (2013), who found that ongoing research regarding the level of teacher ICT competency is needed for related authorities to plan and design suitable professional development which suits with teachers' need in order to prepare teachers to keep abreast with the contemporary technologies. Furthermore, in implementing new systems, principals must ensure that teachers are trained to be competence and familiar about the setting of these new systems.

The third implication relates to the principal technology leadership practices as the contextual factor that influence teacher acceptance and use of SMS, and here the study showed the importance of the principal technology leadership practice in term of digital citizenship, visionary leadership and systemic improvement in influencing teacher acceptance and use of SMS. Thus, principals as technology leaders must be able to model and facilitate understanding of social, ethical, and legal issues, and responsibilities related to SMS usage; able to inspire and lead the development and implementation of a school vision for comprehensive integration of information technology to promote excellence and support transformation throughout the school; and able to provide digital age leadership and management to continuously improve the school through the effective use of ICT. This study revealed that principals who embrace their evolving role as technology leaders can effectively enhance teacher ICT competency and teacher acceptance and use of SMS. The anticipated findings will contribute to practice because it will help the principals to know what are their practices could influence teacher acceptance and use of SMS. Hence, educational leadership training programs need to carefully consider how best to fulfill these leadership standards as outlined from the findings of this study. In short, the findings of this study reinforced the importance and usefulness of the ISTE Standards•A (2009) as the guidelines for successful principal technology leadership practices.

To summarize, any computer-based information system initiatives ought to consider all the three variables as proposed in this study. The factors discussed have been collectively found to facilitate teacher acceptance and use of SMS. Thus, failure or success of implementing such information system (SMS) does not solely depend on the teachers' attitude alone but is dependent on a wide-range of factors. Hence, in order to enhance teacher acceptance and use of any information system in the educational setting, effort and commitment must be made by policy makers, stakeholders, principals and teachers to foster principal technology leadership practices and teacher ICT competency on teacher acceptance and use of SMS has been discussed above.

5.4.3 Contributions

The findings of the present study have some useful contributions to the body of knowledge in the education field. These contributions are listed below:

1. This study has contributed significantly to the integration of educational technology in particular, and added value in order to enhance teacher acceptance and use of SMS in school.
2. This study has discovered a new topic in educational research by combining the theoretical approaches of the influence of others human factors in teacher acceptance and use of technology which has sparked a new phenomenon in the educational leadership theory in particular. The essence of both leadership theories – transformational and path-goal theory has sparked a new model that have been established in this study. Hence, this study has enriched the technology leadership literature to some extent in the field of educational management and leadership.
3. This study has developed a new research instrument that incorporates principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS as the three main variables. This instrument was analyzed and tested by CFA with SEM and has achieved good degree of reliability and validity. Hence, this instrument is an added value to future researchers who are seeking directions to further examine the relationships that exist between these variables.
4. Finally, the findings of this study suggest that there should be some form of official standards that are consistent and related to the dimensions of principal technology leadership practices and teacher ICT competency appropriate with the aims of educational institutions in Malaysia. Hence, this study provided a guideline to the policy maker about the important determinants related to principal technology leadership practices and teacher ICT competency that need to be considered when developing such standards according to the findings that emerged from this study.

5.5 Suggestions to Improve Teacher Acceptance and Use of SMS

Based on the findings and discussions that have been presented above, the researcher believes that there are still rooms for improving teacher acceptance and use of any form of information technology in school. Among the suggestions are:

1) Teachers need to have awareness in discovering and exploring their own opportunities to improve their ICT competency from time to time.
2) Principals must have the awareness to acquire knowledge regarding their technological leadership.
3) School leaders need to conduct a study (survey) to determine the level of teacher ICT competency before designing any ICT training program to suit with the teachers' need so that the training program is more focused, systematic and effective.
4) Principals should be educated with the important of their roles as technology leaders in enhancing teacher ICT competency and teacher acceptance and use of any form of information technology.
5) Institute Aminuddin Baki (The National Institute of Educational Management and Leadership) under the flagship of MOE should provide necessary training to the principals in the area of technology leadership through their short term in-service courses or even their long-term diploma courses such as the National Professional Qualification for Educational Leaders (NPQEL).
6) In line with shift five in the Malaysia Education Blueprint 2013-2025 which is ensuring high-performing school leaders, this leadership training packages is hoped to create greater awareness among the principals of the importance in

adhering to the principal technology leadership practices as outlined by ISTE Standards•A to meet the requirements for improving school leadership quality.

7) The MOE should ensure that appropriate facilities and equipment have been provided to schools before the implementation of any ICT project.

5.6 Recommendations for Future Research

Based on the implications and suggestions mentioned, it is clear that there are a number of issues that need to be addressed. There are practices that need to be implemented in order to achieve several goals and objectives. In light of these, some recommendations are forwarded for future consideration and research in the same field. The recommendations for future research are based mainly on the limitation of the study and extended beyond the scope of the study.

From the methodological perspective, studies of user information system acceptance may need a methodological shift in order to gain a richer understanding of less studied factors. So far, almost all the prior research studies use quantitative research methodology and usually from a positivist perspective. Qualitative methodology, especially from an interpretive perspective, however, is informative and may be another useful alternative method that can provide researchers with new insights about information system acceptance and use. In addition, the nature of user acceptance calls for periodic examinations of the determining factors along with the development of information system technology. New technologies often involve factors that have rarely been considered before. This methodological perspective can help researchers to identify the potential determinants inductively.

The survey method was utilized in the investigation of the relationships between principal technology leadership, teacher ICT competency, and teacher acceptance and use of SMS. Data were collected through the use of a self-administered questionnaire. This method of data collection has some limitations. First, the method relies on participants providing as veridical a response as possible to the researcher's questions. Also, as was the case in this study, the research then calls for examining the relationships between two or more of these self-reported pieces of evidence. The utilization of this type of research design and analysis introduces a potential source of bias referred to as common method variance, where responses to one question may affect the response to another question. Thus, it is recommended that future research should include other techniques of data collection such as interviews and direct observation for the purpose of cross validation on the responses given.

The present study was cross-sectional in nature, and from Negeri Sembilan secondary schools only at a single point in time. Individual perception regarding the acceptance and use of SMS may change over time when they gain experience on its usage. Hence, future studies may utilize a longitudinal research design to study changes that occur over times.

There are so many constructs that explain on the phenomenon of teacher acceptance and use of SMS. Besides, this study integrated two human factors - principal technology leadership practices and teacher ICT competency as the predictors of teacher acceptance and use of SMS is a relatively new research area in Malaysia, the findings and results of this study can only be used and interpreted with caution. Therefore, results from correlation and regression analysis have to be further tested and verified with more studies of this nature. In other words, this is an area that necessitates future exploration so that the current and future school leaders can be prepared to deal more effectively with technology and successfully implement technology policy. Furthermore, ISTE Standards•A will be refined over time. Hence, a research agenda on technology leadership should keep up with such changes and monitor the evolving capacity in school for technology leadership.

5.7 Conclusions

Overall, teachers in Negeri Sembilan secondary schools perceived that their principals demonstrated high level of technology leadership practices and the teachers also rated themselves to have high level of ICT competency, and acceptance and use of SMS. Furthermore, the findings of this study confirm that there are statistically significant positive and moderately strong relationships existing between principal technology leadership practices, teacher ICT competency, and teacher acceptance and use of SMS.

In addition, digital citizenship and visionary leadership seem to be the two dominant predictors of teacher acceptance and use of SMS among the principal technology leadership practices dimensions while digital citizenship and systemic improvement are the two dominant predictors of teacher ICT competency among principal technology leadership practices dimensions. Smart pedagogy, professional growth and leadership, and digital citizenship and responsibility are the three teacher ICT competency dimensions that are statistically significant predictors of teacher acceptance and use of SMS in Negeri Sembilan secondary schools.

There is a positive and partial mediating effect of teacher ICT competency on the relationship between principal technology leadership practices and teacher acceptance and use of SMS while teacher demographic variables (gender, age, educational level, teaching experience, and experience in using computer) were not significant moderators to the relationship between principal technology leadership practices and teacher acceptance and use of SMS in Negeri Sembilan secondary schools. Further, a new model that comprises principal technology leadership practices, teacher ICT competency and teacher acceptance and use of SMS has been validated using the data collected.

This study has highlighted that two important human factors - individual (teacher ICT competency) and contextual (principal technology leadership), in predicting teacher acceptance and use of SMS. In other words, the present study suggests that teacher acceptance and use of SMS among teachers can therefore be enhanced significantly by exercising principal technology leadership practices directly and also through improved teacher ICT competency indirectly. The findings of this study also reveal several invaluable implications and contributions for academics and practitioners. It has contributed to the general body of knowledge in education and particularly educational technology integration. The model derived from this study could be further tested, refined and improved through other techniques of data collection such as interviews and direct observation or utilize a longitudinal research design which focuses in the context of Malaysian educational setting.

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