EXPLICATING THE ACCEPTANCE OF VIRTUAL LEARNING ENVIRONMENT: THE ROLES OF CHANNEL EXPANSION AND THE THEORY OF SELF DETERMINATION

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THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

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Field of Study: Information Systems

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ABSTRACT

The Malaysian government has launched the 1BestariNet (*1SmartNet*) project to provide high-speed 4G mobile Internet access to 5.5 million students, 0.5 million teachers and 4.5 million parents from 10,000 schools spread over 329,847 square-kilometers along with the Frog VLE system. The goal of this study is to examine the determinants of VLE acceptance from the context of cloud-based Frog VLE from the perspective of school teachers by applying the Self Determination Theory (SDT), Channel Expansion Theory (CET) and the unique constructs of VLE contend design, interactivity, knowledge sharing attitude and trust-in-website. The research question is "What are the factors that may impact the intention to use the VLE for instructional effectiveness among teachers?". The survey instrument was rigorously validated for face validity, content validity and reliability by expert panel members and practitioners using content validity index and Q-sort technique. A three-round English-Malay back-translation was engaged to ensure translation equivalence. After getting the permissions from various stakeholders, 1,720 questionnaires were administered in first wave (T1) to collect the data of the respondents' demographics and the independent variables. After a 4-months gestation period, dependent variables were gathered in second wave (T2). Based on the PLS analysis, SDT and CET constructs were found to be significant predictors for teachers' intention to use the Frog VLE. Teachers' specialization was found to have confounding effects on behavioral intention. Finally, behavioral intention was found to have significant influence on perceived instructional effectiveness. The research has contributed several theoretical and practical implications for scholars, MoE, FrogAsia, school administrators and other stakeholders.

ABSTRAK

Kerajaan Malaysia telah melancarkan projek 1BestariNet untuk menyediakan akses Internet mudah alih 4G kelajuan tinggi kepada 5.5 juta pelajar, 0.5 juta guru dan 4.5 juta ibu bapa daripada 10,000 sekolah sekitar 329,847 kilometer persegi bersama-sama dengan sistem Frog VLE. Matlamat kajian ini adalah untuk mengkaji faktor penentu penerimaan VLE dari konteks Frog VLE berasaskan awan dari perspektif guru-guru sekolah dengan menggunakan Teori Penentuan Kendiri (SDT), Teori Perkembangan Saluran (CET) dan konstruk-konstruk unik seperti reka bentuk kandungan, interaktiviti, sikap terhadap perkongsian pengetahuan dan kepercayaan dalam laman web. Soalan kajian ialah "Apakah faktor-faktor yang mungkin mempengaruhi niat untuk mengguna VLE bagi keberkesanan instruksional dalam kalangan guru?". Instrumen kajian telah disahkan untuk kesahan muka, kesahan kandungan dan kebolehpercayaan oleh ahli-ahli panel pakar dan pengamal menggunakan indeks kesahan kandungan dan teknik Q-sort. Proses perterjamahan-balik Inggeris-Melayu tiga-kitaran telah dilakukan untuk memastikan kesetaraan terjemahan. Selepas mendapat kebenaran daripada Bahagian Perancangan Pendidikan dan Penyelidikan (BPPDP), Jabatan Pelajaran Negeri, Pejabat Pendidikan Daerah dan pentadbir sekolah yang berkaitan, 1,720 soal-selidik telah ditadbir dalam gelombang pertama (T1) untuk mengumpul data demografi responden dan pembolehubah bebas. Selepas 4 bulan tempoh matang, pembolehubah bersandar telah dikumpul dalam gelombang kedua (T2). Berdasarkan analisa PLS, konstruk-konstruk SDT dan CET didapati sebagai peramal yang signifikan bagi niat guru untuk menggunakan Frog VLE. Pengkhususan guru didapati mempunyai kesan sampingan terhadap niat tingkah laku. Akhirnya, niat tingkah laku didapati mempunyai pengaruh yang besar ke atas persepsi keberkesanan instrusional. Kajian ini telah menyumbang beberapa implikasi teori dan praktikal untuk sarjana, KPM, FrogAsia, pentadbir sekolah dan pihak berkepentingan yang lain.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (continued)

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF TABLES (continued)

LIST OF SYMBOLS AND ABBREVIATIONS

+	**:**	Significant positive relationship
-	:	Significant negative relationship
*****	:	No causal relationship
3-TUM	:	Three-tier Technology Use Model
4G	**:**	Fourth Generations
AG	:	Age
AMOS	**:**	Analysis of Moment Structures
ANCOVA	:	Analysis of Covariance
ANN	:	Artificial Neural Network
ANOVA	:	Analysis of Variance
ANX	:	Anxiety
ASV	:	Average Shared Variance
AT	:	Attitude toward Knowledge Sharing
ATT	:	Attitude
AU	:	Actual Use
Ave	:	Average
AVE	:	Average Variance Extracted
BI	:	Behavioral Intention
CA	:	Computer Anxiety
CAA	:	Computer Assisted Assessment
CBSEM	:	Covariance Based SEM
CDC	:	Curriculum Development Center
CET	:	Channel Expansion Theory
CFA	:	Confirmatory Factor Analysis
CMB	:	Common Method Bias
CMC	:	Computer Mediated Communications
CR	:	Composite Reliability
CVI	:	Content Validity Index
DG	:	Teacher Salary Scheme
DV	:	Dependent Variable
e-CRM	:	Electronic Customer Relationship Management
ED	:	Education
EFA	:	Exploratory Factor Analysis
ELE	:	E-Learning Effectiveness
e-LMS	:	Electronic Learning Management System
ELSS	:	E-Learning System Success
EPRD	:	Education Planning and Research Division
eRAS	:	Electronic Research Application System
FC	:	Facilitating Conditions
FIMIX	**:**	Finite Mixture
FLR	:	Fornell-Larcker's Ratio
H-Index	:	Harzing's Index
ICT	:	Information Communications Technology
I-CVI	:	Item-level CVI
ILA	:	Interactive Learning Activities
InfQ	:	Information Quality
IPMA	:	Importance Performance Matrix Analysis
IS	:	Information Systems
ISSM	:	Information Systems Success Model

LIST OF SYMBOLS AND ABBREVIATIONS (continued)

IV	:	Independent Variable
JPN	:	State Education Department
KPM	:	Ministry of Education, Malaysia
LISREL	:	Linear Structural Relations
MBA	:	Master of Business Administration
MCMC	:	Malaysian Communication and Multimedia Commission
MI	:	Multimedia Instruction
MoE	:	Ministry of Education
MOOC	:	Massive Open Online Courses
MSE	:	Mathematics, Science and English
MSV	:	Maximum Shared Variance
MV	:	Mediating Variable
N/A	:	Not Applicable
ns	:	Not significant
OLS	:	Ordinary Least Squares
OS	:	Operating System
PA	:	Perceived Autonomy
PC	:	Perceived Competence
PCA	:	Principal Component Analysis
PE	:	Performance Expectancy
PEOU	:	Perceived Ease of Use
PhD	:	Doctor of Philosophy
PIE	:	Perceived Instructional Effectiveness
PIIT	:	Personal Innovativeness in Information Technology
PLS	:	Partial Least Squares
PMR	:	Perceived Media Richness
POS	:	Prediction Oriented Segmentation
PPD	:	District Education Office
PR	:	Perceived Relatedness
PU	:	Perceived Usefulness
R&D	:	Research and Development
RMR	:	Root Mean Square Residual
RO	:	Research Objective
RQ	:	Research Question
SAT	:	Satisfaction
S-CVI	:	Scale-level CVI
SDT	:	Self Determination Theory
SE	:	Self Efficacy
SEF	:	System Effectiveness
SEM	:	Structural Equation Modeling
ServQ	:	Service Quality
SI	:	Social Influence
Sig.	:	Significance level
SML	:	Self-Managed Learning
SN	:	Subjective Norm
SPL	:	Specialization
SPM	:	Sijil Pelajaran Malaysia (equivalent to O-Level)
SPSS	:	Statistical Packages for Social Sciences
SQ	:	System Quality
SS	:	School Support

LIST OF SYMBOLS AND ABBREVIATIONS (continued)

STDEV	:	Standard Deviation
STPM	:	Sijil Tinggi Pelajaran Malaysia (equivalent to A-Level)
T1	:	Phase 1
T2	:	Phase 2
TAM	:	Technology Acceptance Model
TAM2	:	Technology Acceptance Model 2
TEX	:	Teaching Experience
TS	:	Technical Support
TVLE	:	Technology-mediated Virtual Learning Environment
TW	:	Trust in Website
U	:	Use
UA	:	Universal Agreement
US	:	United States of America
UTAUT	:	Unified Theory of Acceptance and Use of Technology
VAF	:	Variance Accounted For
VBSEM	:	Variance Based SEM
VCD	:	VLE Content Design
VI	:	VLE Interactivity
VIF	:	Variance Inflation Factor
VLE	:	Virtual Learning Environment
WBL	:	Web Based Learning
WBLS	:	Web Based Learning System

LIST OF APPENDICES

LIST OF APPENDICES (continued)

CHAPTER 1: INTRODUCTION

1.1 Overview of the research

The goal of this study is to examine the antecedents of intention to use the cloud-based Frog VLE and its effect on perceived instructional effectiveness. The Malaysian government has introduced the 1BestariNet project which involves 10,000 schools nationwide with 5 million students, 4.5 million parents, 500,000 teachers and 1 platform. The Malaysian Ministry of Education (MoE) is partnering with YTL Communications to deliver high-speed wireless 4G Internets together with the proven Frog Virtual Learning Environment (VLE) to all Malaysian schools. Through the 1BestariNet project, FrogAsia is bringing the future of education to every student, teacher and parent in Malaysia. Combining 4G high-speed internet access, a world class instructional platform and access to 'best-in-class' resources and technology, Malaysia is the first country in the world to bring its entire education community together on a single converged network designed specifically to meet the needs of teaching and learning. For the first time in Malaysia, every child will have access to world-standard learning tools (1BestariNet, 2014).

Under the 1BestariNet project, FrogAsia, a YTL owned subsidiary will provide its Frog Virtual Learning Environment (Frog VLE) for students to access online libraries, educational resources, Google learning content, Google Apps, Google Calendar, Google Maps etc. Besides that students can also do homework online and submit it online as well as interact and collaborate with each other in accomplishing their assignments projects through online social networking facilities. For teachers, they can assign homework to students, monitor their progress and intervene when needed. In addition

to that, teachers can also interact with parents online while parents can view their children's progress online and etc.

With the 1BestariNet project, students and teachers are able to access the Frog VLE anywhere anytime using any device such as desktop PC, notebook, netbook, tablet or even smartphone with Internet connection. The Frog VLE uses the Yes 4G WiMAX wireless broadband connectivity provided by YTL Communications with speeds ranging from 2Mbps to 10Mbps in urban areas and from 2Mbps to 4Mbps in rural areas.

The 1BestariNet project is main component in the seventh shift of the Malaysia Education Blueprint 2013-2025 (*PPPM 2013-2025*). On 15th May, 2011, the Ministry of Education (MoE) has launched an open tender for procurement of the 1BestariNet service for a period of 15 years. A total of 16 companies have participated in the open tender and after evaluation by the MoE's procurement board, YTL Communications was awarded with a contract worth RM1.5 billion over the subsequent five years and a sum of RM663 millions for a period of two and a half year starting from 13 Dec 2011 to 12 June 2014. The entire 15 year project would cost over RM4 billion in total.

A conventional VLE is a web-based communications channel, which enables learners, without restriction of time and place, to access various learning tools, including program information, teacher assistance, course content, learning resources, discussion boards and document sharing systems (Martins & Kellermanns, 2004; Ngai, Poon & Chan, 2007).

In this study, the cloud-based VLE is defined as a cloud computing virtual learning environment communication platform that resembles the traditional classroom in all aspects and enables teachers and students to access, save, retrieve and sharing instructional resources anytime, anywhere on the cloud without storage limitation.

1.2 Problem statement and research gaps

With the vision of becoming a developed nation by the year 2020, the Ministry of Education (MoE) has implemented several ICT initiatives in schools nation-wide in an attempt to integrate technology into the classrooms starting with programs such as Computer Literacy Pilot Project, Computer in Education, Computer Aided Instruction and Learning (Hendehjan & Noordin, 2013). Although Malaysia has a long history of bringing technology into the classrooms, research findings show that teachers are not optimizing on what technology has to offer and having high-end technology in schools does not necessarily mean high uptake by the teachers (Ghavifekr, Kunjappan, Ramasamy& Anthony , 2016; Mahmud & Ismail, 2010).

The level ICT usage in classroom can be seen from a study which revealed that on average, Mathematics, Science and English (MSE) teachers in Malaysian schools only utilized ICT equipment for about 29 hours in two year period (MHS Resources, 2005). It was also found that MSE teachers are not fully utilizing the ICT facilities in their teaching (Chong, Sharaf & Jacob, 2005; Mahmud & Ismail, 2010). Overall only one-tenth (i.e., 10%) of the English teachers admitted that they did carry out ICT integrated activities three times in a year (Samuel & Bakar, 2006). Another study showed that almost 80% of teachers spent not more than 1 hour a week using ICT (Kenayathulla, 2014).

Hendehjan and Noordin (2013) found that the level of ICT implementation among English as Second Language (ESL) teachers was moderate. Although teachers have been sent for training to obtain knowledge and skill in actual usage of computer and ICT equipment, most have returned only to fall back onto their traditional mode of teaching (Kumar, Rose & D'Silva, 2008). In fact "VLE usage by teachers, students and parents was very low that was between 0.01% to 4.69%" (Auditor General's Report, 2013, p. 71). Hence, there is a need to increase the level of ICT usage in classroom (Alazam,, Bakar & Asmiran, 2012) in order to address the issue of under-optimization of ICT usage in class room teaching especially with the introduction the Frog VLE in Malaysian schools.

Although VLE are popular, Liaw, Huang and Chen (2007) claimed that there is minimal research on instructors' and learners' attitudes towards VLE. Furthermore, Liao and Lu, (2008) found that despite the continuous growth of the VLE market; there is still a lack of discussion on the individuals' behavior in the adoption and continued use of VLE. In fact, the number of studies on the acceptance and adoption of VLE is small but still growing (Van Raaij & Schepers, 2008). Virtual learning environments (VLEs) such as WebCT, Blackboard and Moodle support blended learning (Ngai, Poon & Chan, 2007; Blas & Serrano-Fernández, 2009). However, the transition from traditional teaching to ICT-enhanced environments is not obvious and many teachers are still hesitant or reluctant to adopt technology for teaching tasks (Al-Senaidi, Lin & Poirot, 2009).

It is obvious that most of the prior studies focus primarily on the contexts of undergraduates or university instructors (Cobo, Rocha & Rodríguez-Hoyos, 2014; Chou & Liu, 2005; Eom, 2012; Liaw, 2008; Motaghian, Hassanzadeh & Moghadam, 2013;

Sanchez & Hueros, 2010; Shin, Biocca & Choo, 2013; Sumak, Polancic & Hericko, 2010; Sun & Hsu, 2013; Van Raaij & Schepers, 2008). There is no study conducted so far in understanding the acceptance of school teachers towards using VLE. Since the culture and environment of teaching and learning in universities and schools are different in terms of subjects, syllabus, pedagogical approach, levels of instruction, assessment and evaluation, education administration, structure of organization and etc., the findings from these studies (Cobo et al., 2014, Chou & Liu, 2005; Eom, 2012; Liaw, 2008; Motaghian et al., 2013; Sanchez & Hueros, 2010; Sumak et al., 2010; Sun & Hsu, 2013; Van Raaij & Schepers, 2008) may not be the same and applicable to the school context and hence there is a need to study the VLE from the context of school teachers. Besides, all of these studies were aimed at identifying the underlying factors of VLE acceptance. Moreover, the relationship between VLE acceptance and Perceived Instructional Effectiveness (PIE) has not been well studied. This is important because once the relationship is empirically validated, then specific measures may be taken to imporove the level of PIE by increasing the level of VLE acceptance.

Furthermore, the previous studies (e.g. Cobo et al., 2014, Chou & Liu, 2005; Eom, 2012; Liaw, 2008; Motaghian et al., 2013; Sanchez & Hueros, 2010; Sumak et al., 2010; Sun & Hsu, 2013; Van Raaij & Schepers, 2008) have focused mainly on the online or web based learning systems such as Moodle, e-LMS, WBLS, Blackboard and etc. which use the conventional grid computing technology that do not provide the facilities of unlimited storage space, information sharing and collaboration as well as access to teaching and learning resource material in comparison to the facilities provided by the cloud computing infrastructure. Cloud computing offers “an opportunity of flexibility and adaptability to use the computing resources on-demand” (Ercan, 2010, p. 939). Besides, it also supports cooperative learning and socially oriented theories of learning

via collaborative methods of instruction (Thorsteinsson, Page & Niculescu, 2010 as cited in Mircea & Andreescu, 2011). With the cloud-based high speed Frog VLE systems, teachers and students are able to save their work and share them with their colleagues and peers, anytime and anywhere. Due to these differences, it would be interesting to investigate whether there are differences between the acceptance of the grid computing web based instructional systems and the cloud computing based Frog VLE system.

Previously only TAM (Sánchez & Hueros, 2010), TAM2 (Van Raaij & Schepers, 2008), TAM and ISSM (Motaghian et al., 2013) and UTAUT (Sumak et al., 2010) were used as the model to predict user behavioral intention and use. Generally, the influences of Self Determination Theory and Channel Expansion Theory were not examined. These studies have mainly focused on the external motivational or utilitarian factors instead of the internal factors such as teachers' self-determination and motivation towards using the VLE technology. The effects of self-motivation and self-determination to use the VLE without any external influence and interference are worth studying as it may contribute to the cloud-based VLE literature as well as providing vital understanding to practitioners in drawing up effective policies, strategies and measures to further enhance the level of VLE acceptance as well as its instructional effectiveness..

Furthermore, none of the previous studies (Cobo et al., 2014; Chou & Liu, 2005; Eom, 2012; Liaw, 2008; Motaghian et al., 2013; Sanchez & Hueros, 2010; Shin et al., 2013; Sumak et al., 2010; Sun & Hsu, 2013; Van Raaij & Schepers, 2008) have examined the effects of the media rich characteristics of the VLE systems on its acceptance. As the VLE consists of a media rich environment with lots of video, sound,

animations, graphics and other multimedia elements, the effects of these media are worth studying. Hence, it would be interesting to examine whether Self Determination Theory and Channel Expansion Theory play significant roles in influencing teachers to use the VLE system. Therefore, in this study, Self Determination Theory and Channel Expansion Theory are integrated in predicting teachers' acceptance of the Frog VLE. In addition, VLE Content Design and VLE Interactivity as well as School Support are also incorporated in the integrated research model.

Moreover, the task specific characteristics of content design and interactivity of the VLE system have been omitted in the previous studies (Cobo et al., 2014; Chou & Liu, 2005; Eom, 2012; Liaw, 2008; Motaghian et al., 2013; Sanchez & Hueros, 2010; Shin et al., 2013; Sumak et al., 2010; Sun & Hsu, 2013; Van Raaij & Schepers, 2008). Since the VLE system is able to provide various teaching and learning contents such as teaching community, Frogstore online resources, teaching sites, assignment module, forums, quizzes, email and etc., the impacts of these content designs may need further investigation. Similarly, as the VLE involves interactivity between the teachers and the VLE system, the effects of interactivity towards the intention to use and perceived instructional effectiveness warrant an investigation to be carried out.

Another gap identified is the absence of a rigorously validated instrument to measure the instructional effectiveness of cloud-based VLE. Currently there are no instruments for measuring the instructional effectiveness of a cloud-based VLE. All of the existing instruments (Cobo et al., 2014; Chou & Liu, 2005; Eom, 2012; Liaw, 2008; Motaghian et al., 2013; Sanchez & Hueros, 2010; Shin et al., 2013; Sumak et al., 2010; Sun & Hsu, 2013; Van Raaij & Schepers, 2008) were developed for the grid computing VLEs without rigorous validation processes. Besides that, except for Eom (2012), no English

back-translations were conducted even though the previous studies (Cobo et al., 2014; Chou & Liu, 2005; Liaw, 2008; Motaghian et al., 2013; Sanchez & Hueros, 2010; Shin et al., 2013; Sumak et al., 2010; Sun & Hsu, 2013; Van Raaij & Schepers, 2008) were done in non-English speaking countries. Since there is no translation into the local languages, there may be issues of interpretation and understanding among the respondents due to language differences.

Moreover, cultural differences (The Hofstede Center, http://geert-hofstede.com/, 2015) also play an important role in acceptance and use of information technologies (Al-Gahtani, Hubona & Wang, 2007; Bagchi, Hart & Peterson, 2004; Carter & Weerakkkody, 2008; Leidner & Kayworth, 2006; Straub, Keil & Brenner, 1997). According to Hofstede (2010), the cultural differences can be divided into six dimensions (i.e. power distance, individualism, masculinity, uncertainty avoidance, long term orientation and indulgence).

Power distance refers to the fact that all individuals in societies are not equal. This dimension expresses the attitude of the culture towards the inequalities among individuals. Power Distance is defined as the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed equally (Hofstede, 2010). Individualism is the degree of interdependence a society maintains among its members. This dimension has to do with whether individual's self-image is defined in terms of "I" or "We". In Individualist societies, individuals are assumed to look after themselves and their direct family only. In Collectivist societies, individuals belong to "in groups" that take care of them in exchange for loyalty (Hofstede, 2010).

On the other hand, a high score in the Masculinity dimension implies that the society will be driven by competition, success and achievement where success is being defined by the winner or best in the field. This is a value system that begins in school and continues throughout organizational life. A low score in Masculinity indicates that the dominant values in society are caring for others and quality of life. A Feminine society is one where quality of life is the indication of success and standing out from the crowd is not admirable. The basic issue in this dimension is what drives people, wanting to be the best (Masculine) or liking what they do (Feminine).

The dimension of Uncertainty Avoidance refers to the way a society deals with the fact that the future can never be known: should we try to control the future or just let it happen? The ambiguity may lead to anxiety and different cultures have learnt to deal with this anxiety in different ways. The extent to which the members of a culture feel threatened by ambiguous or unknown situations and have created beliefs and institutions that try to avoid these is shown in the score on Uncertainty Avoidance.

The dimension of Long Term Orientation explains how every society has to maintain some links with its own past while dealing with the challenges of the present and future and societies prioritize these two existential goals differently. Normative societies will score low in this dimension; prefer to maintain time-honored traditions and norms while viewing societal change with suspicion. Individuals with a culture which score high, on the other hand, take a more pragmatic approach there encourage thrift and efforts in modern education as a way to prepare for the future.

The dimension of Indulgence is defined as the extent to which people try to control their desires and impulses based on the way they were raised (Hofstede, 2010). A relatively weak control is known as “indulgence” while the relatively strong control is known as “Restraint”.

As a comparison, there are significant huge cultural differences between Malaysia and the US (Figure 1.25). For example, in the dimension of Power Distance, Malaysia scores 100 compared to the US with score of 40. This indicates that Malaysian people accept a hierarchical order in which everyone has a place and which needs no further justification. The hierarchy in an organization is viewed as reflecting inherent inequalities, centralization is popular, subordinates expect to be instructed on what to do and the ideal boss is a benevolent autocrat (Hofstede, 2010).

In terms of Individualism, Malaysia scores 26 in comparison to the US with score of 91. This shows that Malaysia is a collectivistic society. This is reflected in a close long-term commitment to the ‘member’ group, be that a family, extended family or extended relationships. In a collectivistic culture, loyalty is paramount and overrides most other societal rules and regulations. This society instills strong relationships, where everybody takes responsibility for fellow members of their group.

In a collectivistic society, offence will bring about shame and loss of face and employer-employee relationships are perceived in terms of moral, hiring and promotion take account of the employee’s in-group and management is the management of groups (Hofstede, 2010). From the perspective of the Uncertainty Avoidance dimension, Malaysia’s score of 36 compared to the US with a score of 46 indicates low preference for avoiding uncertainty.

Malaysian maintains a more relaxed attitude in which practice means more than principles and deviance from the norm is more easily tolerated. They also believe there should be no more rules than are needed and if they are ambiguous or do not work; they should be abolished or changed. There should be flexible schedules and hard work is undertaken when needed but not for his own sake. Precision and punctuality do not come naturally and innovation is not viewed as threatening (Hofstede, 2010).

Besides that, the low score of 41 in Long Term Orientation denotes that Malaysia has a normative culture. Malaysians have a strong concern with establishing the absolute Truth. They are normative in their thinking and exhibit great respect for traditions, low propensity to save for the future and a focus on accomplishing quick results (Hofstede, 2010).

Finally, the high score of 57 compared to 68 by the United States in the dimension of Indulgence shows that Malaysian culture is one of indulgence where the people generally exhibit a willingness to realize their impulses and desires with regard to enjoying life and having fun. They show positive attitude and have a propensity toward optimism. They also place a high degree of importance on leisure time, act as they please and spend as they want (Hofstede, 2010). Due to the cultural differences between Malaysia and other countries, an instrument for measuring the instructional effectiveness of a cloud-based VLE from the context of Malaysia is indeed warranted.

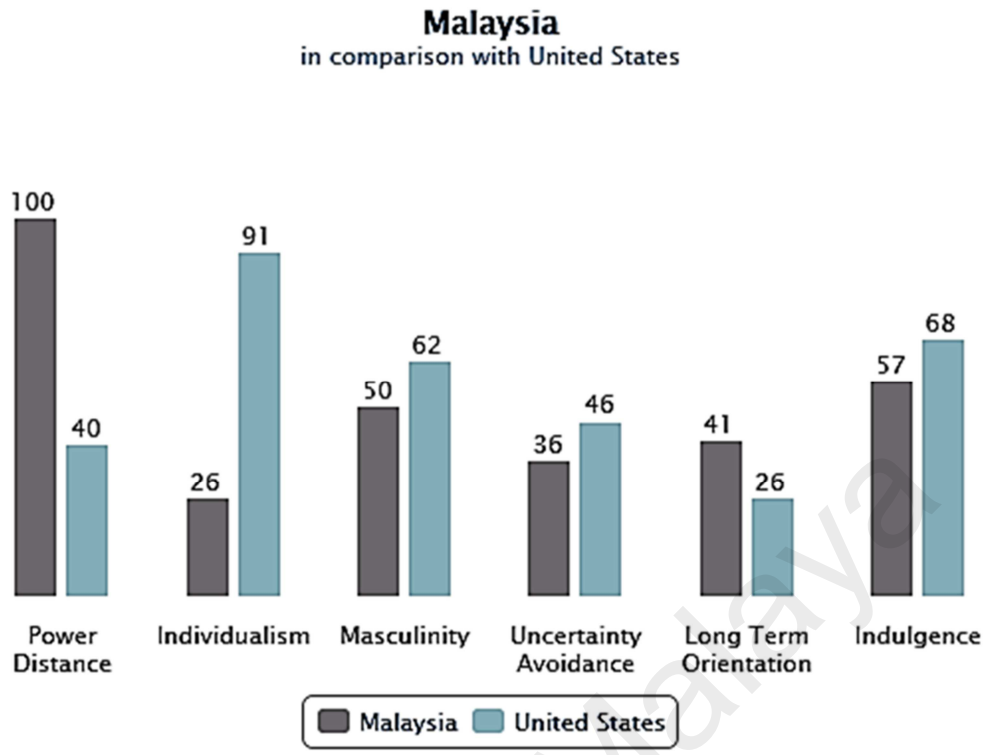

Figure 1.1: Cultural differences between Malaysia and Unite States (Source: http://geert-hofstede.com/malaysia.html)

Lastly, previous studies have not examined the use of the cloud-based high-speed 4G Frog VLE and it is still in its early stage of implementation in Malaysia. In order to gain a more comprehensive and thorough understanding about the use of the cloud-based Frog VLE, a quantitative research method was used in this study. Gay, Mills and Airasian (2006) defined quantitative research method as the collecting and analyzing of numerical data in order to explain, predict and/or control phenomena of interest. This study is concerned with identification of the determinants of cloud-based VLE acceptance and its influence on perceived instructional effectiveness as well as measuring the strengths of the relationships among the independent and dependent variables and the significant of the mediating effects. A descriptive analysis was performed in examining the level of VLE usage among teachers. Therefore a non-experimental quantitative research method was used.

1.3 Research question

Based on the problem statement, this study has a main research question put forward as:

- ***RQ***: What are the factors that may impact the intention to use the VLE for instructional effectiveness among teachers?

1.4 Research objectives

In view of the scarcity of knowledge regarding acceptance and effectiveness of VLE, this research has the following objectives:

- ***RO1***: To examine the possible factors that may affect teachers' intention to use VLE.
- ***RO2***: To investigate the effects of behavioral intention to use VLE on perceived instructional effectiveness.

1.5 Scope of the study

The scope of the study was constrained to the Frog VLE context among Malaysian primary and secondary school teachers. It only covered teachers in government schools and did not include private or international schools. Furthermore, the scope of the study is also limited to teachers who are currently teaching in their schools and therefore did not include pre-service teachers or teachers who have retired.

More specifically, the scope of this study is limited to Malaysian geographical context (Figure 1.2) with 11 states in Peninsular West Malaysia, 2 states in East Malaysia (i.e. Sabah and Sarawak) and 3 Federal Territories (i.e. Kuala Lumpur, Putrajaya and Labuan) with a geographical area of 329,758 sq. km and a population of

31.7 million (i.e. 68.6% ethnic Bumiputera, 223.4% Chinese, 7.0% Indian and 1.0% Others).

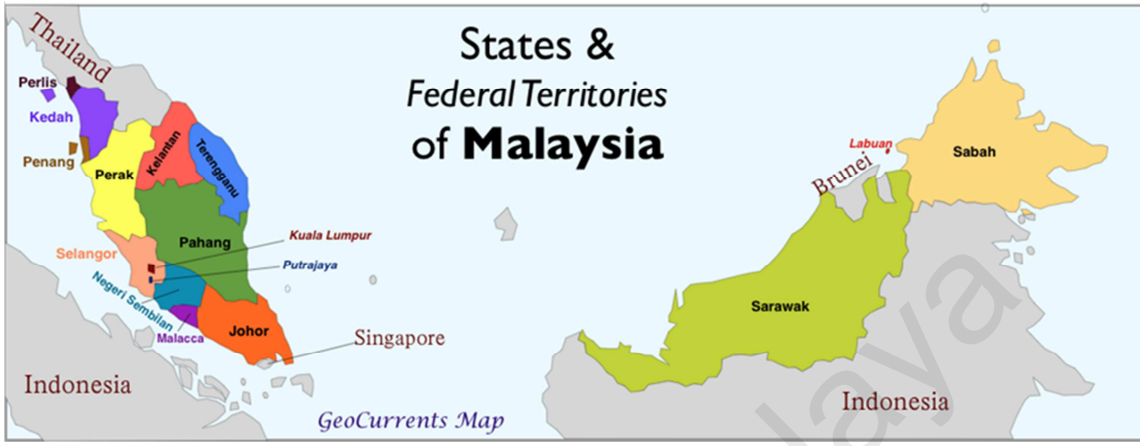

Figure 1.2: The Malaysian geographical area
(Source: http://geocurrents.info/wp-content/uploads/2013/09/Malaysia-states-map.png)

From the perspective of theoretical underpinnings, the scope of this study is limited to Self Determination Theory and Channel Expansion Theory. It did not include other IS theories such as Technology Acceptance Model (TAM), United Theory of Acceptance and Use of Technology (UTAUT), Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Expectation Confirmation Theory (ECT), Information System Success Model (ISSM), Diffusion of Innovation Theory (DOI) etc. From the perspective of user behavior, the scope of the study is limited to users' behavioral intention and did not examine continuance intention, satisfaction etc.

Finally, from the perspective of control variables, the scope of this study is limited to three demographic variables (i.e. specialization, teaching experience and education level) and did not include other demographic variables such as age, gender, category of school etc.

1.6 Research methodology

In order to answer the research question and to achieve the research objectives, this study used a non-experimental quantitative approach by administering survey questionnaire to the respondents. The study commenced with the identification of the problem and the research gaps through comprehensive and extensive literature review. Then the hypotheses and research model were developed followed by the survey instrument development and validation in the pre-test stage to evaluate face validity, content validity and construct validity base on content validity index by expert panel review and two rounds of Q-sort procedure by practitioners. This is followed by pilot test to evaluate the clarity of the instrument and construct reliability based on the Cronbach's alpha values.

Before the data gathering stage, permissions and consents of study were obtained first from the Education Planning and Research Division (EPRD) of the Malaysian Education Ministry and then all state education departments as well as relevant district education offices and school principals and headmasters.

In the fieldwork stage, survey questionnaire was mailed to randomly selected primary and secondary schools based on the sampling frame of 351 Frog VLE champion schools nationwide in two phases with a gestation period of four months (Venkatesh, Thong & Xu, 2012).

During the data analysis stage, initial data screening was conducted to eliminate incomplete survey questionnaire followed by evaluation of common method bias, non-response bias and multivariate assumptions (i.e. normality, linearity, homoscedasticity

and multicollinearity). Then descriptive statistics and inference statistical analyses were performed.

In the hypothesis testing, Partial Least Squares (PLS) was engaged using SmartPLS 3.0 with 5000 bootstrap samples with no sign changes. The quality of the measurement model was evaluated based on convergent validity and discriminant validity using Fornell-Larcker's criterion (1981). The quality of the structural model was evaluated based on predictive relevance and effect size. Mediation effects were examined using Baron-Kenny's approach and Sobel's test of significance of mediation.

Finally, based on the outcomes of the statistical analyses, the findings were discussed in detail by comparing them with the previous related studies and justifications were given for contradictory outcomes. The study has provided several theoretical and practical contributions to scholars and practitioners as well as the limitations and future research direction.

1.7 Significance of the study

The study is able to examine the integrated model derived from the consolidation of the Channel Expansion Theory, Self Determination Theory and the VLE characteristics of Content Design and Interactivity as well as School Support in explaining the behavioral intention to use cloud-based VLE. Besides that the impact of behavioral intention to use cloud-based VLE on the perceived instructional effectiveness was also examined. The construct of perceived instructional effectiveness was adapted from (Limniou & Smith, 2010). The mediating effects of behavioral intention to use on perceived instructional effectiveness was examined. In addition, the study also investigate the confounding effects of the control variables of educational level,

specialization and teaching experience and the mediating effects of perceived media richness, trust-in-website and attitude towards knowledge sharing.

Furthermore, the findings from this study may provide vital insight and understanding to stake holders such as the FrogAsia and YTL service provider, MoE as well as teachers in uplifting the level of VLE usage. YTL may utilize the outcomes of this study in their R&D process in enhancing the VLE platform whereas MoE may find the results of this study useful in developing better strategies to encourage teachers to use VLE in their class room teaching. VLE system developers may use the findings from this study in their software development so that the developed system may meet the needs of the VLE users. VLE content providers may utilize the findings from this research in designing the VLE contents to cater the needs of the VLE users. Finally, teachers will be able to use the VLE platform more efficiently once the VLE system is enhanced and necessary measures are taken by MoE to address the teachers' needs.

1.8 Organization of the thesis

This thesis is organized into seven (7) chapters.

Chapter 1: This chapter provides general information and motivations for research in the field of Virtual Learning Environment (VLE). In this chapter, the problem statement and research gaps are presented. Following on is the research question and objectives and significance of the study and the chapter ends with the organization of the thesis.

Chapter 2: This chapter presents an overview or broad picture of VLE and cloud computing. The chapter explains in detail the role of VLE in education, the components of the Frog VLE and the benefits of using the Frog VLE. Besides that it also elaborates on the fundamental concepts of cloud computing technology including the cloud computing architecture that include Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS) and Infrastructure-as-a-Service (IaaS) layers and the deployment modes of private cloud, public cloud, community cloud and hybrid cloud. It also elucidates the role of cloud computing in online education.

Chapter 3: This chapter focuses on the review on the VLE literature in a chronological manner to identify the deficiencies and weaknesses of the previous studies related to VLE. It encompasses the theoretical underpinnings for this study which are the Self Determination Theory (SDT) and Channel Expansion Theory (CET). In addition to this, the chapter also presents the related studies on each of the independent, mediating, dependent and control variables. After explaining the variables understudy, the chapter proceeds to explain the relationship between the variables. The chapter ends with a summary of the literature review and a construct analysis.

Chapter 4: In this chapter, research methodology is presented. The chapter starts with the development of the research model and its hypotheses. It then continues to describe the research paradigm, research design, research method and research approach. Moreover, the chapter also elaborates on the instrument development and validation which include operationalization of scales, population and sample size, unit of analysis, questionnaire design and administration, face validity, expert panel and content validity index and construct validity. Following on is the elaboration of the pilot test and construct reliability. Then, the chapter continues to report the consent of study and data

gathering procedure. The chapter ends with a presentation of the data analysis methods which include descriptive statistics and inferential statistical analyses.

Chapter 5: This chapter presents the results of the data analyses. Besides the descriptive statistics of demographic profile, it also reports the results of the tests on multivariate assumptions, common method bias, non-response bias, unidimentionality, convergent validity, discriminant validity, construct reliability, hypothesis testing, mediation effects and ends with the predictive relevance and effect size.

Chapter 6: This chapter discusses the findings from the study. The results are compared with the previous literature outcomes. The chapter also explains the contradicting outcomes by providing the relevant justifications.

Chapter 7: This is the conclusive chapter. The chapter concentrates on explaining the methodological contributions, theoretical contributions and practical contributions. Several new or novel theoretical contributions for scholars and researchers are to be presented. Besides that the chapter also provides several useful practical suggestions and recommendations to practitioners such as the Malaysian Ministry of Education, YTL Communications, FrogAsia and etc. The chapter ends by stating the limitations of the study and the future research direction.

1.9 Chapter summary

This chapter presented the overview of the research including the research background such as the 1BestariNet project and the Frog VLE system. Besides that the problem statement was also discussed. The main problems identified are the low usage of the Frog VLE among teachers (Auditor General's Report, 2013) and lack of studies

on cloud-based VLE (Liaw et al., 2007). Besides identification of the problems, this chapter has also presented the research gaps. Among the research gaps identified are the lack of attention given by the previous studies in examining the effects of intrinsic motivational factors and media richness attributes of the VLE systems. These include the SDT and CET theories.

Furthermore, none of the previous VLE related studies have incorporated the content design and interactivity as the antecedents of behavioral intention to use VLE and more importantly no studies have been carried out to examine the instructional effectiveness of a cloud-based VLE system using a nationwide survey approach. These studies have been conducted from the contexts of undergraduates and university instructions and not from the context of the school teachers. Due to the significant difference between the university and school cultures and environments as well as the huge differences between grid computing and cloud computing VLE, the findings form these studies may not be applicable to the new cloud-based VLE context.

Another essential problem identified is the absence of a rigorously validated instrument to measure instructional effectiveness of a cloud-based VLE as all of the existing instruments have been developed by adopting items from existing studies without proper validation and translation procedures.

In this chapter, the research question and objectives are also presented together with the significance of the research from the perspectives of theoretical and practical contributions. The chapter ends with the organization of the thesis.

CHAPTER 2: VLE AND CLOUD COMPUTING

2.1 Introduction

A Virtual Learning Environment (VLE) consists of the following elements, which can be provided separately and are available in different combinations (Bostock, 2000)

- Computer mediated communications (CMC). This includes e-mail and bulletin board facilities. Some support real-time messages between users who are online.
- Publishing (i.e. dissemination of learning materials). Provision of online documents required by students such as lecture slides, module outlines, case studies and assessment materials.
- Computer assisted assessment (CAA) such as multiple-choice questions.
- Course management facilities to control access and submission of work by students.

A typical VLE comprises the following tools (Britain & Liber, 1999)

- Assessments / grade-book
- Assignments / quizzes
- Book marking
- Calendar
- Class list and student homepages
- Conferences
- Course outline
- Email tutor and other students
- File upload area
- Metadata
- Multimedia resources repository
- Navigation model
- Notice-board
- Search tools
- Synchronous collaboration tools

2.2 VLE in education

Dillenbourg, Schneider and Synteta (2002, p.1) opined that VLE can be recognized by the following features:

- A VLE is a designed information space
- A VLE is a social space where educational interactions transpire in the environment, transforming spaces into places
- The virtual space is explicitly represented where the representation of this information or social space may differ from text model to 3D immersive virtual world
- Students are not only active but also actors as they co-construct the virtual space
- VLEs are not limited to distance education as they also enrich classroom activities
- VLEs incorporate heterogeneous technologies and multiple pedagogical approaches
- Most VLEs overlap with physical environments

VLE comes with a specific view of education namely the social constructivist paradigm (Oliver & Herrington, 2003; Konrad, 2003). According to Maor (2003), proponents of VLE find within social constructivism, a theoretical foundation to underpin their work. Specific instructional approaches such as scaffolding and coaching appear to be well suited to VLE.

There are seven goals of constructivist learning environments (Oliver & Herrington, 2003, p.113) that can be promoted by VLE:

- Provide experience in the knowledge construction process;
- Provide experience in and appreciation for multiple perspectives;

- Embed learning in realistic and relevant contexts;
- Encourage ownership and voice in the learning process;
- Embed learning in social experience;
- Encourage the use of multiple modes of representation;
- Encourage self-awareness in the knowledge construction process

It is believed that the use of VLE would enhance students' approaches to learning especially within a social constructivist approach in education. A social constructivist approach to learning may be accompanied by changes in the form of assessment to eliminate inconsistencies between teaching methods and assessment procedures (Goodyear, 2002). A VLE may promote students' attainment through immediate feedback, extra support, cooperative revision and etc. "The use of a VLE combined with a more 'active' pedagogical approach, the possibility to collaborate, and given independence to learners, helped to deliver expected pedagogical outcomes and made a difference in learners achievement" (European Schoolnet, EUN 2003, p.20).

2.3 Cloud computing

Cloud computing may be defined as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics (i.e. on-demand self-service, broad network access, resource pooling, rapid elasticity, measured service), three service models (i.e. Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS)) and four deployment models (i.e. Private cloud, Community cloud, Public cloud, Hybrid cloud) (Mell & Grance, 2011, p.6).

Cloud computing (Figure 2.1) is defined as “a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (Puthal, Sahoo, Misha & Swain, 2015, p.2). Hence, it refers to computing services being delivered over the Internet, on demand, from a remote location instead of residing on a personal desktop, laptop, mobile device or an organization’s server.

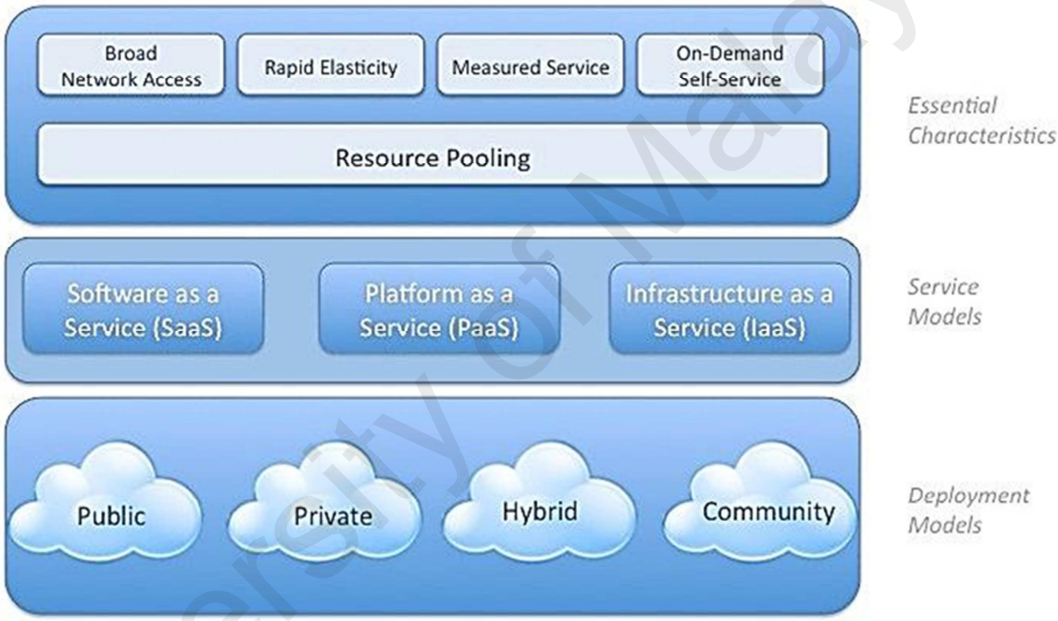

Figure 2.1: The cloud computing model
(Source: http://www.cloudcontrols.org/cloud-standard-information/cloud-definitions/)

Basically, computing becomes location- and device-independent irrespective of where the information is based or where computation process take place to enable computing tasks and information to be accessed anytime, anywhere from any device. The cloud concept means that computing will become an infinite resource, taking on an on-demand, scalable form and with additional network bandwidth, storage and computing capability may be added as needed.

Wyld (2009) opined that cloud computing has the benefits of rapid scalability and deployment capabilities (i.e. provide just-in-time computational power and infrastructure), decreased maintenance or upgrades, improved resource utilization (i.e. elasticity, flexibility, efficiencies), disaster recovery capabilities, economies of scale and collaboration capabilities, ability to engage in usage-based pricing, reduced IT infrastructure needs (i.e. up-front and support costs), capacity for on-demand infrastructure and computing power, green-friendly (i.e. reduced environmental footprint). The fundamental elements of cloud computing are illustrated in Figure 2.2. Cloud computing evolved from grid computing (Figure 2.3). This has brought some advantages in terms of scalability, reliability etc. where an application even though in the presence of peak of resource's demand due to an increase of users or an increase of data, can still provide an answer in real time as it can obtain more instances of a determinate service and the same happens in the case of a drop of the demand whereby it can liberate resources. Hence, the key feature of the cloud computing architecture is its loose coupling, high inter-operativity and existence of some interfaces that isolate the service from the implementation and the platform. In a Service Oriented Architecture (SOA), the services are likely to be organized in a common way in layers or levels where usually some modules use the services which are provided by the lower levels to provide other services to the superior levels.

Cloud computing implies a transformation in the way of solving problems with computers. The design of applications is cloud computing is based on the combination and use of various services in contrast to grid computing which relies on the concept of process or algorithm. Grid computing mainly concentrates on high performace computing whereas cloud computing provides both standard and intensive computations such as web hosting, multiple operating systems, Database support etc. Besides that

grid computing tends to be more loosely coupled, geographically dispersed and heterogeneous in comparison to the conventional cluster computing technologies (Fernandez, Simo, Sallan & Enache, 2013).

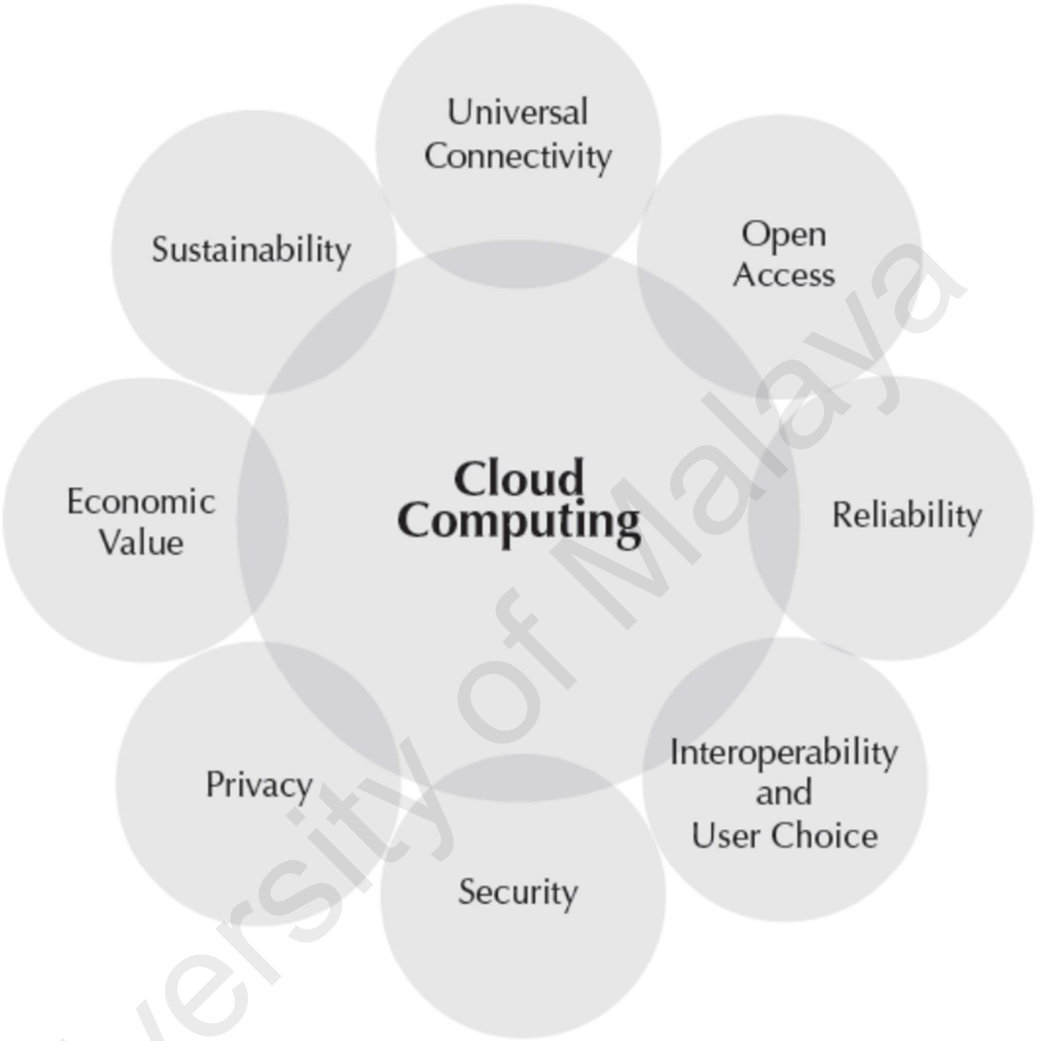

Figure 2.2: Elements of cloud computing
(Source: Rayport & Heyward, 2009, p.4)

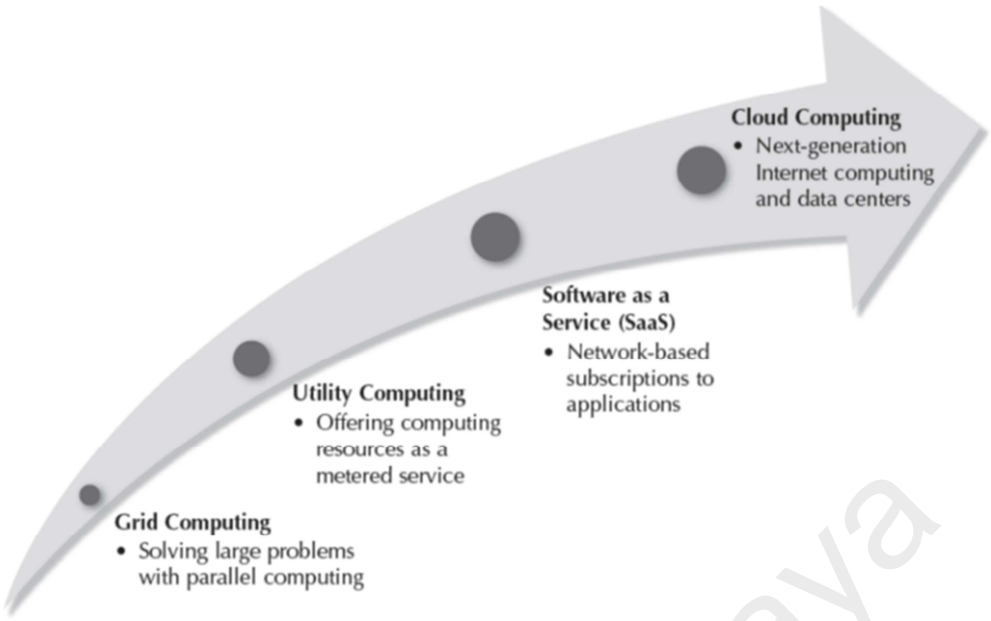

Figure 2.3: Evolution of cloud computing

(Source: United States IBM Corporation (2009) White Paper - Seeding the Clouds: Key Infrastructure Elements for Cloud Computing, February 2009 (p. 6)

According to Sasikala (2013), the main characteristics of cloud computing are as follows:

On-demand self-service – Resources such as storage, processing power, virtual machines and etc. can be registered, obtained and used anytime without the need for human relationship with the cloud administration suppliers (Puthal et al., 2015).

Broad network access – The required resources can be obtained through a system using heterogeneous devices such as mobile phones or laptops (Puthal et al. 2015).

Resource pooling – Cloud administration suppliers can share their resources which are later imparted by various clients which is referred as multi-tenure. For instance, a physical server can have a number of virtual devices having a place with distinct clients (Puthal et al., 2015).

Rapid elasticity – A user or client may quickly obtain more resources from the cloud by scaling out and may scale back in by discharging the resources when they are no more required (Puthal et al., 2015).

Measured service – Resources usage is gauged by observing CPU hours, storage use, bandwidth use and etc. These measurements are utilized to all clouds but every individual cloud can provide users with services at various abstraction levels which is an option for an administration (Puthal et al., 2015).

Puthal et al. (2015) opined that generally there are three common cloud computing service models (Figure 2.4) namely Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (*SaaS*).

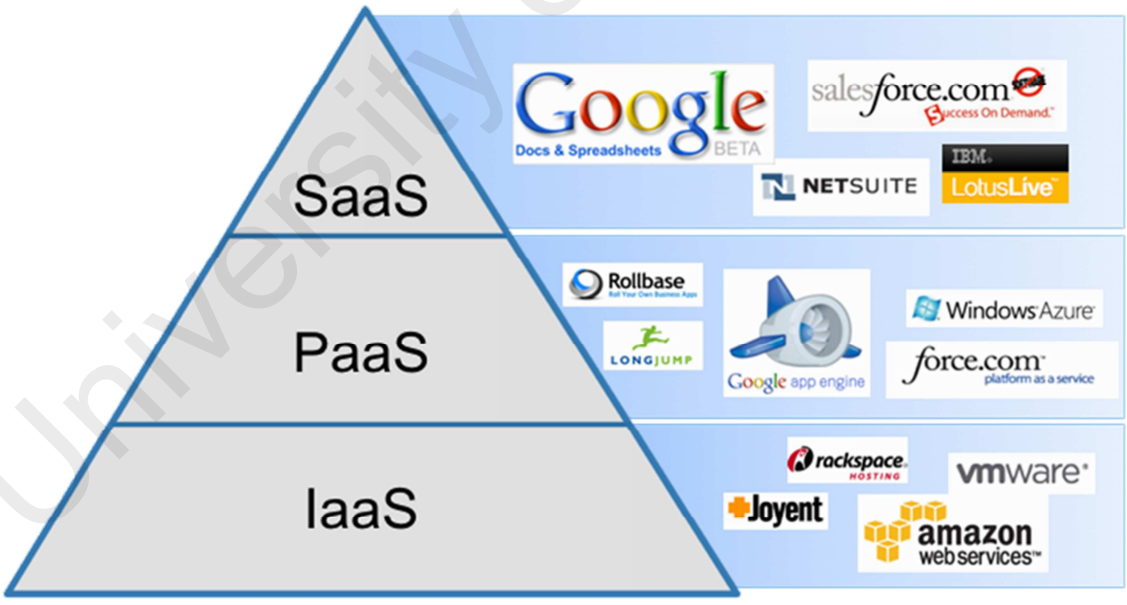

Figure 2.4: Service oriented architecture of cloud computing
(Source: http://www.keyword-suggestions.com/
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SaaS offers the ability for clients to adopt applications running on a cloud infrastructure primarily on the web browser to access software as a service through the web and the clients need not figure out or control how the underlying operating systems, framework of system, storage, network, servers or even individual application capacities. Google Docs and Salesforces are famous examples of SaaS (Puthal et al., 2015).

PaaS provides clients with the ability to install onto the cloud infrastructure, applications created using set of tools and programming languages which are supported by PaaS providers and the clients need not control or oversee the underlying cloud framework such as network, storage, operating systems or servers but has control of the sent applications and conceivably applications the facilitate environment arrangements (Puthal et al., 2015). Just like SaaS, clients need not control or access to the underlying base that is used to have the applications at the PaaS level. Among the famous instances of PaaS are Microsoft Azure and Google App Engine.

IaaS provides clients the ability to provision processing, storage, networks and various basic computing resources from IaaS providers and enables them to install and run any software that may contain applications, services and operating systems whereby the clients have control over storage, operating systems, installed applications and may have restricted control of selected system administration components (Puthal et al., 2015). Unlike PaaS, IaaS is a low level of reflection that allows clients to the right of the entry in the underlying foundation with the application of virtual machines. Moreover, IaaS provides clients with more adaptability over PaaS since it allows the clients to transfer any product stack on top of the operating system. Some of the famous instances of IaaS are Amazon Web Services S3 and EC2.

In terms of deployment models, basically there are four deployment models namely private cloud, public cloud, community cloud and hybrid cloud (Puthal et al., 2015). Private cloud is deployed exclusively by an organization, a firm or one of its clients. The cloud may be handled by himself or a third party. The private cloud provides better security at a higher cost. Some examples of private clouds are Concur Technologies and the St. Andrews cloud computing co-laboratory (Puthal et al., 2015).

Public cloud is utilized by general public and owing to its openness, it may be less secure, however public cloud is the best option that is less expensive (Puthal et al., 2015). Public clouds need substantial investment and are normally possessed by large companies like Google, Amazon or Microsoft.

Community cloud is shared by two or more companies or organizations and is normally setup based on their specific requirements (Puthal et al., 2015). Community cloud is organized to serve a common function or purpose and it can be for one organization or several organisations but they share common concerns like mission, policies, security, regulatory compliance needs etc. A community cloud can be managed by the constituent organization(s) or by a third party.

Finally, hybrid cloud uses a combination of two or more public, private or community cloud but retain their unique identities even though they are bound together as one unit (Puthal et al., 2015). A hybrid cloud may provide standardized or proprietary access to data and applications including application portability.

Cloud computing offers several potential values for education as follows (Ouf &Nasr, 2011):

- No backup is needed as user can create repository of information that can keep growing as long as he or she wants.
- No crash recovery is needed as everything is stored on the cloud.
- Enables users to work from multiple places (e.g. school, home, library etc.), find files and edit the files using cloud-based applications with various devices such as mobile phones, laptop, desktop etc.
- Enables users to dynamically scale as demand increases
- Increase security as it is quite impossible for anyone to determine where the data is stored not to say stealing the data.
- Low maintenance cost as rapid replacement of compromised cloud server can be done easily by using clones of virtual machines.
- No losing of cloud client as the main part of the applications and data is stored in the cloud.
- Easy data monitoring as the data access is centralized at one place and not thousands of computers scattered over a large geographical area.

2.4 The cloud-based Frog VLE

Frog VLE is an easy-to-use virtual learning platform, specially tailored with the users in mind. Created in the United Kingdom with a thirteen-year track record, Frog concentrates on making life easier for students and teachers while improving the process of teaching and learning (www.frogasia.com, 2015). Furthermore, the Frog VLE is incorporated with other content partners and powerful educational tools, comprising of the Khan Academy and Google Apps for Education (1BestriNet, 2014a).

The Frog VLE (Figure 2.5) is a cloud-based learning system which imitates real-world learning by incorporating virtual counterparts of conservative concepts of education. For instance, teachers may deliver lessons, tests, and mark assignments virtually, while students may submit assignments and obtain their marks over the VLE (www.frogasia.com, 2015). Parents may communicate with school administers while school administrators may plan their school calendars and circulate school notices over the Internet (www.frogasia.com, 2015).

Frog's easy-to-use feature enables teachers and students to look for almost anything on the Internet (educational resources, videos, images) and construct it into a sleek-looking Site, without needing any technical knowledge (www.frogasia.com, 2015). The Frog VLE is also a gateway to a plethora of educational resources and cool apps from around the web, all accessible within a safe, filtered environment.

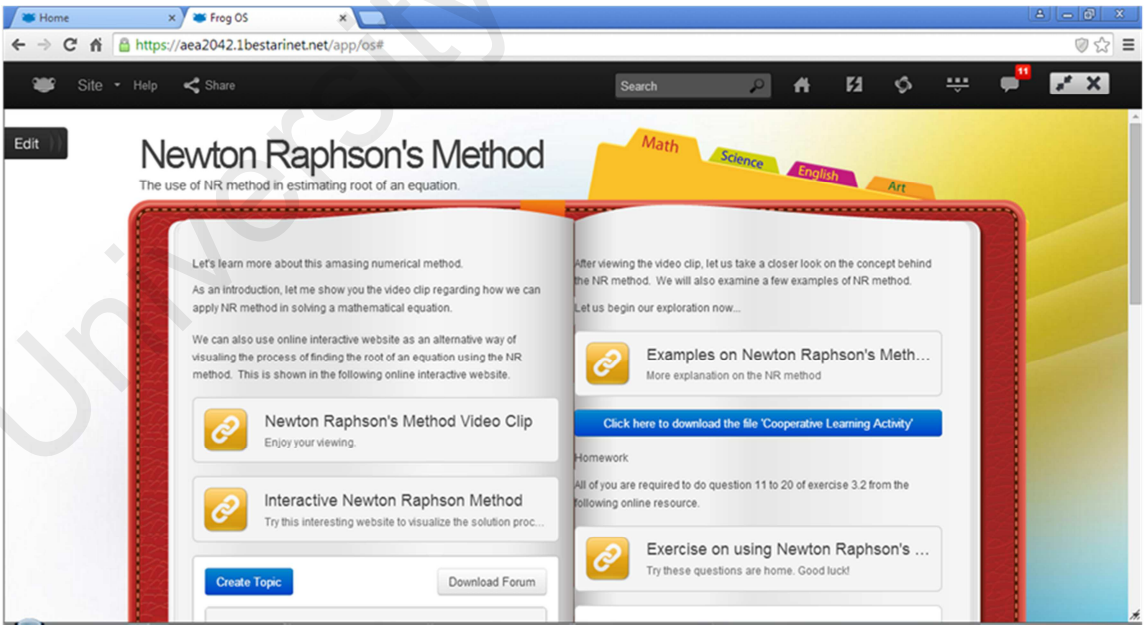


Figure 2.5: An example of the Frog VLE interface
(Source: https://aea2042.1bestarinet/app/os#)

2.5 The infrastructure of Frog VLE

In preparing the nation for the education transformation into the cloud-based Frog VLE, adequate infrastructure is a necessity and mandatory. For this purpose, the Malaysian government especially the MoE has provided the hardware infrastructure to all schools nationwide in an effort to kick start the 1BestariNet project. The main components of the 1BestariNet project are illustrated in Figure 2.6. It encompasses the 1BestariNet Enabler, Frog VLE cloud platform, cloud-based solution, Back-end support and the Prime Minister's Office (PMO) Transformation Program.

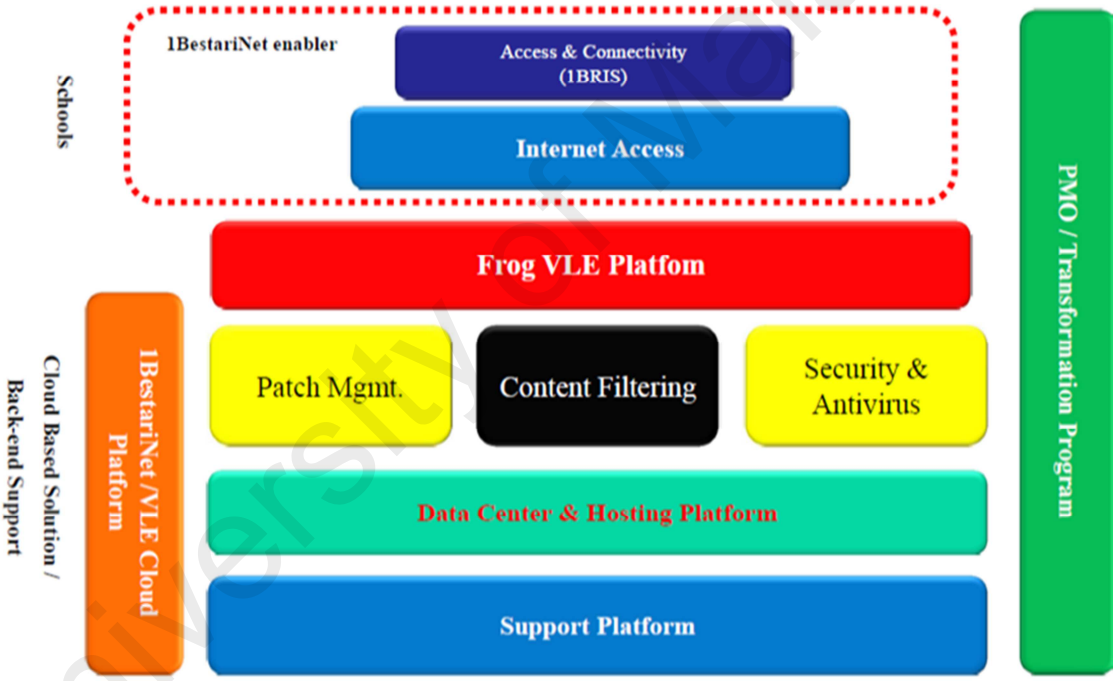


Figure 2.6: Main components of the *1BestariNet* project
(Source: 1BestariNet)

The operation of the 1BestariNet project starts from schools with wireless connectivity via the Frog VLE cloud-based platform to the borderless Internet at anytime and anywhere as illustrated in Figure 2.7. Basically, there are two options to get connected to the Frog VLE system. First, teachers and students at schools may use desktop computers or notebooks to login into the Frog VLE systems via the high-speed

4G wireless access provided by YTL Communications via FrogAsia. With the assistance of the wireless connectivity to the cloud-based Frog VLE, teachers and students will be able to use the Frog VLE built-in applications. Secondly, teachers and students at homes or comunnity centers may use desktop computers or notebooks to get connected to the Internet by login into cloud-based Frog VLE applications.

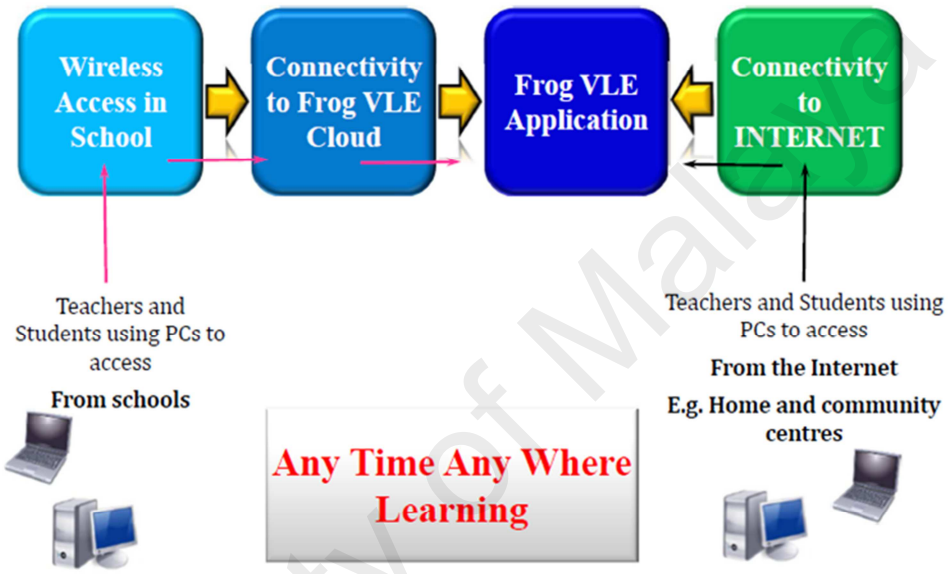


Figure 2.7: Operation of the *1BestariNet* project
(Source: 1BestariNet)

To enable schools to access the wireless 4G high-speed Internet, each school is equiped with the 1BestariNet Receiver Integrated System or 1BRIS which will provide connectivity in all common areas of the school compound using WiMAX or WiFi with 4G Customer Premises Equipment (CPE) or Dongle. There are three options for the installation of the 1BRIS system, namely on roof-top of school building, on top of school water tank or by using monopole tower. Every school will be served by the 1BRIS that will connect back to the 1BestariNet data center. 1BRIS will provide connectivity access to all common areas of the school using either Worldwide Interoperability for Microwave Access (WiMAX) or Wireless Fidelity (WiFi) using a

4G CPE or Dongle. A CPE is telephone or other service provider equipment that is located on the customer's premises (physical location) instead of the provider's premises or in between. Telephone handsets, cable TV set-top boxes, and Digital Subscriber Line (DSL) routers are some examples of CPEs. On the other hand, a dongle is a small device capable of connecting computers particularly in enabling access to wireless broadband or use of protected software often over the USB connections.

A common scenario of the 1BRIS configuration is at the teacher's room, computer laboratories or administrative office, wireless connection will be provided using the ZOOM Internet Port (RJ45). For other areas such as school library, classrooms or common areas such as canteen, hall, workshop and etc. wireless connection is provided using Dongle over the notebooks.

2.6 The components in Frog VLE

Besides the hardware infrastructure, the Malaysia government has also provided the software infrastructure in the form of the cloud-based Frog VLE system. Equipped with the Frog VLE are numerous applications and tools for teachers, students and parents. Figure 2.8 illustrates some of the main applications in the Frog VLE.

Figure 2.8: Main applications in Frog VLE
(Source: FrogAsia)

Assignments

This application allows teachers to deliver, check, comment and alters the tasks assigned to the students. Once a site for assignment is created, it can be sent to the students as an assignment through a simple process. Assignments may be given as individual or group work. The application also allows teachers to send message to the students who are assigned. Teachers can send individual or group messages. When the students submit their assignments, these assignments will be sent back to the Assignments panel so that teachers may check and give their comments. The teachers will receive notifications through the Notifications panel when an assignment is sent or a message is received. Students are not allowed to assign any

assignment. They only can view, complete and send their assignments. When an assignment is assigned to them, students will receive a notification through the Notifications panel. The assignment can be opened by clicking on the notification. Students will also receive notification when the marks are given.

Calendar

Calendar allows teachers to manage all activities. When needed, teachers may share the calendar with their colleagues. Other calendars may be created and shared publicly or internally. For example, calendar for a co-curricular activity or special private event. Additional information may be attached to a particular event or activity such as the location, invitation or note.

Booking Calendar

Booking Calendar allows teacher to book a room or resource. If a room or resource has been booked, Frog VLE will not allow other users to book them at the same time and date. Frog administrator may add new room or resource to the Booking Calendar.

Community

Community is a portal for teachers to obtain common questions, documentation, assistant video and forum space to discuss relevant current issues. Community is based on a group concept. Each group possesses a Wall where each member of the group can send message. Teachers may search a group and participate in any group that is listed in the search result. If no group is found, teachers may have the option to create new group and select one of the following categories:

Public: group will be shown in the search result and any one can participate

Private: group will not be shown in the search result and group member need to be invited by the group owner.

Department Site

Each department has its own Department Site. The main page should display a welcoming notice, organizational chart of the panel, examination marks and other notices. The subject page is linked to the panel page where students may obtain information regarding to the subject. The subject page may contain information on curriculum, gallery, video, teachers' profiles, revision guidelines, past year questions and etc. The subject page can be added if needed.

Lesson Resources

Files in the Lesson Resources may comprise of all the instructional resources for the school. An example of resource is the file used for instruction or a file uploaded in Site. Teachers may create files and upload existing resources to the Site. This area is also used to provide access of resources to the other teachers. These documents consist of fail in the format of zip, MS Word, Excel, PDF, MP4 video or audio. It is recommended that each Panel has its own panel folder. In each folder, teachers have their own folders to upload the resources.

Frogstore

Frogstore is an online store that contains applications and resources to be used in the VLE. User can search the content for teaching and learning such as image and video to be used in Site. There are 3 public areas for teachers to surf:

Home - Teachers can search for video and image to be used in VLE (video and image can be attached by using Media Widget)

Apps - This area displays applications which teachers can download. This will add to the function in the VLE.

Channels - This area contains content from teachers' colleagues to share instructional content such as Khan Academy. Here, teacher can obtain image, video and instructional content to be used in Site that they create.

Forums

The Forums area displays the school forum. This is a forum for the whole school and may be viewed by teachers and students. Only Frog Admin can create a topic in the school forum. Discussion forum may be created for group discussion regarding a particular topic. All information has a certain date that allows teachers to check the discussion topic and identify the individuals who have contributed to the topic. The forum creator may control all topics, access and viewing.

The Pond

In the Pond, great mind and idea may be induced and shared. The Pond is created for the students. They may start experiencing together the Frog through tips and idea in using the Frog effectively.

School Documents

School Documents is a place where document is saved and used by all members of the school. All teachers and students may view and download fails that is uploaded into this area. This covers teachers' and students' user manual, policies and school information. Files may be categorized in the form of folder.

Document may be in the format of zip, MS Word, MS Excel, PDF, MP4video or audio file. Students will have access to read while teachers may access admin to add or delete information.

My Documents

My Documents is an area for saving all private files. This is a private area and cannot be accessed by other users.

Sites

Sites are websites that are created in the VLE. These websites can be tagged with keywords to provide easy search and to facilitate category division. The created websites will be listed in My Sites area in the Resource Manager.

Website that has specific subject tag such as English; will appear in the Subject Sites category. Website with co-curriculum activity tag like club and visiting will appear in the Co-curricular Sites area. The Other Sites area contains websites with no tag of keywords on specific subject or co-curriculum or websites that are tagged with keyword "other".

For security reason, the Sites cannot be accessed with login into the VLE. The website creator may control the right to access and edit. If a website is not shared with the teachers, it cannot be viewed in the Resource Manager.

The website that is created can be sent to MoE Repository to be shared with other schools in Malaysia. After uploading, the website will be checked and listed for download. Only teacher can upload and download sites through the MoE Repository.

Email

Each user that has a Frog VLE account possesses the access to their own email. Email can be sent and received from other users, not only within schools but schools anywhere. The email address is the same as the user ID that is used to login into the VLE.

Resource Manager

Resource Manager is the main application to access resources that is created by the teachers or which is shared with the teachers. It allows teachers to save, view, edit and create content in all permitted areas of the VLE.

There are several areas in this section:

Latest Files – Displays recent files that teachers have uploaded into My Documents

Favorites – Selected sites may be added into this area to allow easy and fast access to these sites

My Documents – This is the storage for teachers' private files. Uploaded files cannot be viewed or accessed by other users

Sites – Websites that are shared with the teachers are displayed here

Applications – Displays all applications. Frog Admin can access user and group data from this area

Lesson Resources – All teaching and learning files should be uploaded to the Lesson Resources. Only teachers and admin have access to this part

School Documents – Teachers and admin may upload and download files. Students only can view and download files.

My Dashboard

My Dashboard is the first page that teachers will find after login into the VLE. This site can be edit to display school calendar, RSS Feeds or notifications. Teachers may add personal content such as photo, video or links to teachers' favorite sites. Widgets may be used to edit the appearance and content of the Dashboard according to suitability.

School Dashboard

School Dashboard displays notice and information managed by the school. Here, teachers can view notice board, image, video and download important files. It also contains MoE RSS feed to ensure that teachers are always informed about

educational news or other information for school and teachers. School Dashboard only can be edited by Admin.

2.7 Benefits of using Frog VLE

Frog VLE was tailored with the user in mind and is aimed at fostering a creative generation of Malaysians who are empowered to take possession of their education and are ready to compete in an international knowledge-based economy (www.frogasia.com, 2015). The advantages of Frog VLE are as follows (1BestriNet, 2014a):

- ***Save effort and time***: Frog provides teachers with tools to effortlessly perform tasks such as managing academic calendars, planning lesson, and marking exercises (www.frogasia.com, 2015).
- ***Collaborate and connect***: Frog VLE links teachers across the nation, enabling them to collaborate and share ideas and resources (www.frogasia.com, 2015).
- ***Learn beyond borders***: Since Frog is cloud-based; learning can occur anywhere and anytime. Moreover, by permitting students to save everything on the cloud, carrying heavy text books will become a thing of the past (www.frogasia.com, 2015).
- ***Engage and compel***: Frog's easy-to-use feature enables teachers and students to look for educational content (e.g. images, videos, instructional resources) on the internet and shape it into a functional web site, without requiring advanced technical knowledge and this will enable teachers to swiftly construct fascinating and appealing lesson resources that may cater to various learning styles, with a number of simple clicks (www.frogasia.com, 2015).

- ***An established learning platform***: Frog has a thirteen-year track record and has been adopted in over 700 schools in the United Kingdom and globally. Furthermore, the Frog VLE is incorporated with other content partners and powerful educational tools such as the Khan Academy and Google Apps for Education (www.frogasia.com, 2015).

2.8 Chapter summary

In this chapter, the fundamental concepts about VLE and cloud computing have been explained in detail. These include the definition of VLE and cloud computing. The role of VLE in education was also elucidated. Then the cloud computing architecture and capabilities were explicated and these include the SaaS, PaaS and IaaS infrastructures as well as the deployment models of community, public, private and hybrid cloud. The potential of cloud computing in education was also included. Finally, the main components of the Frog VLE were elaborated in detail. The chapter ends with explanation on the advantages of using the Frog VLE.

CHAPTER 3: LITERATURE REVIEW

3.1 Introduction

This chapter focuses on literature review of the related VLE studies. It begins with the review on the VLE literature is presented based on the previous studies related to VLE. Next, the theoretical underpinnings of the study is presented by elaborating on the Self Determination Theory and Channel Expansion Theory. Then, the variables used in this study are explained in detail starting from the independent variables (i.e. perceived relatedness, perceived autonomy, perceived competence, school support, interactivity and content design), mediating variables (i.e. attitude toward knowledge sharing, trust in website and perceived media richness), dependent variables (i.e. VLE behavioral intention and perceived instructional effectiveness) and finally the control variables (i.e. specialization, teaching experience and education level). After that, the influence of each of the independent variables on its dependent variable is explained in detail. Then, the influence of the control variables on VLE behavioral intention is elucidated. This chapter ends with a summary of the literature review followed by construct analysis.

3.2 Previous studies related to VLE

Based on the literature review, several VLE related studies were discovered. However, there is scarcity in studies on the cloud-based VLE as it is a relatively new context of study. All of these studies have focused on the grid-based VLE such as Moodle, Black-Board, e-LMS, web-based learning system and etc.

Basically, the kinds of study that have been done in this areas are related to the acceptance of Moodle (Cobo et al., 2014; Sumak et al., 2010), Blackboard (Liaw, 2008), CassLearn (Van Raaij & Schepers, 2008), Web-based instruction (Sun & Hsu, 2013), e-LMS (Eom, 2012), Web-based LMS (Motaghian et al., 2013), Technology-mediated VLE (Chou & Liu, 2005) and 3D VLE (Shin et al., 2013). This study is different from these existing studies in several ways. First of all, unlike the present studies which engaged extrinsic motivation theories (e.g. UTAUT, ISSM, ECT, TAM and its derivatives), this study used intrinsic motivation based on the Self Determination Theory. Furthermore, the study also integrated Channel Expansion Theory to provide better understanding about the acceptance of the cloud-based Frog VLE. Secondly, unlike extant studies which did not included context specific constructs, this study has included several cloud-based VLE task-specific constructs (i.e. VLE interactivity, VLE content design, school support, trust in website and attitude toward knowledge sharing). Third, different from existing studies which have used convenient sampling, this study used simple random sampling to provide higher degree of validity. In addition to that, unlike prior studies, this study engaged two phases of nationwide surveys in to gather the independent variables (T1) and dependent variables (T2). This has significantly reduced the problem of common method bias. Fourth, unlike earlier studies which did not involve rigorous instrument development and validation, this study engaged a rigorous process in developing and validating the instruments which involved face validity and content validity by expert panel members, Q-sort procedure by practitioners, content validity index, English-Malay back-translation, pre-test and pilot test. Besides that, this study is different in the sense that it is done in the cloud-based context compared previous studies which were done on the grid-based context. Finally, unlike former studies which focused on the perspectives of undergraduates and university

instructors, this study focused on the acceptance of school teachers. The details of these previous studies in explicated in the next paragraphs.

Chronologically, Chou and Liu (2005) have conducted a study on technology-mediated VLE (TVLE) in the context of basic information technology skills training in Taiwan. TVLEs are defined as computer-based environments that are relatively open and permit interactions and knowledge sharing with other participants and instructors' and offering access to a wide range of resources (Wilson, 1996). The advantage of TVLEs is the characteristics of "learning anywhere" and "learning anytime" that emphasizes on self-control, diffuse thinking models, diverse viewpoints and independent thinking (Hill & Hannafin, 1997).

Advocates of TVLEs argued that the technology-mediate VLEs may potentially eradicate the barriers by providing increased convenience, flexibility, currency of material, individualized learning, student retention, and feedback over traditional classrooms (Massy & Zemsky, 1995; Hackbarth, 1996; Kiser, 1999). Drawing from the Technology-mediated Learning Theory (Alavi, Wheeler & Valacich,1995; Leidner & Jarvenpaa, 1995; Piccoli, Ahmad & Ives, 2001) and the Component Display Theory (Merrill, 1983), they studied the relationships between learner control and learning effectiveness based on four categories (i.e. learning achievement, self-efficacy, satisfaction and learning climate). 210 usable responses were gathered from a junior high school in Taiwan.

The Taiwan study showed that students in the TVLE environment achieved better learning performance, reported high levels of computer self-efficacy, satisfaction and learning climate than their counterparts in the traditional environment. However, their

study did not examine the impact of human dimension (i.e. individual traits of students) on learning effectiveness. They opined that the key difference between TVLEs and traditional classrooms is in the shift of control and responsibility on the learner where individual characteristics of the learners may play an important role in influencing learning effectiveness.

Three years later, Liaw (2008) conducted a study on students' gratification, intention to use as well as the efficiency of the Blackboard e-learning platform in Taiwan by using the Three-tier Technology Use Model (3-TUM). The advantages of e-learning have been talked about in a number of studies (Bouhnik & Marcus, 2006; Liaw, Huang & Chen, 2007a; Raab, Ellis & Abdon, 2002; Shotsberger, 2000). For instance, Bouhnik and Marcus (2006) as cited in Liaw (2008, p. 864) listed four advantages of e-learning as:

1) Freedom to decide when each online lesson will be learnt
2) Lack of dependence on the time constraints of the lecturer
3) Freedom to express thoughts and ask questions without limitations
4) The accessibility to the course's online materials at students' own selection

On the other hand, Capper (2001) as cited in Liaw (2008, p. 865) put forward the following advantages of e-learning:

1) Anytime: a student may access the learning content anytime that is convenient
2) Anyplace: the students need not to meet face to face
3) Asynchronous interactions: the interactions may be more concise and the discussion becomes more on-track
4) Group collaboration: electronic messaging provides new opportunities for groups to collaborate through shared electronic discussions and conversation

5) Novel educational approaches: a lot of new learning strategies and choices become economically feasible via online programs. Online programs may also offer unique prospects for students and teachers to share novelties in their own works with the instant support of the electronic groups

Based on a survey on 424 undergraduates, their findings indicated that perceived self-efficacy is a vital factor that affects undergraduates' satisfaction with Blackboard e-learning platform. Perceived satisfaction and perceived usefulness were found to have significant influence on undergraduates' intentions to use the Blackboard platform. They also found that e-learning effectiveness is affected by e-learning system quality, interactive learning activities and multimedia instruction. Learners' self-efficacy is the dominant factor that affects e-learning usage. Moreover, e-learning system quality and multimedia instruction significantly predict perceived satisfaction with e-learning.

Liaw (2008) also found that system and multimedia quality were the strongest predictors of perceived usefulness of e-learning whereas system quality, self-efficacy and interactive learning activities are prime factors that affect e-learning usefulness. Furthermore, system quality, interactive learning activities and multimedia instruction are key antecedents of e-learning effectiveness. It showed that diverse multimedia learning content is vital for improvement in performance, e-learning efficacy and motivation among the undergraduates. It is also found that even though undergraduates trust that e-learning is a useful learning instrument, they are more concern with the system quality particularly interactivity. They also implied that they require more communicative and interactive functions and activities while using the Blackboard e-learning platform.

Meanwhile, in the same year in China, Van Raaij and Schepers (2008) studied the acceptance and use of grid-based VLE using the CassLearn system. They adopted a conceptual model which extends TAM2 by incorporating subjective norm, computer anxiety and personal innovativeness in the domain of information technology (PIIT). PIIT is defined as the individual's willingness to try out any new information technology (Agarwal & Prasad, 1998). It is also referred as an individual's predisposition or attitude reflecting his tendency to experiment with and to adopt novel information technologies independent from the communicated experience of others (Schillewaert, Ahearne, Frambach & Moenaert, 2005). In a nutshell, it is the willingness of a person to try out an innovation and generally may be viewed as a concept of risk taking tendency (Agarwal & Prasad, 1998; Bommer & Jalajas, 1999).

Even though PIIT has been used in various models of technology adoption a number of times, its role remain unclear and need more study (Rosen, 2004). Lewis, Agarwal and Sambamurthy (2003) opined that PIIT has obtained constant support as an imperative predictor of technology acceptance. On the other hand, computer anxiety is referred as the uncontrolled happening of an emotional or anxious reaction when performing a behavior using a computer (Compeau & Higgins, 1995). It is also referred as the tendency of an individual to be apprehensive, phobic and/or anxious or the emotional distress towards the use of computers (Igbaria & Livari, 1995). These may include anxious about the effects of computer usage such as damage of imperative data, worry of looking foolish, making other mistakes or jeopardizing computer equipment (McInerney, McInerney & Sinclair, 1994).

According to Van Raaij and Schepers (2008), VLEs are tailored for enhancing and supporting personal process of study by providing a repository for program documents, mass communication options, chat boxes, discussion forums and etc. Although there have been many studies on technology acceptance, nevertheless, the number of studies on acceptance and adoption of VLEs is small but constantly growing (e.g. Martins & Kellermanns, 2004; Ngai et al., 2007; Ong, Lai & Wang, 2004; Pituch & Lee, 2006; Selim, 2003).

In their study, 45 Chinese respondents enrolled in an Executive MBA program were taken as the samples. However one sample was discarded due to incompleteness while four outliers were identified and dropped from the dataset leaving a final usable data of 14 female and 26 male respondents. The data was analyzed using PLS due to small sample size. Van Raaij and Schepers (2008) assert that previous studies on technology adoption (e.g. Cool et al., 1989; Kahai & Cooper, 2003; So & Balloju, 2005; Venkatesh & Davis, 2000; Yoo & Alavi, 2001) have revealed stable results based on sample of this size or smaller. The findings from the PLS analysis revealed a significant positive influence of perceived usefulness on use but no significant influence of perceived ease of use or subjective norm (Van Raaij & Schepers, 2008). It was also found that subjective norm and perceived ease of use have significant positive influence on perceived usefulness. On the other hand, computer anxiety was found to have direct negative influence on perceived ease of use while PIIT was found to have positive direct influence on perceived ease of use and a negative significant influence on computer anxiety but no significant influence on perceived usefulness (Van Raaij & Schepers, 2008).

Van Raaij and Schepers (2008) further explained that the indirect effect of subjective norm on perceived usefulness indicated that a process of 'internalization' has occurred. Internalization is an ongoing process and thus the longer a person deals with a system, the lesser salient subjective norm becomes a direct antecedent of usefulness (Van Raaij & Schepers, 2008). It is also recommended that when users gain more experience with a novel system, perceived ease of use will become less profound as instrumentality concerns surpass the concerns about the ease of use of the system (Straub et al., 1997). The degree to which the system is utilized may be anticipated to be activated more by perceived usefulness rather than by the perceived ease of use since students are more willing to overcome usability difficulties compared to prospect of better academic achievements (Van Raaij & Schepers, 2008).

The research model is able to provide 54% of variance in perceived usefulness and 59% of variance in perceived ease of use. PIIT was able to explain 10% of variance in computer anxiety. However, Van Raaij and Schepers (2008) stressed that their study is limited by the small sample size of 44 usable respondents. Another limitation is the use of self-reported survey which may lead to issue of common method bias.

Two year after that, Sumak et al. (2010) conducted a study on acceptance of Moodle in Slovenia using the UTAUT model. Moodle offers a variety of activity modules (e.g. Forums, Wikis, Tracking, Blogs, Assignments, Quizzes, etc.) and hence may be applied as a tool for delivering content to students and assess learning via assignments or quizzes and more interestingly for building rich collaborative learning communities (Sumak et al., 2010). It has a large and diversified community with more than 83,327,196 registered users, 245,546,910 enrolments, 9,504,299 courses, 168,874,568

forum posts, 86,193,588 resources and 424,268,299 quiz questions that spread over 223 nations with 68,880 registered sites (https://moodle.net/stats/, 2016).

The study involved 235 undergraduates at the Faculty of Electrical Engineering and Computer Science in Maribor, Slovenia. The statistical results showed that the performance expectancy and social influence have significant influence on attitudes toward using Moodle. Social influence significantly affects behavioral intention while facilitating conditions and behavioral intention significantly influence use of Moodle. However, they did not found any significant effects of performance expectancy, effort expectancy and attitude towards using Moodle on behavioral intention. Likewise, there was also no evidence to support the effect of effort expectancy on attitude towards using the Moodle.

Nevertheless, Sumak et al. (2010) stressed that their findings are limited to undergraduates at a faculty that is very much technically oriented and therefore the findings may not be generalized to a large population of full time undergraduates. These undergraduates are mostly male students and have possessed the technical skills in using the Moodle. They also suggested that future studies may try to answer what factors that affect professors' and teaching assistants' perceptions in deciding whether to accept or not accept the Moodle.

In the same year, back in Spain, Sanchez and Hueros (2010) also study the acceptance of Moodle by extending the TAM model with technical support and perceived self-efficacy. The TAM model has been used in predicting the usage of new information and communication technologies such as email (Gefen & Straub, 1997), WWW (Agarwal & Karahanna, 2000; Agarwal & Prasad, 1998; Sanches-Franco &

Roldán, 2005), search engines (Morris & Dillon, 1997), online sales (Chen, Gillenson & Sherrell, 2002; O'cass & Fenech, 2003), web purchase intention (Van der Heijden, Verhagen & Creemers, 2003) and etc. TAM model was introduced by Davis, Bagozzi and Warshaw (1989) to explain the acceptance and use of information technologies based on the Theory of Reasoned Action (TRA) developed by Fishbein and Ajzen (1975). TRA is a macro theory for explaining almost every type of human behavior and part of the importance of individual beliefs in order to predict human conduct (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). TAM focus mainly on the analysis of information technology (Chau, 1996; Featherman & Pavlov, 2003; Mathieson, 1991; Taylor & Todd, 1995, 1995a; Venkatesh, 2000) and unlike TRA models, pre-establish factors that condition user attitude towards innovation, behavioral intention and intensity of system usage. Davis et al., (1989), Davis and Wiedenbeck (2001) opined that the two main factors in determining behavioral intention are perceived usefulness (PU) and perceived ease of use (PEOU).

Perceived usefulness is assumed as an extrinsic motivation for the user and is defined as the extent to which an individual believes that the user of a specific system may enhance work performance (Davis, 1989; Lederer, Maupin, Sena & Zhuang, 2000). Ease of use on the other hand is defined as the extent to which an individual perceives that the usage of a specific technology does not require extra effort (O'cass & Fenech, 2003; Venkatesh, 2000). The TAM model has been validated for a wide range of information systems (Moon & Kim, 2001).

Sanchez and Hueros (2010) used a model consisting of technical support, perceived self-efficacy, perceived usefulness, perceived ease of use, attitude and system usage. Technical support is defined as personnel trained to assist users in solving problems

regarding to computer hardware and software (Ralph, 1991). It is one of the most important factors in teaching technology acceptance (Hofman, 2002; Sumner & Hostetler, 1999). Self-efficacy is defined as the belief people have in their own capability to organize and execute actions needed to manage future situations (Sanchez & Hueros, 2010). It does not refer to the resources but rather the view an individual has on what can be done with them (Bandura, 1977). Attitude is defined as the extent to which an individual is interested in particular systems and it has a direct influence on intention to use those systems in the near future (Bajaj & Nididumolu, 1998).

In Sanchez and Hueros's (2010) study, 226 students from Business Administration and Management and Infant and Primary School Teaching degree courses of the University of Huelva were involved in the study. From the structural path analysis, the coefficient of determination (R^2) for perceived usefulness, attitude and system usage are 54%, 77% and 41% respectively. The results showed that technical support positively influence perceived ease of use, perceived usefulness and attitude. Perceived ease of use has direct influence on perceived usefulness, attitude and Moodle usage. Moreover, perceived usefulness positively influence attitude and attitude has significant positive influence on system usage.

Sanchez and Hueros (2010) assert that extrinsic variables and technical support has direct influence on perceived use of use (Ngai et al., 2007) and also perceived usefulness. It also indirectly affect attitude which supports the importance of technical support on both personal level and the via the Web as well as training users to use the Moodle (Sanchez & Hueroes, 2010). They suggested universities to recruit more trained personnel in the use of distance learning systems in order to support teaching staff and students and drive the motivation to use the learning systems. Also

recommended is the importance of fostering user self-confidence so that they will see that the system is easy to use. They also suggested that system designers should incorporate more assistance options and support services to the users, students and teachers in order to resolve problems and answer potential doubts about the system. However, they mentioned that the students' varied experiences and time spent on using the system are not quantified and future studies may explore other variables that may influence the usage of the Moodle system.

Two years later, in the USA, Eom (2012) has conducted a study on the users' satisfaction and system effectiveness of electronic Learning Management System (eLMS). Eom's (2012) aim is to test the impacts of eLMS, self-regulated learning and self-efficacy on system effectiveness and learners' satisfaction empirically. Eom (2012) has extended the VLE effectiveness model of Piccoli et al. (2001) and the Information System Success Model (ISSM) by DeLone and McLean (2003). The ISSM model is one of the extensively used IS success models according to a systematic review of 180 studies (Eom, 2012). Livari (2005) has summarized that information quality and perceived system quality are significant antecedents of user satisfaction but failed to support the positive relationship between user satisfaction and system use. Eom (2012) opined that ISSM has been validated in many studies including organizational memory ISs (Jennex, Olfman, Panthawi & Park, 1998), health club industry (Skok, Kophamel & Richardson, 2001), e-commerce systems (Molla & Licker, 2001), customer relations management (Avlonitis & Panagopoulos, 2005; Wilson, Daniel & McDonald, 2002), e-Government systems (Wang & Liao, 2008), enterprise resource planning (Bernroider, 2008; Zhang, Lee, Huang, Zhang & Huang, 2005), online community (Lin & Lee, 2006) and etc. ISSM consists of six key constructs which are interdependent and

interconnected namely information quality, system quality, use, user satisfaction, organizational impact and individual impact (Eom, 2012).

Bandura (1986; 1994) defined self-efficacy as individual's belief in his or her capability to achieve a particular task and to obtain designated degrees of performance with the skills he or she possesses. Management Information Systems (MIS) scholars later introduced the concept of 'computer self-efficacy' as an imperative MIS construct and it is referred as an individual's perception of his or her capabilities to utilize computers in accomplishing a task (Compeau & Higgins, 1995). Computer self-efficacy was found to have positive effects on e-learning outcomes (Simmering, Posey & Piccoli, 2009). It was also discovered that perceived course performance, content value and course satisfaction were positively associated to self-efficacy and perceived usefulness of e-learning system (Johnson, Hornik & Salas, 2008).

Self-regulation is referred as cognition, motivation and self-managing behavior (Zimmerman, 1995; Eom, 2012). Various studies (e.g. King, Harner & Brown, 2000; Jonassen, Davidson, Collins, Campbell & Haag, 1995) have suggested that self-regulation in distance learning can be more essential than in conventional face-to-face learning due to the altering role of learners from passive to active learners. Self-regulated learners possess three self-regulatory attributes namely self-efficacy, self-awareness and resourcefulness (Eom, 2012). Self-efficacy positively influences effective study activities, learning outcomes and task persistence (Zimmerman, 1989). Resourcefulness is referred as the capability to control physical surroundings and to seek assistance from social sources including persons and non-human references (Zimmerman, 1989).

Eom (2012) used the multi-dimensional research model developed by Wang, Wang and Shee (2007) to evaluate e-learning system success. The population consists of graduate and undergraduate students registered in an online program at a large university in midwest of United States. A total of 674 usable samples consisting of 140 business and 534 non-business students participated in the survey. Using PLS analysis, the structural model is able to explain 50.9% of the variance in system use, 82.1% of variance in system effectiveness outcomes and 75.4% of variance in user satisfaction (Eom, 2012). Since all percentage of variance explained exceeds 10%, it indicates substantial influences and satisfactory results as well as significant predictive power of the research model (Falk & Miller, 1992). The path analysis showed that self-efficacy, system and information quality have positive effects on system use. User satisfaction on the other hand is influenced by system and information quality. Finally, systems effectiveness is positively influenced by user satisfaction. There were no evidences to support the effects of self-managed learning, information quality, system quality and user satisfaction (Eom, 2012).

However, Eom (2010) further confirmed the prior findings of Freeze et al. (2010), Livari (2005) and Rai, Lang and Welker (2002) on the strong positive relationships between information quality and user satisfaction and between system quality and user satisfaction in the context of voluntary or mandatory. Another finding is the very strong effect of user satisfaction on system effectiveness which is consistent with Freeze, Alshare, Lane and Wen (2010), Eom, Wen and Ashill (2006), Rai et al. (2002) and Livari (2005). Nevertheless, no evidence was found to support the positive relationship between system use and system effectiveness. Eom (2012) argued that despite of its enormous success in various different contexts, the ISSM model can have a very

restricted explanatory power in understanding learners' satisfaction and effectiveness of the system in e-learning context.

Eom (2012) failed to achieve uni-equivocal consensus and the results are inconclusive pertaining to the paths to system use from system quality and information quality and the paths from system use to user satisfaction. There is also no evidence to support that students' psychological learning process (e.g. self-regulated learning management) and psychological variables (e.g. self-efficacy) have any effect on students' satisfaction (Eom, 2012).

A year after Eom (2012), Motaghian et al. (2013) conducted a study on web-based learning systems in Iran. Even though both university instructors and learners are the main users of web-based learning systems, university instructors play the most vital role in determining the success or failure of the systems (Motaghian et al., 2013). When the university instructors decided to conduct all or part of their teaching activities via a web-based learning system, learners will have no choice but to use the system (Wang & Wang, 2009). Though there have been many studies conducted to examine students' adoption of web-based learning systems (e.g. Al-Harbi, 2011; Liu, Chen, Sun, Wible and Kuo, 2010; Ngai et al., 2007; Park, 2009; Raaij & Schepers, 2008; Roca, Chiu & Martinez, 2006) however only a few studies have been done on instructors' adoption of the web-based learning systems (e.g. Pynoo, Devolder, Duyck, van Braak, Sijnave & Duyck, 2011; Sanchez-Franco, Martínez-López & Martín-Velicia, 2009; Wang & Wang, 2009; Yuen & Ma, 2008). No study has been done on instructors' adoption of web-based learning systems in Iran (Motaghian et al., 2013). Web-based learning system or Virtual Learning Environment (VLE) is defined as a web-based communications platform that permits learners, without limitation of time and place, to access different

learning tools like program information, course content, teacher assistance, discussion boards, document sharing systems and learning resources (Raaij & Schepers, 2008). Some examples of these systems are Web Course Tools (WebCT), the Web Course Homepage System (WebCH), Blackboard Learning System and the System for Multimedia Integrated Learning (Smile).

According to Wang and Wang (2009), the successful implementation of an information system is mainly relied on user attitude, participation and satisfaction. However, the implementation is expensive and has a relatively low success rate (Sanchez-Franco et al., 2009; Yuanquan, Jiayin & Huaying, 2008; Yuan & Ma, 2008). The huge investment in e-learning has made user acceptance a critical issue for technological management and implementation (Ong et al., 2004). Educators form the large majority of the educational technology users as they act as drivers in effective integration of technology for instruction (Teo, Lee, Chai & Wong, 2009).

In the work of Motaghian et al. (2013, p. 159), instructors' adoption of web-based learning systems is defined as "the degree to which the instructors intend to continue to use the systems and actually use them". The research model is an integration of the TAM and ISSM models proposed by Wang and Wang (2009). In this model, subjective norm is defined as the perceived social pressure or incentive, especially from the university authorities and fellow instructors, to use a web-based learning system (Motaghian et al., 2013). Self-efficacy on the other hand is defined as the degree of instructor's confidence towards the successful use of the system based on previous experience with other information systems (Wang & Wang, 2009).

To test the hypotheses, cluster sampling of 115 university instructors was engaged. From the structural path analysis, Motaghian et al. (2013) revealed that perceived usefulness is influenced by information quality and subjective norm while perceived ease of use is affected by information quality, service quality, subjective norm and self-efficacy. It is also found that perceived usefulness, perceived ease of use and system quality have positive effects on intention to use which has direct effect on system use. The model is able to explain 58% of variance in perceived ease of use, 29% of variance in perceived usefulness, 53% of variance in intention to use and 16% of variance in system use (Motaghian et al., 2013).

Besides Motaghian et al. (2013), Sun and Hsu (2013) have also conducted a similar study on web-based instruction in Taiwan by examining how various degrees of interactivity in web-based instruction (WBI) may affect learners' perception of adopting WBI. They developed three WBI systems with low, medium and high degrees of interactivity and the influence of interactivity on learners' perceptions was examined in an actual classroom. WBI is considered as an equilibrium between activity and information which encourages learning objectives (Wang & Bagaka, 2003). Interactivity may be seen as having substantial potential in comparison to the traditional forms of education (Sun & Hsu, 2013).

Sun and Hsu (2013) assert that a number of studies (e.g. Gao & Lehman, 2003; Kettanurak, Ramamurthy & Haseman, 2001; Swan, 2002) have shown that high levels of interactivity are linked to more positive learning effects while several studies (e.g. Jung, Choi, Lim & Leem, 2002; Khalifa & Lam, 2002; Proske, Narciss & Korndle, 2007; Swan, 2002) have referred to the positive influences of specific facets of interactivity and offered interactive functions to assess a system's interactivity whereas

several studies (e.g. Sims, 2003; Swan, 2002) have examined learners' perceptions of interactivity. Sun and Hsu (2013) also stated that some studies (e.g. Borsook & Higginbotham-Wheat, 199l; Chou, 2003; Evans & Gibbons, 2007) have recommended research frameworks of interactivity for web-based learning contexts. The well-known classification of five types of interaction provided by Hillman, Willis and Gunawardena (1994), Moore (1989), Soo and Bonk (1998) and the associated dimensions of interactivity attributes for system design proposed by Chou (2003) have been adopted by Sun and Hsu (2013).

According to Sun and Hsu (2013), the terms interactivity or interaction refer to the similar concepts frequently used interchangeably and there are basically five types of interaction based on previous studies (Bannan-Ritland, 2002; Hillman et al., 1994; Moore, 1989; Northrup, 2002; Soo & Bonk, 1998) as follows:

1) Learner-content interaction (Moore, 1989; Gilbert & Moore, 1998; Thurmond & Wambach, 2004)
2) Learner-interface interaction (Hillman et al., 1994)
3) Learner-instructor interaction (Moore, 1989, Rodriguesz, Ooms & Montanez, 2008)
4) Learner-self interaction (Bannan-Ritland, 2002; Northrup, 2002)
5) Learner-learner interaction (Chou, 2003; Downes & McMillan, 2000; Yacci, 2000)

Sun and Hsu (2013) used the open-source and community-based Moodle to construct the 3 WBI systems with interactivity levels stretching from low to high. Moodle assists learners and instructors to access program information, share, communicate and teach others with formation of activity modules to create

collaborative learning atmosphere that facilitates cooperative and independent learning and in the 3 x 1 experimental design, in every group, the learning activities involve learning the content, discussion and assessments (Sun & Hsu, 2013). The objective of the class was to introduce the concepts of database and to teach the learners on how to use database software. The participants were 45 undergraduates in department of the information management from a university located in central Taiwan. Participants were assigned randomly to one of the 3 groups. At the end, 42 participants accomplished the experiment with 14 participants fell in the low level group, 12 in fell the medium level group and 16 participants fell in the high level group. Participants were required to complete 3 questionnaires that gather information regarding their perceptions of interactivity, perceived learning and satisfaction at the end of the experiment.

The findings proposed an association between the level of interactivity and participants' learning, attitudes, satisfaction except perceived interactivity. Perceived interactivity is a form of communication mechanism which encompasses navigability and responsiveness (Wu, 1999). It is a significant antecedent of users' attitudes towards a website (Kiousis, 2002; Newhagen, Cordes & Levy, 1995; Thorson & Rodgers, 2006; Wu, 1999). The result also implied that initially the participants needed a certain quantity of mental effort to access the system but with repetitive exposure to the WBI system, their capability to use the systems will be increased which eventually augmented the similarity of the interactivity perceptions of the 3 groups (Sun & Hsu, 2013). This showed that participants' interactivity perceptions may alter as they become more experienced. However, different interactivity designs may indeed affect their attitudes and achievements in learning.

Besides Motaghian et al., (2013), Sun and Hsu (2013); Shin et al. (2013) have also conducted a study on users' experiences with three-dimensional (3D) virtual learning environments in South Korea. Examples of 3D VLEs are Second Life and Virtual Campus. In 3D VLEs, users take the form of avatars which are normally depicted as textual, two-dimensional (2D) or three-dimensional graphical representations visible to others graphically and have been readily adopted in instructional settings where learners may learn, create, explore, accumulate information collaboratively and individually (Shin et al., 2013). With 3D technology, it would allow educators to transmit their lectures to geographically dispersed learners (Kapp & O'Driscoll, 2010).

Even though 3D technology may not be applicable universally for all educational contexts, it may be particularly useful for distance learning applications like ubiquitous campus (u-campus) and e-learning (Shin et al., 2013). In their study, Expectation Confirmation Theory (ECT) and Technology Acceptance Model (TAM) were integrated with immersion, presence and prior experiences in order to examine consumers' perceptions of 3D VLEs. ECT is a cognitive theory which attempts to explicate post-adoption or post-purchase satisfaction as a function of perceived performance, expectations and disconfirmation of beliefs (Shin, Lee & Hwang, 2017). Based on ECT, higher degree of perceived performance will lead to positive confirmation which will then provide the foundation for subsequent behavior (Shin & Biocca, 2017). Immersion is defined as sub-optimal experience that is concerned with the specific, psychological experience of engaging with certain activities such as online games. Presence is defined as the degree of salience of other person in the interaction and the consequent salience of the interpersonal relationship (Short, Williams & Christie, 1976). The concept of presence was originally defined as "the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationship" (Short et al.,

1976; p. 65). Presence may be viewed as a state of the mind whereas immersion is an experience in time (Jennett, Cox, Cairns, Dhoparee, Epps, Tijs & Walton, 2008).

The ECT theory (Bhattacherjee, 2001) assumes that users' continuance intention is mainly determined by their satisfaction with previous information technology use. Satisfaction is defined as a psychological or affect best related to and resulting from a cognitive appraisal of the expectation-performance discrepancy (Bhattacherjee, 2001; Chou & Chen, 2009 as cited in Shin et al. 2013, p. 205). Satisfaction is also referred as an affect, captured as a positive (satisfied), indifferent or negative (dissatisfied) feeling (Shin et al., 2013). Davis (1989) has theorized and validated affect as attitude in TAM-based studies. Prior studies have shown that IS continuance intention is positively influenced by satisfaction (Bhattacherjee, 2001; Lin, Wu & Tsai, 2005). Furthermore, a number of other studies have also validated the positive causal relationship between confirmation and satisfaction (Hayashi, Chen, Ryan & Wu, 2004; Lin et al., 2005; Hackbarth, Grover & Yi, 2003; Tse & Wilton, 1988).

To conduct the study, a prototype 3D VLE similar to the immersive systems that allows users to feel as was constructed using 3D technologies which permits users to feel as if they are interacting with the instructors in a real class environment (Shin et al., 2013). In the 3D VLE system, teachers' lectures were recoded, whilst they are giving lectures in offline classes. During recording, a special 3D camera was used to capture a 3D image. The recorded lectures were converted into 3D formats in 3D TV. These lectures were then sent to the university web-courseware system where the lectures were stored and retrieved. To retrieve the 3D lectures, students may need to access them from the designated labs where 3D displays were equipped. For those who absent or

miss the classes or who wanted to review the course content design again may retrieve the 3D content.

Data were collected from a survey administered to undergraduate students majoring in human-computer interaction, user interface and communications at several universities in Seoul, South Korea. 264 surveys were gathered but 40 were incomplete or apparently inconsistent. The findings showed that intention to use 3D VLE was positively influenced by experience and satisfaction while confirmation was influenced positively by perceived usefulness, perceived ease of use and presence. It was also found that confirmation, perceived usefulness, perceived ease of use; immersion and presence have positive effects on confirmation. The study further confirmed the importance of cognitive factors and clarified that cognitive factors may be substantially enhanced by experiential factors or subconscious constructs of immersion and presence. They recommended that 3D VLEs should provide a stable user interface with quality user experience to users. It also supported that user confirmation and satisfaction are strongly influenced by psychological factors. The effect of presence on intention was stronger than previous studies (Hayashi et al., 2004; Cyr, hassanein, Head & Ivanov, 2007; Hassanein & Head, 2007). Generally, the research model is capable of explaining 35%, 34% and 30% of variance in confirmation, satisfaction and intention respectively.

However, Shin et al. (2013) confessed that the use of student sample has limited the generalization of their findings to other populations, contexts and times. Also, due to the fact that respondents were tested in a laboratory setting, Hawthorne effect may be an issue that leads to students changing their behavior to conform to the expectation of the researcher. Since the respondents were students of the researcher, they might be conscientious about being assessed by the professor.

Another limitation is the exclusion of individual differences as factors (e.g. demographics, user experience, and personal innovativeness) in the 3D VLE acceptance. Besides that, the ECT-related variables are not exactly embedded in users' cognition (i.e. confirmation and satisfaction). Even though the respondents browsed the prototyped 3D VLE before the surveys, it is still unclear how they really confirm the benefits of the systems and how they get real satisfaction from using it (Shin et al., 2013). The respondents were not involved in actual learning but rather in experimental designs and it would be difficult to determine whether they were aware of such cognitive perceptions as much as in an actual education setting. In conclusion, they suggested that more experiments are required to corroborate the findings of their study.

Four years after Sanchez and Hueros (2010), Cobo et al. (2014) revisited the acceptance of Moodle in the year 2014 in Spain and they tried to provide a novel multi-criteria approach to assess and categorize the degree of interactivity of students in Moodle. The multi-criteria model allowed teachers to compute an index of interactivity of those students who take part in training processes conducted using a Learning Management System (LMS) and the model also permitted teachers to understand better how their students utilize the novel technology and also categorize them based on their behavioral patterns (Cobo et al., 2014). The indices of interactivity are obtained by means of integration (i.e. Analytical Hierarchy Process, AHP) and also exploration of data using data mining (DM) techniques (Cobo et al., 2014).

Cobo et al. (2014) assert that AHP is a multi-criteria decision technique introduced by Saaty (1980) to solve problems of management of scarce resources and planning needs whereas DM on the other hand comprises of a set of methods that allow the semi-automatic and automatic exploration and analysis of massive volumes of information.

In a nutshell, DM seeks the "mining" or extraction of knowledge based on big amount of data (Han & Kamber, 2011). Cobo et al. (2014) opined that more specifically, Educational Data Mining (EDM) is a special area of knowledge designed for the use of automatic learning, statistical methods and DM algorithms on various forms of educational data (Romero & Ventura, 2010).

The computation of the interactivity indices may offer parallel advantages for teacher when it comes to knowing students' needs by identifying those students who demonstrate lower levels of activity and therefore provide an individualized response to their problems and similarly, they may recognize those students who show high levels of interactivity and who may in turn lead collaborative learning processes (Cobo et al., 2014).

Cobo et al. (2014) have used the blended-learning experience of Moodle in the University of Cantabria by engaging 343 students as the participants. The participants were first year undergraduates taking the subject 'Optimization Theory' that covers the elementary principles of mathematical modeling of operation research and optimization problems and while taking the course, they had access to the Moodle and may also perform a series of programed and non-programmed activities (Cobo et al., 2014). The course also permits participants to build a collaborative learning environment and to encourage active student participation in the various activities. Cobo et al. (2014, p. 1004) have decided to use the Moodle's administration functions to gather the subsequent information regarding to every student:

1) Quantity of messages read in the bulletin board discussion
2) Quantity of answers given to messages of other users
3) Quantity of fresh debate topics opened

4) Quantity of active days with access to Moodle
5) Quantity of consultations made to curricular material
6) Quantity of subscriptions made to bulletin board discussion or other LMS resources
7) Quantity of readings of messages and indications from teachers
8) Quantity of times they have participated in online polls or consultations posed in the course
9) Quantity of occurrences they had taken self-assessment tests
10) Quantity of assignments they handed in through Moodle

The online interactivity evaluation was categorized into three categories, namely social interaction, material and resources and activities and assessments. Social interaction consists of read messages (RM), messages/responses (MR) and new debates (ND). Material and resources comprises of active days (AD), resource view (RV), subscriptions (S) and read instructions and tutor indications (RI). Finally, activities and assessments encompass the participations in polls (PP), evaluation tests (ET) and Assignments (A). The interactivity level is calculated using the following model (Cobo et al., 2014, p. 1008):

$$\text{Interactivity level} = 0.039*RM+0.151*MR+0.35*ND + 0.062*AD + 0.02*RV + 0.057*S+0.025*RI+ 0.178*PP + 0.069*ET + 0.069*A,$$

The results showed that the created model enables teachers to analyze the degree of interactivity in LMS. Besides that, the rate of the interactivity also permits teachers to analyze students' behavior and to identify students who are less active. In addition, the findings also revealed that LMS behavioral patterns provide certain indicators as to

students' academic achievement, however, the study does not allow us to say that those students who possess passive attitudes may inevitably obtain poor academic achievement (Cobo et al., 2014).

As a conclusion from the past related studies, the researcher found several weaknesses and issues that need to be appropriately addressed. In terms of novelty and parsimonious of the research models, the previous studies have focused almost entirely on standard IS theories like TAM (Motaghian et al., 2013), TAM2 (Van Raaij & Schepers, 2008), extended-TAM (Sanchez & Hueros, 2010), UTAUT (Sumak et al., 2010), ECT (Shin et al., 2013), CDT (Chou & Liu, 2005), ELSS (Eom, 2012) and etc. Except for Sanchez and Hueros (2010) and Sun and Hsu (2013) who have integrated some VLE related attributes in the research model such as technical support (Sanchez & Hueros, 2010) and interactivity (Sun & Hsu, 2013), other studies did not include any VLE related attributes.

Even though these studies demonstrated significant percentage of variance explained in the dependent variables by using the standard IS theory, however all these studies also proposed that other factors may be included in future studies in order to provide better predictive power. Since these studies have mostly engaged with standard IS theories by using mostly extrinsic motivational factors such as perceived usefulness, performance expectancy, perceived ease of use, effort expectancy, social influence, facilitating conditions, system quality, service quality, information quality, social norm, immersion, presence and etc., there is a deficiency in terms of explaining teachers' behavioral intention from the perspective of intrinsic motivations. Hence, the researcher argue that it is important to include the intrinsic motivational factors (i.e. perceived relatedness, perceived autonomy and perceived competence) from Self

Determination Theory in order to gain a better understanding and insight on the effects of these factors towards teachers' acceptance of the cloud-based VLE.

Except for Sanchez and Hueros (2010) and Sun and Hsu (2013) which incorporated technical support and interactivity levels, another deficiency of the other previous studies is the inability in explaining the effects of VLE-related attributes such as VLE content design, VLE interactivity, knowledge sharing attitude, trust in VLE website and school support towards the VLE. Therefore, in order to enhance the novelty and the parsimonious of the research model, it is essential to incorporate these factors into the research model.

Besides the deficiencies in the research models, there is also issue of validity of the previous findings. First of all, in terms of interpretation accuracy, except for Eom (2012) which does not require any translation, all the other previous studies did not engaged English back-translation into the native languages even though the studies were conducted in non-English speaking nations such as Slovenia (Sumak et al., 2010), China (Van Raaij & Schepers, 2008), Spain (Sanchez & Hueros, 2010; Cobo et al., 2014), Taiwan (Chou & Liu, 2005; Sun & Hsu, 2013; Liaw, 2008), Iran (Motaghian et al., 2013) and South Korea (Shin et al., 2005). As a result of the cultural and language differences, there may exist variances in terms of interpretability among the respondents when an English instrument is administered to them as they are not English native speakers therefore it is suggested that English back-translation should be used for cross-cultural studies (Brislin., 1970).

Another validity issue is the absence of expert panel (except for Shin et al., 2013) in reviewing the face validity of the instruments. Besides, none of the previous studies have computed the content validity index of the items and scales and no Q-sort procedures were carried out to evaluate construct validity.

Furthermore, since all of the studies have utilized a single self-reported instrument to measure both independent and dependent variables, there is issue of Common Method Bias (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). Similarly, all of these previous studies also did not examine non-response bias. More importantly, except for Shin et al. (2013) who have examined the multicollinarity problem, other previous studies did not examine the multivariate assumptions of normality, linearity, homoscedasticity and multicollinearity problem. These have substantially compromised the validity of the findings. Thus, it is suggested that common method bias should be tested if self-reported instruments are used in the data gathering process. It is also recommended that researchers should assess non-response bias and all multivariate assumptions before continuing with the statistical analyses.

As a conclusion, the previous grid-based VLE studies have several deficiencies and weaknesses in terms of novelty, parsimonious and validity of research findings that need to be addressed especially in the context of the cloud-based VLE. Nevertheless, due to the enormous differences between the grid-based and cloud-based technologies, the findings from the grid-based VLE studies may not be the same and germane in the cloud-based VLE context. Thus, there is a need to conduct a new study from the context of the cloud-based VLE. A summary of the prior grid-based VLE-related studies are shown in Table 3.3. On the other hand, Table 3.4 shows the construct analysis of these previous studies.

3.3 Theoretical underpinnings

Two main theories used in the research are the Channel Expansion Theory and Self Determination Theory. These theories are further elucidated in the following subsections.

3.3.1 Channel Expansion Theory (CET)

CET (Carlson & Zmud, 1999) builds from a variety of theoretical perspectives that address perceptions of media channels. It combines elements from media richness theory with the social influence model and maintains that media richness is a crucial element in media selection and use. Channel expansion theory states that knowledge-building experiences of the members of an organization influence the perception of media richness. These experiences include experience with the channel, experience with the subject, experience with the communication partner and experience with the organization context (Carlson & Zmud, 1999).

Experience with a communication channel will enable an individual to learn the characteristics, the options, the uses and the limitations of the channel, allowing him to use the communication channel more efficiently and adapting its use to the characteristics of the task required as well as increasing its perceived richness (Fernandez et al., 2013). The experience with communication partners through interactions and mutual learning such as language patterns and expectations in message construction will enable the use of a richer language in communications. The use of symbols and shared cultural references in an organization allows for a richer communication through the media as an outcome from the increase in the sophistication of the organization's knowledge base (Timmerman & Madhavapeddi, 2008).

In the cloud-based Frog VLE, teachers may create topics for discussion in forum, email, assignment and various other channels. They may also communicate with their partners from other schools in sharing instructional resources. From the school organizational context, the social influences of other teachers on the use of the VLE may also influence teachers' perception of media richness of the VLE. Therefore, the researcher anticipates that CET may predict teachers' VLE use behavior.

3.3.2 Self Determination Theory (SDT)

Self Determination Theory (Deci & Ryan, Eds., 2002) is a macro theory of human motivation and personality, concerning people's inherent growth tendencies and their innate psychological needs. It is concerned with the motivation behind the choices that people make without any external influence and interference. SDT focuses on the degree to which an individual's behavior is self-motivated and self-determined.

Unlike other motivational theories which assume human motivation as a monolithic construct, SDT suggests that human motivation can be classified into three main categories namely intrinsic motivation, extrinsic motivation and amotivation. Intrinsic motivation is related to self-pleasure and satisfaction derived from individuals' behaviors. When individuals are intrinsically motivated, they will do something freely, with full sense of volition and without any material reward or constraints (Deci & Ryan, 1985). Extrinsic motivation is pertaining to individuals doing something for some separable outcomes while amotivation refers to the state of lacking intention to do something. Extrinsic motivation is further classified into four types, namely external, introjected, identified and integrated regulation based on the concept of internalization. Internalization is the proactive process when individuals transform regulation by external contingencies into regulation by internal processes.

External regulation refers to “behaviors for which the locus of initiation is external to the person, for example, the offer of a reward or the threat of a punishment” (Deci, Vallerand, Pelletier & Ryan, 1991, p. 329). It is the least self-determined form of extrinsic motivation. Introjected regulation occurs when individuals have taken in but not accepting a regulation as their own. This regulation involves internalization of rules or demands that force an individual to behave and are buttressed with threatened sanctions or promised rewards. Identified regulation occurs when individuals have come to value the behavior and have identified with and accepted the regulatory process” (Deci et al. 1991, 329). Through identification, regulatory process will become a part of the self whereby individuals will do something more willingly, autonomous and self-determined than behaviors regulated by external or introjected regulation.

Integrated regulation on the other hand is “the most advanced form of extrinsic motivation where regulatory process is entirely integrated into the individuals’ coherent sense of self. The identifications are reciprocally assimilated with the individuals’ other values, needs and identities” (Deci et al. 1991, 330). Behaviors regulated by integrated processes are fully self-determined.

Even though integrated regulation resembles intrinsic motivation as both are forms of autonomous self-regulation, however intrinsic motivation is characterized by interest in the activity itself while integrated regulation is characterized by the activity’s being personally important for a valued outcome. Figure 3.1 shows the continuum of self-determination with amotivation being the least self-determined and intrinsic motivation denotes the most self-determined type of motivation.

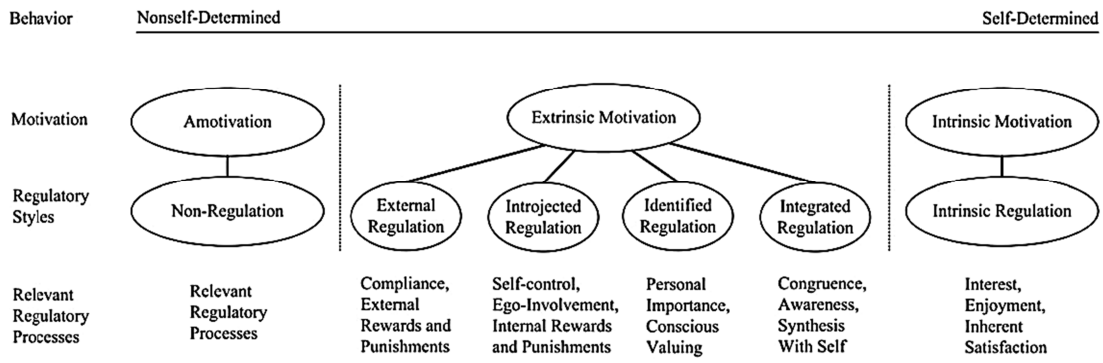


Figure 3.1: The Self-determination continuum

(Source: Chen & Jang, 2010)

According to Deci and Ryan (1985), the three psychological needs motivate the self to initiate behavior and specify nutriments that are essential for psychological health and well-being of an individual. These needs are said to be universal, innate and psychological and include the need for competence, autonomy, and psychological relatedness.

From the perspective of SDT, autonomy refers to the desire to self-organize individual's actions, when the individual is able to freely perform the activity and feels volitional in doing so (Deci & Ryan, 1985a, 1987; Ryan & Connell, 1989). The need for competence indicates that individuals are likely to be effective in their interactions with the surroundings and when they pursue an activity (Deci & Ryan, 1985, 1985a; Elliot & Thrash, 2002) which is akin to the concept of self-efficacy (Bandura, 1986). The need for relatedness (Baumeister & Leary, 1995; Ryan, 1993) is the need to feel associated and supported by important persons, such as parents, teachers, manager or team-mates.

The term self-determination was defined by Deci and Ryan (1985, p. 38) as "a quality of human functioning that involves the experience of choice. It is the capacity to choose and have those choices...be the determinants of one's actions". SDT asserts that

there are three basic and universal psychological needs namely the need for relatedness, autonomy and competency.

Malhotra, Galletta and Kirsch (2008) opined that by deciphering how best an individual's psychological needs are satisfied within social context is crucial in understanding the underlying motivational processes from the psychological context. In the cloud-based Frog VLE, there are characteristics that allow voluntary participation, freedom of expression, sharing of ideas and pre-requisite of ICT competencies that are very closely associated to the fundamental psychological needs of relatedness, autonomy and competence. Therefore, it is argued that SDT has an important role to play in influencing teachers' behavioral intention as well as perceived instructional effectiveness. Based on these justifications, SDT is chosen as one of the theoretical underpinnings in this study.

3.3.3 Application of CET and SDT

In the IS literature, not many studies have used CET and SDT as the theoretical underpinning. However, there are several Information Systems (IS) studies which have utilized the theories of CET and SDT. Table 3.1 depicts the prior IS studies which have engaged both theories.

Table 3.1: Application of CET and SDT in prior IS studies

Author(s)	Context of study	Theory	Reference
Ogara, Koh & Prybutok	Mobile instant messaging	CET & SPT	Ogara, S.O., Koh, C.E., & Prybutok, V. R. (2014). Investigating factors affecting social presence and user satisfaction with mobile instant messaging. *Computers in Human Behavior, 36*, 453-459.

Table 3.1 continued

Author(s)	Context of study	Theory	Reference
Fernandez, Simo, Sallan & Enache	Online discussion forum	CET	Fernandez, V., Simo, P., Sallan, J. M., & Enache, M. (2013). Evolution of online discussion forum richness according to channel expansion theory: A longitudinal panel data analysis. *Computers & Education*, *62*, 32-40.
Wu, W.N.	Citizen relationship management system	CET	Wu, W.N. (2017). Citizen relationship management system users' contact channel choices: digital approach or call approach?. *Information*, *8*(1), 8.
Choudrie & Spencer	Public sector online communication channel	ECT, UTAUT & CET	Choudrie, J., & Spencer, N. (2016, June). Public sector online communication channel adoption and usage amongst older adults: A UK local government perspective. In *European Conference of Information Systems*. association of information systems.
Roca & Gagné	e-learning continuance intention	SDT	Roca, J.C., & Gagné, M. (2008). Understanding e-learning continuance intention in the workplace: A self-determination theory perspective. *Computers in Human Behavior*, *24*(4), 1585-1604.
Sørebø, Halvari, Gulli & Kristiansen	e-learning continuance intention	SDT	Sørebø, Ø., Halvari, H., Gulli, V.F., & Kristiansen, R. (2009). The role of self-determination theory in explaining teachers' motivation to continue to use e-learning technology. *Computers & Education*, *53*(4), 1177-1187.
Chen & Jang	Online learning	SDT	Chen, K.C., & Jang, S.J. (2010). Motivation in online learning: Testing a model of self-determination theory. *Computers in Human Behavior*, *26*(4), 741-752.
Xie, Debacker & Ferguson	Online discussion	SDT	Xie, K.U.I., Debacker, T.K., & Ferguson, C. (2006). Extending the traditional classroom through online discussion: The role of student motivation. *Journal of Educational Computing Research*, *34*(1), 67-89.
Zhou	MOOCs	SDT	Zhou, M. (2016). Chinese university students' acceptance of MOOCs: A self-determination perspective. *Computers & Education*, *92*, 194-203.

Table 3.1 continued

Author(s)	Context of study	Theory	Reference
Nikou & Economides	Mobile-based assessment	SDT & TAM	Nikou, S.A., & Economides, A.A. (2017). Mobile-Based Assessment: Integrating acceptance and motivational factors into a combined model of Self-Determination Theory and Technology Acceptance. *Computers in Human Behavior, 68*, 83-95.

Note: CET=Channel Expansion Theory, ECT=Expectation Confirmation Theory, SDT=Self Determination Theory, SPT=Social Presence Theory, TAM=Technology Acceptance Theory, UTAUT=Unified Theory of Acceptance and Use of Technology

3.4 Variables under study

Basically the variables under this study may be categorized into four categories namely the independent variables, the mediating variables, the dependent variables and the control variables. There are six independent variables, two mediating variables, three control variables and three dependent variables. Table 3.2 shows the list of the four categories of variables.

Table 3.2: List of variables in the study

Independent variable	Mediating variables	Control variables	Dependent variables
Perceived Relatedness	Attitude towards Knowledge Sharing	Specialization	Perceived Media Richness
Perceived Autonomy	Trust in Website	Teaching Experience	VLE Behavioral Intention
Perceived Competency		Educational Level	Perceived Instructional Effectiveness
School Support			
VLE Interactivity			
VLE Content Design			

3.4.1 Perceived Relatedness

Relatedness is referred as "the desire to feel connected to others" (Sørebø, Halvari, Gulli & Kristiansen, 2009, p. 1179). Teachers' desire to feel connected with and supported by individuals in their social surroundings is reflected in their need for relatedness in organizing students' use of e-learning (Sørebø et al., 2009). The need for relatedness is also referred as the need to feel connected and supported by key persons such as a manager, team-mates, teachers or parents (Baumeister & Leary, 1995; Ryan, 1993).

Deci and Ryan (2000) argued that when activities are not naturally fascinating or pleasant, the core reason why individuals accomplish them is because these activities are appreciated by significant others (i.e. family, peers or an organization) to whom they feel connected. Ryan and Deci (2000) also assert that when people are in an autonomy-supportive setting, they will have a sense of relatedness and their motivation is boosted.

Roca and Gagne (2008) opined that people are more willing to continue to use IT when they have an autonomous feeling since this basic need has effect on their extrinsic and intrinsic motivation, perceived playfulness and perceived usefulness, which eventually influence their continuance intention towards the system. They also found that when workers feel connected and supported by colleagues, they will adopt the system just for the pleasure they gain from using it.

In the domain of IS, perceived relatedness signifies a type of social influence and prior studies have evaluated the social influence by means of subjective norm which is referred as individual's evaluation of whether or not individuals important to him or her think that the behavior should be demonstrated (Ajzen, 1991). Moreover, the effect of

subjective norms has been examined on attitude (Hsu & Chiu, 2004a), perceived usefulness (Venkatesh & Davis, 2000), continuance intention (Bhattacherjee, 2000; Tan & Teo, 2000; Taylor & Todd, 1995) and satisfaction (Hsu & Chiu, 2004b).

Subjective norm has been positively associated with behavioral intention in the adoption of computing resource center for both inexperienced and experienced users (Taylor & Todd, 1995a). On the other hand, subjective norms were found to have significant influences on attitudes towards e-service usage (Hsu & Chiu, 2004a) but not user's intention to use Internet banking (Tan & Teo, 2000).

Perceived relatedness was found to have significant influence on perceived playfulness (Roca & Gagne, 2008) and no significant effects on perceived usefulness (Sørebø et al., 2009; Roca & Gagne, 2008) and intrinsic motivation in using e-learning (Sørebø et al., 2009). Intrinsic motivation is referred as performing an activity for its own sake because an individual loves the process (Ryan & Deci, 2000).

3.4.2 Perceived Autonomy

Perceived autonomy is referred as "the desire to self-initiate and self-regulate own behavior" (Sørebø et al., 2009, p. 1179). A desire to self-regulate teachers' engagement in using e-learning tools of their own choice is reflected by the need for autonomy among teachers to organize students' use of e-learning (Deci & Ryan, 1985). An imperative assumption in SDT is that perceived autonomy in relation with an activity will increase self-determined types of extrinsic motivation and intrinsic motivation (Sørebø et al., 2009).

According to Gagne and Deci (2005), autonomy will stimulate internalization and integration of extrinsic motivation which in turn will bring about genuine intrinsic motivation. Perceived autonomy also referred as the desire to self-organize an individual's behaviours when the individual can liberally pursue the activity and feels volitional in doing so (Deci & Ryan, 1985a, 1987; Ryan & Connell, 1989). Previous studies on SDT (e.g. Baard, Deci & Ryan, 2004; Deci & Ryan, 1985a, 1987; Deci, Ryan, Gagne´, Leone, Usunov & Kornazheva, 2001; Grolnick & Ryan, 1987) have shown that positive outcomes like enhanced learning, well-being and performance are more influenced with autonomy-supportive motivating style than with a controlling style (Roca & Gagne, 2008).

Roca and Gagné (2008) also assert that other SDT studies have indicated that when the context supports the satisfaction of the need for autonomy, individuals are more probable to uphold their engagement in various sorts of behaviors (Gagne´, 2003; Vansteenkiste et al., 2004; William & Deci, 1998). Baard et al. (2004) assert that autonomy-oriented workers are more likely to experience high need on satisfaction at work that in turn boosts their well-being and performance.

Perceived autonomy is concerns with the sense of volition or willingness when doing a task (Deci & Ryan, 1980, 2000). When activities are performed for personal interest or value, perceived autonomy is high and these may include provisions for choice, use of rewards as informational feedback rather than to control behavior and non-controlling instructions (Ryan, Rigby & Przybylski, 2006). On the other hand, events or conditions that diminish a sense of choice, control or freedom for either means or ends of action interfere with perceived autonomy (Deci, Koestner & Ryan, 1999).

The associations between perceived autonomy and positive outcomes have been verified in several studies (Roca & Gagne, 2008). Deci, Schwartz, Sheinman and Ryan (1981) found that school children assigned to autonomy-supportive teachers, relative to those assigned to controlling teachers; reported higher intrinsic motivation, perceived competence and self-esteem over time. From the actual educational contexts in the USA (Grolnick & Ryan, 1987) and Japan (Kage & Namiki, 1990), autonomy support had facilitated students' intrinsic motivation for classroom topics and materials as well as their performance in school. Meanwhile, Tsai, Kunter, Lüdtke, Trautwein and Ryan (2008) found that seventh grade German public school students' interest was enhanced for lesson in which teachers were autonomy supportive while students' interest was diminished for lessons in which teachers were controlling.

Likewise, Standage, Duda and Ntoumanis (2006) found that in British physical education classes, perceived autonomy support was linked to higher autonomous self-regulation which in turn was linked to greater effort and persistence in physical education. Grolnick, Ryan and Deci (1991) found that in general, elementary school children who are more autonomous in doing schoolwork will achieve greater conceptual learning and better memory than children with less autonomous motivation.

Benware and Deci (1984) further confirmed the similar result in college students. Likewise, Connell and Wellborn (1991) found that students who have developed more autonomous regulatory styles tend to stay in school to achieve, to evidence conceptual understanding and to be well adjusted than students with less self-determined motivation.

Roth, Assor, Kanat-Maymon and Kaplan (2007) found that Israeli teachers who felt more controlled in their own professional activities were less autonomy supportive toward their students. Likewise, Pelletier, Séguin-Lévesque and Legault (2002) found that K1 to K12 Canadian teachers who perceived pressure from above (e.g. having to adhere to an imposed curriculum, pressure toward performance standards), the less autonomous they are toward teaching which in turn was linked to teachers being more controlling with students.

From the context of work domain, Deci, Connell and Ryan (1989) found that autonomy support is a significant predictor of trust in the organization, positive affect at work and work satisfaction. Deci, Ryan, Gagne´, Leone, Usunov and Kornazheva (2001) further verified that autonomy support in the job was significantly associated with work engagement and well-being of Bulgarian and US workers. Gagne´, Koestner and Zuckerman. (2000) found that management autonomy support had direct influence on acceptance of organizational change. Perceived autonomy was found to have significant influence on confirmation and not perceived usefulness in using e-learning (Sørebø et al., 2009). However, Roca and Gagne (2008) discovered that perceived autonomy support has significant effects on perceived playfulness and perceived usefulness.

3.4.3 Perceived Competence

Perceived competence is defined as "the desire to feel effective in attaining valued outcomes" (Sørebø et al., 2009, p. 1179). Teachers' desire to be effective in their use of e-learning tool is reflected by their need for competence in organizing students' use of e-learning (Deci & Ryan, 1985). When teachers' need for e-learning competence is satisfied, they will feel qualified to organize students' use of e-learning (Sørebø et al.,

2009). The need for competence indicates that individuals tend to be effective in their interactions with the surroundings and when they do an activity (Deci & Ryan, 1980, 1985a; Elliot & Thrash, 2002) which is analogous to the self-efficacy concept (Bandura, 1986). Perceived competence has been found to predict persistence in behaviors in previous SDT studies (Williams, Edwards & Vandenberg, 2003; Williams, McGregor, Zeldman, Freedman & Deci, 2004). In the context of IS literature, computer self-efficacy is referred as self-evaluation of individual's ability to use computer skills to accomplish the specified tasks (Compeau & Higgins, 1995).

Computer self-efficacy has been found to have effect on perceived ease of use in previous studies (e.g. Agarwal, Sambamurthy & Stair, 2000; Chau, 2001; Venkatesh & Davis, 1996). It is also found to have effect on perceived usefulness in prior studies (e.g. Chau, 2001; Compeau & Higgins, 1995; Compeau, Higgins & Huff, 1999). Perceived competence was found to have significant effects on perceived ease of use, perceived usefulness and perceived playfulness (Roca & Gagne, 2008; Sørebø et al., 2009) as well as confirmation and intrinsic motivation in using e-learning (Sørebø et al., 2009).

3.4.4 School Support

School support is defined as the extent to which an individual believes that schools are committed to effective implementation and adoption of a system (Venkatesh & Bala, 2008). The support from top management is vital in adoption of innovation technology because assistance for the required resources can be easily acquired (Huang, Cheng & Huang, 2009). Top management support is a key factor critical for effective information system implementation (Thong, Yap & Raman, 1996). Similarly, university support (Selim, 2007) and institutional or faculty support (Govindasamy, 2002) are among the critical success factors in e-learning (Selim, 2007). Organizational

support may reduce anxiety linked to system use (Venkatesh & Bala, 2008). When teachers are encouraged by school authorities to adopt a web-based learning system, their behavioral intention to use the system will increase (Franklin, 2007).

School support is a primary influence on adoption of teaching blogs among secondary school teachers (Lai & Chen, 2011). It is theorized that learning designers and teachers should be supported in their quest to match learning tasks to learning technology in order to improve their understanding as well as their effectiveness in using the technology (Bower, 2008). The whole school community involvement and commitment from the executive teak and all teaching staff including novice teachers (Gao, Wong, Choy & Wu, 2010) is a key determinant of successful technology integration (Bernauer, 1996).

When teachers are led by administrators who actively support fundamental change, there will be far greater chances for successful growth of new beliefs and practices (Dwyer, Ringstaff & Sandholtz, 1990). The most imperative factor influencing the success of technology integration "was the active involvement and support of the principal (Hayes & Harriman, 2001, p.5).

3.4.5 VLE Interactivity

Interactivity is referred as users' perceptions of two-way communication, level of control, responsiveness, navigation, sense of place, time sensitivity and user activity (McMillan, 2000; McMillan & Hwang, 2002). Controllability, two-way communication, responsiveness and personalization are regarded as the core elements of interactivity based on previous studies (McMillan & Hwang, 2002; Liu, 2003, Pitch & Lee, 2006; Wu & Wu, 2006; Song & Zinkhan, 2008; Cyr, Head & Ivanov, 2009; Yoo,

Lee & Park, 2010). Controllability is referred as users' ability to control the content, timing, the sequence of communication (McMillan & Hwang, 2002; Yoo et al., 2010). When users experience better control and access to web site content, they will perceive effectiveness and efficiency in adopting the web site (Cyr et al., 2009).

Responsiveness on the other hand is referred as how the users perceive that an interactive medium responds to their input (Wu & Wu, 2006; Cyr e al., 2009). In the context of e-learning, responsiveness is defined as the degree to which a learner perceives that the response from the e-learning system is fast, reasonable and consistent (Bailey & Pearson, 1983; Pituch & Lee, 2006). When learners perceive that the response from the system is fast, reasonable and consistent, this system response will be perceived as useful and easy to use among the learners (Pituch & Lee, 2006).

Two-way communication is referred as the ability for reciprocal communication between the source and the receiver (McMillan & Hwang, 2002; Yoo et al., 2010). In the context of e-learning, two-way communication is referred as the ability for reciprocal communication between instructors and the learners via the e-learning systems (Palloff & Pratt, 2007; Pituch & Lee, 2006). When learners perceive that the communication between the instructors and the learners via the e-learning system is bi-directional and reciprocal, they will perceive that the system is more useful and easier to use (Pituch & Lee, 2006).

Personalization is defined as the degree to which a user perceives how his/her communicative counterparts' responses are tailored to his/her communicative behaviors (Wu & Wu, 2006; Cyr et al., 2009). In the context of e-learning, personalization

involves delivering customized content for the individual learner via the e-learning system (Cheng, 2014).

Interactivity is assumed as having substantial potential in comparison to the traditional forms of education. It is the most critical element in technology-enhanced learning environments (Spector et al., 2001). Sun and Hsu (2013) assert that prior studies of interactivity design in Web Based Instruction (WBI) have concentrated on the development of learners' outcomes and achievements and a number of studies (e.g. Gao & Lehman, 2003; Kettanurak et al., 2001; Swan, 2002) have showed that higher degrees of interactivity are linked to more positive learning outcomes. Several scholars (e.g. Jung et al., 2002; Khalifah & Lam, 2002; Proske et al., 2007; Swan, 2002) have referred interactivity to the positive impacts of specific aspects of interactivity and provided interactive functions to assess a system's interactivity or investigated learners' perception of interactivity (Sims, 2003; Swan 2002). Furthermore, others scholars (e.g. Borsook & Higginbotham-What, 1991; Chou, 2003; Evans & Gibbons, 2007) have proposed frameworks of interactivity for WBI environments.

Interactivity may be seen as a multi-dimensional concept and is a key concern in a broad range of applications in the area of education and prior studies have indicated that interactivity has positive impacts on learning (Sun & Hsu, 2013).

Interactivity originated from interpersonal communication and is used in numerous domains (Sun & Hsu, 2013). Rafaeli (1989) as cited in Sun and Hsu (2013) suggested that interactivity is a process of message exchange which stresses the association between messages, the extents to which users partake and the ability of users to adapt the messages and exchange roles throughout the communication process (Kiousis,

2002). Besides that, interactivity is also viewed as the outcome of technological integration that designates the attributes of the new media (Sun & Hsu, 2013).

According to Sun and Hsu (2013), the concept of interactivity is not only linked to communication studies (e.g. Kiousis, 2002; Koolstra & Bos, 2009; Rafaeli, 1989) but also studies in business (e.g. Ghose & Dou, 1998; Ha & James, 1998; Teo, Oh, Liu & Wei, 2003), education (e.g. Chou, 2003; Liaw & Huang, 2000; Northrup, 2001; Thurmond & Wambach, 2004) and human computer interaction (e.g. Dillon & Zhu, 1997; Preece, Rogers, Sharp, Benyon, Holland & Carey,1994).

Barker (1994, p. 157) opined that interactivity is "a necessary and fundamental mechanism of knowledge acquisition that enhances learners cognitive and operational skills". Some studies (Ghose & Dou, 1998; Kettanurak et al., 2001; Sundar, Kalyanaraman & Brown, 2003) have proposed that higher degrees of interactivity may give individuals more feedback, choice, positive perceptions and control of websites (Sun & Hsu, 2013). Kettanurak et al., (2001) found that system users with higher interactivity may have enhanced motivation to learn and more positive attitudes. Based on 3 different degrees of interactivity in using hypertext links, Grigorovici, Nam and Russil (2003) found that users tend to have more positive perceptions at high degree of interactivity.

Other studies (e.g. Evans & Gibbons, 2007; Gao & Lehman, 2003; Lustria, 2007; Northrup, 2001; Swan, 2002; Thorson & Rodgers, 2006) have shown that higher degree of interactivity yields better learning outcomes and learner perceptions (Sun & Hsu, 2013). Proske et al. (2007) also found that interactive functions may improve learning outcomes when learners complete more learning tasks as they tend to have more

positive view of the website. With 3 different degrees of interactivity in terms of functionality, activity and response time, Gao and Lehman (2003) found that learners of a highly interactive website achieved better as real-time feedback improved learning motivation.

Evans and Gibbon (2007) found that increased interactivity via a computer-based lesson produced greater depth of learning and assisted learners to understand the teaching content. Last but not the least, Lustria (2007), Thorson and Rodgers (2006) found that the higher the website interactivity, the more positive users' attitudes would be.

3.4.6 VLE Content Design

Content design is referred as the degree to which "learning contents are designed and developed to fit students' needs" (Lee, Yoon & Lee, 2009, p. 1323). Lederer et al. (2000) found that ease of understanding and ease of finding variety of web contents may predict ease of use. Learners tend to feel that using the e-learning system is easy if the system is provided with plentiful of contents designed to satisfy their needs (Lee et al., 2009). Course content is one of the critical success factors in e-learning (Papp, 2000). Similarly, course structure is one of the critical success factors in e-learning (Govindasamy, 2002). Sun, Tsai, Finger, Chen and Yeh (2008) found that course dimension which consists of course flexibility and course quality has significant effect on learners' satisfaction in e-learning.

Flexibility of an e-learning course is a strong predictor of learners' satisfaction (Sun et al., 2008). This is consistent to Arbaugh (2002) and Arbaugh and Duray (2002) who found that course flexibility played an imperative role in perceived satisfaction in e-

learning. It is recommended that institutions with online learning should fully use the advantage of the virtual environment and design courses with highest flexibility in order to fulfill students' need (Sun et al., 2008).

Sun et al. (2008) also found that course quality which includes overall course design, teaching material, interactive discussion arrangements and etc. has the strongest relationship with satisfaction in e-learning. They asserted that for higher satisfaction, the course timetable, discussion arrangement and types and course material should be properly prepared and the instructional expertise and technical assistance should also be in place. According to them, a well-designed delivery mechanism, with proper assistance to learners for solving their curriculum and technical difficulties may decrease learners' uncertainty and frustration in e-learning thus leading to better learning experiences.

A study by Liaw (2008) showed that e-learning quality, multimedia instruction and interactive learning activities are all crucial predictors of e-learning effectiveness which implies that different multimedia learning content is an imperative factor for enhancing e-learning effectiveness, achievement and motivation among students.

According to Lee (2006), there are two dimensions of content quality, namely content richness and update regularity. Content richness positively influences learners' satisfaction level with the course (Arbaugh, 2000; Burns, Clift & Duncan, 1991). The internet technology provides content richness far beyond any other technology may offer as the whole information content of the internet is available as complementary course content and the special attributes of internet hyperlinks and interactivity enable learners and teachers to access and share various resources in addition to the basic

course contents (Boisvert, 2000; Cheong, 2001; Peterman, 2000). An e-learning system has higher appeal to learners due to the richness of content provided by the internet as compared to the conventional learning methods. Learners, teachers and classmates may search through the relevant content on the internet and then share it on the system. If a learner who was a potential users of the system perceived that the content quality on the system was high, there would be a high tendency that the learner would regards the content as having a positive effect on learning and thus would adopt the system (Lee, 2006).

On the other hand, update regularity means that the content of the e-learning system can be updated anytime and anywhere. Arbaugh (2000), Burns et al. (1991) and Chen et al. (2003) found that learners' satisfaction could be enhanced substantially if they could obtain updated content on a regular basis. Updated and new content may lead to students feeling that the system is a useful means of obtaining new knowledge and learning (Lee, 2006).

3.4.7 Attitude towards Knowledge Sharing

Knowledge is defined as "a fluid mix of framed experience, values, contextual information and expert insights" (Davenport & Prusak, 1998, p.5). Knowledge sharing is the process of mutually exchanging knowledge and jointly creating new knowledge (van den Hooff & de Ridder, 2004) which implies synergistic collaboration of individuals who work towards a common goal (Boland & Tenkasi, 1995).

Knowledge sharing happens when a person is willing to help and learn from others in developing new competencies (Sawhney & Prandelli, 2000). The final goal of sharing knowledge is the attempt at transferring all individuals; experiences and knowledge to

organizational assets and resources (Yang & Wan, 2004). From the perspective of sharing-and-retaining knowledge, when individuals share what they have learnt, they will become more experienced and knowledgeable and may also think more systematically through the context of phenomena derived from the group operations (Liaw, Chen & Huang, 2008).

According to Chen and Chen (2009), learners' abilities in creating useful knowledge to other are vital in a virtual learning community where individuals are anticipated to learn anytime and anywhere. Previous studies have given evidence for support of the importance of knowledge exchange in enhancing the learning performance (Chen & Chen, 2009).

Attitude toward knowledge sharing has been found to have positive effects on behavioral intention in previous studies (Agarwal & Prasad, 1999; Bhattacherjee & Premkumar, 2004; Brown & Venkatesh, 2005; Galletta, Henry, McCoy & Polak, 2006; Kolekofski & Heminger, 2003; Wixom & Todd, 2005). From the findings of Chen and Chen (2009), it was found that attitude toward knowledge sharing in web site of the virtual learning community is significantly linked to intentions of performing a behavior.

3.4.8 Trust in Website

Prior studies have indicated that trust not only has an imperative role in initial IT adoption but also on the intention to use or continuance intention to use a service (Shin, Lee & Hwang, 2017). Trust is an anticipation that alleviates the fear that an individual's exchange partner will act opportunistically (Bradach & Eccles, 1989; Schoorman, Mayer & Davis, 2007). In the technology context, trust denotes believing that the technology can be utilized to obtain desired task accomplished satisfactorily

(Teo, Lee & Chai, 2008). Trust in technology is the degree to which the web site users trust the security and competence of the Internet (Teo et al., 2008). Previous studies (Belanger, Hiller & Smith, 2002; Otjacques, Hitzelberger & Feltz, 2007) have discussed various sources of risks in transactions over the Internet especially risk of security and privacy. Security risk is referred as the safety of the computer and the credit card or financial information whereas privacy risk is referred as the loss of control over personal information (Teo et al., 2008).

Previous studies have stressed the role of trust in website success in terms of adoption or behavioral intention to adopt (Gefen, Karahanna & Straub, 2003; Pavlov, 2003), satisfaction (Balasubramanian, Konana & Menon, 2003), intention to use (Kim, 2008) or reuse the website (Turel, Yuan & Conelly, 2008). Trust is a significant determinant of participation in online interactions and transactions as it serves as a central mechanism to minimize perception of uncertainty and risk (Teo, Srivastava & Jiang, 2008). Trust is a primary determinant of users' perception on quality (Teo et al., 2008) that may in turn affect their satisfaction (Lin and Wang, 2006; Shiau and Luo, 2012) and continuance intention (Hsu, Chang, Chu & Lee, 2014).

Several studies (Hsu, Chang & Yen, 2011; Leimeister, Ebner & Krcmar, 2005; Ratnasingam, 2005) have suggested that trust in online setting may be classified into two categories according to the target of trust namely system and interpersonal trust. Basically, system trust is referred as the belief resulting from the reliance and reliability of an information system (Hsu et al., 2011; Leimeister et al., 2005) while interpersonal trust is referred as the belief resulting from the feeling of secure for other parties in the social exchange (Hsu et al., 2011; Pennington, Wilcox & Grover, 2003).

However, Hsu et al. (2014) argued that trust could be divided into two types namely trust in website and trust in sellers. Trust in website manifests the favorable conditions and structures of website provided by the intermediary that lead to users to believe that transaction in the website is safe (Hsu et al., 2014). Trust in sellers manifests the parties selling the products are dependable, reliable and honest (Verhagen, Meents & Tan, 2006).

Trust in website was found to have significant effects on quality and satisfaction with website (Hsu et al., 2014). Similarly, Teo et al. (2008) found that trust in government website significantly influences users' continuance use and satisfaction in e-government website.

3.4.9 Perceived Media Richness

The application of multiple media may enrich communication context and perceived learning (Balaji, 2010). It was found that presentation type with the highest media richness (i.e. text-audio-video presentation) has the highest level of concentration while presentation type with the lowest media richness (i.e. text-audio presentation) was found to have the lowest level of concentration (Liu, Liao & Pratt, 2009).

Furthermore, Balaji (2010) found that perceived media richness of online discussion forum has significant positive influence on students' participation, interaction and learning. Gellevij, van der Meij, de Jong & Pieters (2002) also suggested that the application of multiple medium of instruction may lead to better student performance.

Past studies of e-learning have revealed that use of a plurality of media (Kim, 1989) and interactive media (Hunt, Burvall & Ivergard, 2004) may attract learner's attention and effectively boost their learning effectiveness (Wu & Hwang, 2010). Internet researches have also revealed that the rich information media embedded in websites may enhance website users' satisfaction (e.g. Qin, Zhou, Reid, Lai & Chen, 2007).

In fact, Lee (2006) opined that media richness is an important determinant of e-learning. Similarly, Hackman and Walker (1990) stressed that media richness contributes to increasing e-learning satisfaction based on their empirical study of the use of television for teaching. This is further supported by studies by Chen, Wu & Yang (2006), Liu et al. (2009), Sun and Cheng (2007) who found that media richness will influence learners' satisfaction and the evaluation of e-learning system usability.

3.4.10 VLE Behavioral Intention

The term "intention" is usually defined as the perceived notion between oneself and some action (Liang, Chen & Turban, 2009). It is also referred as the future behavior of someone (Venkatesh, Morris, Davis & Davis, 2003). Most of the technology or innovation implementation related studies used intention as a predictor of associated adoption (Irani, Dwivedi & Williams, 2009). Ajzen (1991) opined that intention directly affects adoption of a new innovation or technology. Adoption is usually defined as the acceptance and continued use of a product, service or idea (Rogers, 2010). Adoption is also referred as implementation, usage, utilization or satisfaction (Liu & Guo, 2008). Many studies (e.g. Yu, 2012; Kim, Fiore & Lee, 2007) have used intention to predict adoption intention of mobile based services.

Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), Unified Theory of Acceptance and Use of Technology (UTAUT) and other related models are also known as intention-based models because they take behavioral intentions as the core measure for acceptance (Venkatesh et al., 2003). In this context, behavioral intention serves as an antecedent to use (either self-reported or observed) which is not always measured or taken into consideration in technology acceptance studies (Pynoo & van Braak, 2014). Ignoring use may threaten the validity of acceptance studies as evidenced by studies of Duyck, Pynoo, Devolder, Adang, Vercruysse & Voet (2008) and Pynoo et al. (2012) where behavioral intention did not predict self-reported use.

The attraction of intention as a dependent variable is that intention can be used in situations in which the technology has already been introduced (Pynoo et al., 2012) but also, unlike observed use, for cases where it is still under planning (Duyck et al., 2008). For examples, studies on technology adoption at early or embryonic stage that used behavioral intention include a wide range of contexts such as cross-platform services (Shin & Biocca, 2017), interusable systems (Shin, 2016a), social TV (Shin, 2016b), multi-screen adotion (Shin & Biocca, 2017a), mobile-learning (Tan, Ooi, Leong & Lin, 2014), Near-Field-Communication (NFC) mobile credit card (Tan, Ooi, Chong & Hew, 2014a), mobile music (Sim, Tan, Wong, Ooi & Hew, 2014), mobile TV (Wong, Tan, Loke & Ooi, 2014), mobile shopping (Wong, Tan, Ooi & Lin, 2014a), mobile advertising (Wong, Tan, Tan & Ooi, 2015), mobile wallet (Tang, Lai, Law, Liew & Phua, 2014), mobile social networking sites (Wong, Tan, Loke & Ooi, 2015a), mobile tourism (Hew, Lee, Leong, Hew & Ooi, 2016), mobile social commerce (Hew, Lee, Ooi & Lin, 2016a), mobile apps (Hew, Lee, Ooi & Wei, 2015) and etc.

In most circumstances, items measuring behavioral intention are stated in a general way, without specification of the nature of use. For example, "I intend to use (the technology) in the next (n) months/weeks", with substantial exceptions e.g. Nistor et al. (2012) who distinguished between receptive ("I intend to use the help system for information search in the next months") and active ("I plan to contribute to the further development of the help system in the next months") use intention. The constraints of behavioral intention as predictor of self-reported use in circumstances in which use of a technology has become a habit have been unveiled in several studies (e.g. Duyck et al., 2008; Nistor, Schworm & Werner, 2012; Pynoo et al., 2012; Pynoo & van Braak, 2014).

Behavioral intention in educational technology has been studied in various contexts such as e-learning (Lee, Hsien & Ma, 2011a; Ong & Lai, 2006), BlackBoard (Halawi & McCarthy, 2008), Moodle (Hsu, 2012; Raman, Don, Khalid & Rizuan, 2014; Sumak et al., 2010), PowerPoint (Hu, Clark & Ma, 2003), ICT integration (Birch & Irvine, 2009; Gupta, Dasgupta & Gupta, 2008; Sang, Valcke, van Braak & Tondeur, 2010), Computer (Ma, Andersson & Streith, 2005; Teo, 2009, 2009a; Teo et al., 2008), Internet portal (Pynoo, Devolder, Tondeur, Braak, Duyck & Duyck, 2011), mobile-learning (Park, Nam & Cha, 2012; Tan, Ooi, Sim & Phusavat, 2012; Wang, Qu, Chen & Duan, 2009) and web-based learning system (Chiu & Wang, 2008; Gong, Xu & Yu, 2004; Wang & Wang, 2009).

3.4.11 Perceived Instructional Effectiveness

Instructional effectiveness is used for assessing teachers' instructional performance whereby teachers with high instructional effectiveness are more likely to affirm their job and well application of instructional strategies to achieve the instructional objectives (Chou, 2012). Studies on instructional effectiveness tend to focus on teachers' self-

efficacy and effective instructions (Jaber, 1997; Vannatta & O'Bannon, 2002). Effective instruction referred to teachers developing their professions, achieving the teaching objectives and enhancing the learning effectiveness with numerous teaching behaviors (Eradio, 2003; Lin, 2001; Yost, 2002). Teachers' instructional effectiveness may also be explained as teachers' actions with a series of strategies to achieve the present educational objectives (Kuo, 2009).

Chien (2002) asserts that instructional effectiveness is indicated by children's favorable performance on the learning and behaviors. Yang (2010) opined that instructional effectiveness is indicated by teachers being able to arrange suitable instructional activities, provide good instructional environments, deliver systematical instructional contents, effectively use instructional skills and establish harmonious classroom atmosphere in the teaching process.

"Effective teaching is difficult to describe and measure because it is multidimensional, high individualized and seldom observed other than by students and there is no widely accepted agreement about what exactly effective teaching is and how it should be measured" (Lumpkin & Multon, 2013, p.1). Several studies have reported that specific classroom behaviors of instructors may differentiate them from those who were less successful (Lumpkin & Multon, 2013). For example, Murray (1985) who examined perceived instructional effectiveness of 48 full-time instructors at the University of Western Ontario based on the end-of-term student ratings and low-inference teaching behaviors recorded by trained observers in regular class lectures found that student ratings tend to be higher whenever they believed their instructors showed enthusiasm more than for any other factor and engaging and holding students' attention was very important in their assessment of teaching effectiveness.

Jameson Boex (2000) on the other hand used responses from students' evaluations at George State University to examine which attributes assisted instructors in improving the quality of their instruction. He used all the undergraduate and graduate economics sections taught by 70 different instructors over several years and through factor analysis identified six instructor attributes from the 33-item questionnaire. His conclusion is that students across four comparison groups (undergraduates in core courses, undergraduates in non-core courses, students in graduate core courses and students in non-core graduate courses) believed a combination of organization and clarify is most import attribute of effective instruction. Students in all four groups identified presentation ability as the second dominant attribute followed by instructors' ability to motivate students.

Donald (1985, p.8) however identified five characteristic of effective instruction as (a) content knowledge and conceptual understanding (b) organization and clarify (c) instructor-group interaction (d) instructor-individual student interaction and dynamism or enthusiasm. Chickering and Gamson (1987) on the other hand identified seven principles for good instructional practice as (a) encourages contact between students and instructor (b) develops reciprocity and cooperation among students (c) encourages active learning (d) give prompt feed-back (e) emphasize time on task (f) communicates high expectations and (g) respects diverse talents and ways of learning.

Alternatively, Bain (2004) recommended that the best college teachers (a) create a natural critical learning environment (b) get students' attention and keep it (c) start with the students rather than the discipline (d) seek commitments (e) helps students learn outside of class (f) engage students in disciplinary thinking and (g) create diverse learning experiences.

3.5 Control variables

Besides the independent, mediating and dependent variables, three control variables were also included in the study. The next subsection will elaborate in more detail the control variables of teachers' specialization, teaching experience and education level.

3.5.1 Specialization

Specialization is the course; subject or specific field a teacher studied or majored while undergoing the teacher training program (Amadi, 1978; Emmanue & Ambe, 2014). Many studies (Emeh & Enukoha, 1994; Durojaiye, 1986; Ekpenyong, 1990; Green, 1996; Ifiok, 2005; Lawrenz, 1995; Okpala & Onocha, 1999; Patton, 2000) have provided theoretical support for the importance of specialization towards teachers' effectiveness.

Green (1996) opined that a strong background in the subject for teachers is a necessity and vital indicator of their capability to teach the subject. This is further supported by Lawrenz (1995) who found that teachers' knowledge on the subject matter is positively related to students' achievement and subject matter specialization is "*sine qua non*" for all teachers. It is a general assumption that teachers must possess reasonable amount of knowledge of the subject in order to reasonably cope with the demands of teaching as area of specialization may culminate to subject matter knowledge (Emmanue & Ambe, 2014).

In terms of area of specialization, Goldhaber and Breweer (1996, 2000) have investigated the influences of teachers' holding master degrees on high school students' mathematics achievement and supported the importance of subject area in which the degree was awarded. They found that students' achievement in mathematics were

positively associated with the assigned teachers who hold master degree in mathematics controlling for student and teacher characteristics. This is further confirmed by Goldhaber and Brewer (1998) on the importance of subject-specific information about teachers' preparation.

Rowan, Chiang and Miller (1997) further validated the importance of subject matter of teachers' degrees and the results showed that subject-specific degree was a positive predictor of 10^{th} grade students' achievement in all specifications of the model being tested. Finally, Croninger, Rice, Rathbun and Nishio (2007) found that students taught by teachers with an elementary education degree gain more in reading than students taught by teachers with other different types of degree such as early childhood education.

3.5.2 Teaching Experience

Experience is a significant individual difference factor in technology acceptance studies (Zmud, 1979). Favorable experience regarding an innovation affects adoption of technology based on stimulus generalization (Dabholkar, 1992). Previous studies (Lymperopoulos & Chaniotakis, 2005; Venkatesh & Morris, 2000; Venkatesh et al., 2003) have found that users' level of relevant experience moderates the relationships within Technology Acceptance Model. Basically, when users have prior knowledge in using the technology, it will provide the users with a more robust foundation to learn as they will relate their incoming information with what they have already know (Cohen & Levinthal, 1990). Experience was found to have moderation effects on the relationships between perceived usefulness, perceived ease of use and social norms with behavioral intention (Tarhini, Hone & Liu, 2014) which further supported the assertion that experienced users may form their perception towards adopting a new technology

according to their previous knowledge that they obtained from using the similar technologies in the past (Morris & Venkatesh, 2000).

3.5.3 Educational Level

Educational qualifications have been an imperative attribute of individual teachers (Croninger et al., 2007). Many studies (Blank, 2010; Burns, Donovan & Bowman, 2000; Zigler, Gilliam & Jones, 2006) have argued that receiving professional education at bachelor degree level is crucial for early childhood teachers to be professionally competent. Howes, James and Ritchie (2003) found that teachers who are bachelor degree holders were more responsive to children's needs and provided more activities to encourage language development and emergent literacy than their peers who did not have such education qualification. Croninger et al. (2007) found that students taught by novice teachers (0-2 years of experience) have lower levels of reading gains than students taught by experienced teachers.

Many studies (Ehrenberg & Brewer, 1994; Harnisch, 1987; Monk & King, 1994; Summers & Wolfe, 1975; 1977) have shown that teacher's degree has significant impacts on high school students' achievement. Torquati, Raikes & Huddleston-Casas (2007) also found that early childhood teachers with a higher educational level tend to adopt innovative approaches to motivate students to learn and promote their social, language and cognitive development (Burns et al., 2000; Croninger et al., 2007; Dwyer, Chait & McKee, 2000). Last but not the least, teachers who had obtained a bachelor degree will have increased knowledge (Barnett, 2003; Fukkink & Lont, 2007), increased confidence (Garbett, 2003), improved leadership skills (Early & Winton, 2001; Justice & Espinoza, 2007) and a change in outlook and attitude (Allen & Seaman, 2005; Kucukturan, 2011).

A qualitative study by Williams (2011) showed that degree training has a positive influence on the development of professional learning community (PLC). Ho, Lee & Teng (2016) found that school-level of teacher qualification has positive relationship with teachers' perception of PLC.

Previous studies (Becker, 1970; Hambrick & Mason, 1984) have shown that educational level affects personal innovativeness, belief or value systems, risk-taking, receptivity of an innovation and cognitive preferences. A weak education level may attract risk aversion, threats to change and imitating the innovators, who may be more educated, more cosmopolitan in the social relationships, more exposed to mass media and more active outside their community (Bass, 1969). Moreover, academic qualification has been verified to have significant influence on perceived usefulness in mobile entertainment (Leong, Ooi, Chong & Lin, 2011).

Educational level has been examined as an antecedent of perceived usefulness or perceived ease of use (Agarwal & Prasad, 1999) and as a moderator that influences the relationship between the main determinants and behavioral intention (Burton-Jones & Hubona, 2006). Specifically, educational level has been found to affect relationship between perceived ease of use, perceived usefulness, social norms and behavioral intention (Burton-Jones & Hubona, 2006; Mahmood, Hall & Swanberg, 2001; Porter & Donthu, 2006; Rogers, 2003; Sun & Zhang, 2006; Zakaria, 2001). Venkatesh, Morris & Ackerman (2000) found that there is a positive correlation between educational level and perceived usefulness.

Previous studies have validated that when users' educational level increases, their intention to use web-based learning system will also increase (Calisir, Altin Gumussoy & Bayram, 2009). Finally, educational level was found to have a significant effect on the associations between social norms, perceived ease of use and behavioral intention further supporting that less educated users will find the technology hard to use and therefore will rely on other's opinion with respect to the adoption and use of web-based learning system (Tarhini et al., 2014).

3.6 Relationship between variables

After looking into each of the variables in the study independently, the next subsection will look into the relationship between these variables in more detail.

3.6.1 Influence of Perceived Relatedness on Attitude towards Knowledge Sharing

Attitude is defined as "a learned predisposition to response in a consistently favorable or unfavorable manner with respect to a given object" (Fishbein & Ajzen, 1975, p. 6). Knowledge is defined as "a fluid mix of framed experience, values, contextual information, and expert insights" (Davenport & Prusak, 1998, p. 5). Knowledge sharing is the process of mutually exchanging knowledge and jointly building new knowledge (van den Hooff & de Ridder, 2004) that indicates synergistic collaboration of individuals who work towards a common goal (Boland & Tenkasi, 1995).

Empirical study has identified the main factors that affect knowledge sharing as individual factors (e.g. lack of trust, fear of loss of power, and lack of social network), organizational factors (e.g. lack of leadership, lack of suitable reward system, and lack

of sharing opportunities), and technological factors (e.g. inappropriate information technology systems and lack of training) (Riege, 2005).

Knowledge sharing has been an imperative factor in technology-mediated learning (Hwang, 2008) and knowledge management literature (e.g. Alavi, Kayworth & Leidner, 2005; Alavi & Leidner, 2001; Bock, Zmud, Kim & Lee, 2005; Ko, Kirsch & King, 2005; Wasko & Faraj, 2005; Chiu, Hsu & Wang, 2006; Powell, Galvin & Piccoli, 2006). Malhotra (2002) opined that tacit knowledge should be managed and controlled primarily by self-control or intrinsic motivation based on Self Determination Theory.

Besides that Bock and Kim (2002) found that expectations to improve work relationships (i.e. perceived relatedness) and to make a substantial contribution to organizational performance were positively related to attitude toward knowledge sharing, intentions and behavior. On the other hand, in virtual communities, knowledge sharing is considered as a self-motivated behavior without any external interference and influence and perceived relatedness is conceptualized as the sense of connectedness or identification an individual feels with others (Yoon & Rolland, 2012). When individuals are in an autonomy-supported setting and they possess a sense of connectedness, their motivation is boosted (Ryan & Deci, 2000; Roca & Gagne, 2008). In the context of knowledge sharing, the sense of identification has been found to be positively linked to knowledge sharing behaviors (Kankanhalli, Tan & Wei, 2005; Chiu et al., 2006; Shen, Yu & Khalifaa, 2010; Yu, Lu & Liu, 2010).

Chiu et al. (2006) assert that individuals' perception of social togetherness and unity of the community will enhance their activeness to share knowledge and increase the depth and breadth of shared knowledge and perceived relatedness was found to have

significant positive influence on knowledge sharing behavior. Besides that, Cho, Chen & Chung (2010) stressed that when individuals have strong attachment to or social bonding with other members of the community; they are more likely to be motivated to shared knowledge.

Finally, many studies (Haythornthwaite, Guziec, Robins & Shoemaker, 2000; Wasko & Faraj, 2000, 2005) have examined the direct effect of a sense of belonging on knowledge sharing behavior. Sense of belongs promotes cooperation in information sharing using a shared electronic database (Kalman, Monge, Fulk & Heino, 2002).

3.6.2 Influence of Perceived Relatedness on Behavioral Intention

Perceived relatedness is also defined as "the desire to feel connected to others" (Sørebø et al., 2009, p. 1179). It is referred as "the degree to which users believe that they can establish and maintain connection with others" (Deci & Ryan, 2000 as cited in Zhang, Wang, Lin & Tai, 2015, p. 8). Ryan (1993), Baumeister and Leary (1995) opined that the need for relatedness is the need to feel connected and supported by significant individuals like a manager, team-mates, parents and teachers. Higgins and Spiegel (2004), Twenge and Baumeister (2005) assert that relatedness is vital to increase individuals' sense of belonging (Leung & Matanda, 2013) that facilitates the internalization of values and practices. The needs for relatedness for teachers who manage students' use of e-learning reflects their need to feel connected with and supported by people in their social environments (Sørebø et al., 2009). Fulfillment of the need for being connected and supported within a social context is presumed to influence the level of motivation (Deci & Ryan, 1985). Roca and Gagne (2008) opined that people are driven to engage in community activities when they feel connected with other people. People in non-Western cultures especially those in Asian cultures are

typically interdependent and instead of being independent of the society, these people want to be inter-related and maintain affinity in interpersonal relationships (Hsu, 1985).

Tsai and Pai (2014) opined that relatedness is an individual's need to feel a sense of closeness with others. A relationship partner that satisfies this need is the object of greater positive affect (Leak & Cooney, 2001). Experience of relatedness may produce intimacy (Deci & Ryan, 1985, Reis & Patrick, 1996). Reis and Patrick (1996) define intimacy as the feelings of being understood and cared for. The degree of newcomers' experience of relatedness through their community participation will make them more likely to adopt the values of the community (Leak & Cooney, 2001; Thomson, 2006). The feelings of relatedness will also make a virtual community-based identity more interesting hence enhancing newcomers' community identification (Ahearne, Bhattacharya & Gruen, 2005; Tajfel, 1978).

Self Determination Theory stresses that support for individuals' needs for relatedness may influence their extrinsic motivation towards their intention to act (Deci & Ryan, 2000). By providing support for relatedness with some meaningful rationale for extrinsic motivated behavior will probably stimulate the internalization of extrinsic motivation (Johnston & Finney, 2010). The internalization of extrinsic motivation will lead to individuals' likelihood to be motivated by endorsing community goals when they feel being connected with others (Ryan & Deci, 2000a). This is based on the reason that when behaviors are not inherently interesting, individuals are willing to do such action because the action is appreciated by significant others to whom they feel connected (Ryan & Deci, 2000a). Perceived relatedness was found to have positive relationship with external, introjected and identified motivations in various areas such

as health (Gourlan, Trouilloud & Sarrazin, 2013) and education (Koh, Tan, Tan, Fang, Fong, Kan & Wee, 2010).

In the Information Systems (IS) domain, perceived relatedness denotes a form of social influence (Roca & Gagne, 2008) which is referred as an individual's evaluation of whether or not individuals important to him or her feel the behavior should be done (Ajzen, 1991). Deci and Ryan (2000) opined that people can be influenced by other people related to them when taking part in activities that are uninteresting thus making relatedness an embodiment of social effects which is equivalent to subjective norms in IS domain (Deci & Ryan, 2000). In a technology-mediated community, individuals are willing to engage in community activities when they are connected to other members (Roca & Gagne, 2008).

The effects of subjective norms have been examined on perceived usefulness (Venkatesh & Davis, 2000), attitude (Hsu & Chiu, 2004a), satisfaction (Hsu & Chiu, 2004b) and continuance intention (Bhattacherjee, 2000; Tan & Teo, 2000; Taylor & Todd, 1995). Taylor and Todd (1995) assert that subjective norms have positive effect on behavioral intention to use computing resource center for both inexperienced and experienced users. Custers, Westerhof, Kuin, Gerritsen and Riksen-Walraven (2012) found that there was positive relationship between perceived relatedness and intrinsic motivation. Lee, Lee and Hwang (2015) assert that when an individual perceives that the use of a technology provides more control to conduct interesting tasks (e.g. more resources, more knowledge, more influence), provides closer relationship with other colleagues or communication partners, and makes him or her feel competent to do the tasks, he or she will be more intrinsically motivated to adopt the technology.

On the other hand, Bhattacherjee (2000) defined interpersonal influence as the influence by friends, family members, colleagues, superiors and experienced people known to the potential adopter and external influence as the influence by mass media reports, expert views and other non-personal information considered by individuals in performing a behavior. Bhattacherjee (2000) modeled interpersonal and external influences as subjective norm and found that both have significant influences on intention to use electronic brokerage services. Nov, Naaman and Ye (2009) found that interpersonal ties have significant positive effect on users' intention to participate in social-technical communities. On the other hand, Zhang, Wang and Techatassanasoontorn (2012) asserted that when individuals perceive that they are connected to others, they will have more tendencies to participate in self-governance in order to protect the environment in which they communicate and interact with others.

Hsu and Chiu (2004b) also opined that subjective norms have significant influences on attitude towards e-service adoption. It was also found that interpersonal influence exerts a stronger influence on satisfaction than external influence (Tan & Teo, 2000). Roca and Gagne (2008) have verified that there was indirect effect of perceived relatedness on continuance intention to use e-learning. Perceived relatedness is one of the significant determinants of e-learning continuance intention (Deci & Ryan, 2000). It is also found to have significant effect on users' intention to participate in self-governance in social-technical communities (Zhang et al., 2012) and virtual communities (Tsai & Pai, 2014). Perceived relatedness also has indirect effect on intention to use Qboard (Lee et al., 2015).

3.6.3 Influence of Attitude towards Knowledge Sharing on Behavioral Intention

Basically, social psychologists assume that knowledge sharing motivation has two complementary perspectives namely egoistic and altruistic (Deci & Ryan, 1975). Egoistic is based on economic and Social Exchange Theory which includes economic rewards. Bock and Kim (2002) integrated both theories with Social Cognitive Theory to suggest expected rewards, expected social associations and expected contribution as the key determinants of a person's knowledge sharing attitudes. Bock et al. (2005) used these two theories to obtain two antecedents of knowledge sharing attitude namely anticipated extrinsic rewards and anticipated reciprocal relationships.

There are several factors that influence knowledge sharing behavior and these may include expected reciprocal benefits, reputation, expected relationships, trust and altruism. Expected reciprocal benefits refers to the extent to which an individual believed he or she could obtain mutual benefits through knowledge sharing whereas reputation refers to the extent to which an individual believed that participation would enhance personal reputation through knowledge sharing. Expected relationship is the extent to which an individual believed that he or she could obtain an improved mutual relationship through knowledge sharing. Trust is defined as the tendency to beloved in others. Altruism is defined as the extent to which an individual is willing to increase other people's welfare without expecting any rewards (Hsu & Lin, 2008). Altruism and reputation were found to have positive indirect effects on behavioral intention to use blog (Hsu & Lin, 2008).

Altruism motivation assumes that a person is willing to increase the welfare of others and has no expectation of any personal gains (Hsu & Lin, 2008). Hars and Ou (2001) found that altruism drive students and hobby programmers to take part in open-source projects.

According to Theory of Reasoned Action (Fishbein & Ajzen, 1975), the more favorable the attitude of a person towards a behavior, the stronger the intention of the person to engage the behavior will be stronger (Bock et al., 2005). Likewise, the more favorable the person's attitude towards knowledge sharing; the stronger the intention to share knowledge will be (Chow & Chan, 2008).

The studies on knowledge sharing motivation have been pluralistic with some scholars examined the issue from the context of economic exchange (Davenport & Prusak, 1998; Markus & Agres, 2000; Kankanhalli et al., 2005). Knowledge exchange happened when both knowledge sellers and buyers believe that they will benefit through the exchange of knowledge which include reciprocity, reputation and altruism (Davenport & Prusak, 1998; Wasko & Faraj, 2005; Lin, 2007). Reciprocity may be used as a payment for knowledge sharing whereas reputation will make a seller willing to dispense his knowledge when he knows that he will be recognized by other users. Altruism occurs because individuals have a natural instinct to help others (Cheng & Chen, 2011).

Individuals may be motivated by either extrinsic or intrinsic factors and reputation is an instance of extrinsic motivation for knowledge sharing which is defined as system characteristic (Hung, Lai & Chang, 2011). Individuals who share more knowledge receive higher reputation (Davenport & Prusak, 1998). Prior studies have suggested

that individuals take part in knowledge management practices to improve or build a reputation (Constant, Sproull & Kiesler, 1996; Donath, 1999; Wasko & Faraj, 2005) or to obtain peer recognition (Carrillo, Robinson, Al-Ghasanni & Anumba, 2004). Establishing a reputation is a strong motivator for knowledge sharing (Davenport & Prusak, 1998; Kankanhalli et al., 2005). Reputation is theorized to have positive effect on behavioral intention to use electronic knowledge repository (Hung et al., 2011).

Davenport and Prusak (1998) opined that individuals suffer from limited energy, time and knowledge and therefore are normally unwilling to shared scarce resources unless it is profitable for them. Reciprocity is a form of conditional benefit which indicates that individuals expect future benefits from their current actions (Hung et al., 2011). Individuals reciprocate previous friendly actions (Fehr & Gachter, 2000) that they believe are unlikely to lead to mutual benefits (Lin, 2007; Hsu & Lin, 2008) or knowledge feedback in the future (Kankanhalli et al., 2005) and therefore they have stronger knowledge sharing intention (Lin, 2007). Reciprocity was theorized to have positive effect on behavioral intention to use electronic knowledge repository (Hung et al., 2011).

Altruism is an instance of intrinsic motivation for knowledge sharing that contrasts with reciprocity and is considered as a form of unconditional kindness without expecting any return (Krebs, 1975; Smith, 1981, Fehr & Gachter, 2000). Altruistic individuals just provide assistance and enjoy doing it (Kollock, 1999; Lin, 2007). Individuals have a desire to assist others stems from relative altruism (Constant et al., 1996; Davenport & Prusak, 1998; Lin, 2007). On the other hand, Hoffman (1975) proposed the empathy concept as a type of emotional response that closely resembles the feelings of others. Hence, the more empathic a knowledge sharer acts, the more

altruistic he will behave (Krebs, 1975). Altruism is hypothesized as having a positive effect on behavioral intention to use electronic knowledge repository (Hung et al., 2011).

From the context of Social Exchange Theory and Theory of Reasoned Action, Bock and Kim (2002) assert that employees' beliefs which include expected associations and contribution are the key determinants of their attitudes towards knowledge sharing. Expected association is referred as the notion that employees believe they could improve relationship with other employees by offering their knowledge. Hence, expected association positively affects an individual's attitude towards knowledge sharing (Bock & Kim, 2002; Bock et al., 2005). Besides that positive attitude will also increase the positive intention of knowledge sharing that may lead to actual behaviors (Chen, Chen & Kinshuk, 2009). Therefore, reciprocity, reputation, altruism, trust and expected association will have positive effects on attitude towards knowledge sharing (Davenport et al., 1998; Bock & Kim, 2002). Cheng and Chen (2011) defined reciprocity as the extent to which an individual believes he or she may obtain mutual benefits through knowledge sharing while reputation is defined as the extent to which an individual believes that participation may promote personal repute through knowledge sharing. Altruism is defined as the extent to which an individual is willing to increase other individual's welfare without expecting rewards and trust is defined as the tendency to believe in others while sharing knowledge (Cheng & Chen, 2011). Cheng and Chen (2011) further defined expected association as the extent to which an individual believes he or she may obtain an enhanced mutual relationship through knowledge sharing.

From the perspective of healthcare technology acceptance, King (2006) opined that knowledge sharing happens by distribution of knowledge through a repository system with individuals who are not normally familiar to the contributor. Individuals' attitude

towards knowledge sharing may influence their intention to share knowledge and eventually influence their actual behavior (Kwok & Gao, 2005). Thus, one way to minimize the negative effects of perceived threat to healthcare professionals' autonomy may be associated with their attitude towards knowledge sharing in hospitals (Esmaeilzadeh, Sambasivan, Kumar & Nezakhati, 2011). When healthcare professionals have a favorable attitude towards knowledge sharing, they may perceive less threat by clinical IT system that is supposed to distribute their knowledge among other members of the organization (Esmaeilzadeh et al., 2011). Subsequently, they will become more likely to use the clinical IT system. Perceived threat to professional autonomy is defined as the extent to which an individual believes that using a particular system would decrease his or her control over the conditions, procedures, processes or content of his or her work (Walter & Lopez, 2008). Esmaeilzadeh et al. (2011) proposed that perceived threat to professional autonomy reduces healthcare professionals' intention to use clinical IT system. Hence, attitude towards sharing was theorized to have indirect influence on intention to use the clinical IT system.

In the context of organizational justice which is referred as the study of fairness within organizational settings and originates from work in social psychology that aimed at understanding fairness issues in social interactions (Greenberg & Colquitt, 2005), attitudes towards knowledge sharing behavior are based on behavioral beliefs about the expected outcomes of a particular behavior and the favorable or unfavorable assessment of these outcomes (Ibragimova, Ryan, Windsor & Prybutok, 2012). A higher attitudinal disposition towards knowledge sharing will increase knowledge sharing intention (Bock et al., 2005). If knowledge outcomes of work belong to the organization and when employees are happy within their organization, they will be more willing to share their expertise for benefit of the organization (Constant, Kiesler & Sproull, 1994). Therefore,

organizational commitment and beliefs in the organizational ownership of work outcomes will encourage knowledge sharing attitudes and individual who have positive feelings about knowledge sharing are more likely to engage in sharing the knowledge (Ibragimova et al., 2012).

Finally, it was found that attitude towards knowledge sharing has indirect effects on behavioral intention to use websites (Lin & Lu, 2000), course blogs (Cheng & Chen, 2011), electronic knowledge repository (Hung et al., 2011) and virtual community of practice (Gang & Ravichandran, 2011).

3.6.4 Influence of Perceived Autonomy on Behavioral Intention

In Self Determination Theory, perceived autonomy is referred as a form of self-government or the degree to which individuals feel self-directed in their actions (Deci & Ryan, 1985, Leak & Cooney, 2001). An individual whose need for autonomy has been fulfilled would report stronger feelings of "volition, agency and initiative" (La Guardia et al., 2000, p. 368) while the less autonomous individuals may not be able to use their personal skills, short of such strong feelings and express less awareness of their group membership (Tsai & Pai, 2014). The extent to which a relationship partner assists fulfillment of the need for autonomy would enhance the development of the relationship (Leak & Cooney, 2001, Thomson, 2006).

From the perspective of mobile learning assessment, students may need to decide which one of the learning activities they wish to engage in and they have a strong sense of device ownership that may change the learning ownership (Nikou & Economides, 2014). Students' control over their own goals and the sense of ownership they experience are among the determinants of mobile learning (Jones & Issoff, 2007). The

self-regulation that students and test-takers experience in the mobile learning and assessment contexts may be conceptualized as autonomy where students will be able to initiate and perform the assessment process anytime and anywhere they want thus transforming even external regulations into self-regulation (Nikou & Economides, 2014). Autonomy was found to have significant indirect effect on behavioral intention to use mobile-based assessment (Nikou & Economides, 2014).

In the context of online discussion board, Xie, Debacker and Ferguson (2006) have studied students' perceived interest (intrinsic motivation), value (extrinsic motivation), choice (perceived autonomy), course engagement (measured by numbers of login and discussion board postings) and attitudes toward class. Their findings revealed that perceived interest, value and choice are positively correlated with online students' course attitude and engagement.

From the perspective of e-learning, a need for autonomy among teachers who organize students' use of e-learning indicates the desire to self-regulate their engagement in using the e-learning tools of their own choice and own usage patterns (Deci & Ryan, 1985). Perceived autonomy is assumed to be connected with an activity that may increase self-determined types of extrinsic and intrinsic motivation (Sørebø et al., 2009). Autonomy stimulates internalization and integration of extrinsic motivation which may bring about genuine intrinsic motivation (Gagne & Deci, 2005). Perceived autonomy was found to have indirect effect on behavioral intention to continue using e-learning (Sørebø et al., 2009).

In retailing service technologies, autonomy is defined as a situation "in which significant others offer choice, provide a meaningful rationale, minimize pressure, and acknowledge the target individuals' feelings and perspectives" (Williams, Rodin, Ryan, Grolnick & Deci, 1998, p. 117). Autonomy does not mean that an individual is independent of others but rather it signifies a sense of living one's own life and acting in harmony with one's integrated self (Deci & Vansteenkiste, 2004). Baard et al. (2004) found that employees who perceived greater autonomy from managers will feel more satisfied with their jobs and thus will have lower anxiety and depression. An autonomy-supported surrounding can enhance physical and psychological well-being in patients (Williams et al., 1998) and boost self-determined motivation and dental clinic attendance (Halvari, Halvari, Bjørnebekk & Deci, 2010). Perceived autonomy was found to have direct effect on behavioral intention to use self-service technologies (Leung & Matanda, 2013).

In the context of self-governance, perceived autonomy is defined as the extent to which individuals believe that they are capable of making their own choices on participating in the community governance (Zhang et al., 2012). Perceived autonomy gives individuals the freedom to participate in self-governance on their own wills and on their own terms (Zhang et al., 2012). A feeling of personal choice and autonomy will make individuals feel that their actions indicate their true-self, therefore creating self-determined motivation toward the behavior (Ryan & Deci, 2000a). An example of effective use of self-governance is Slashdot.org which invited selected individuals to become moderators and these moderators may select whether or not they want to accept the invitation. Perceived autonomy was theorized to have positive effect on individuals' behavioral intention to participate in self-governance (Zhang et al., 2012).

From the perspective of online content evaluation, perceived autonomy is defined as the extent to which individuals believe that they are capable of making their own choices pertaining to participating in assessing online content (Deci & Ryan, 2000). Basically, participation in an online community is a voluntary activity whereby individuals will feel that they choose to perform an activity of their own free will without any pressure from others thus fulfilling their need for autonomy (Gagne, 2003). Once they are free to make their own choices on whether to assess online content, their intention to adapt to the value of this behavior will likely to promote identified motivation towards evaluating online content. It has been found that perceived autonomy has significant indirect effect on behavioral intention to evaluate online content (Zhang et al., 2015). Besides that, similar results have been validated from the context of Q-board acceptance (Lee et al., 2015) and ICT continuance intention (Ho, 2010).

3.6.5 Influence of Perceived Competence on Behavioral Intention

Ryan and Deci (2000a) assert that an individual's perceived competence may facilitate the internalization of extrinsic motivation (Zhang et al., 2015). This is due to the fact that transformation of an extrinsic goal into an individual's own goal needs that individual to feel competent in terms of understanding the goal. The consequence is that perceived competence may influence various types of extrinsic motivation differently depending on the level of internalization for every kind of the extrinsic motivation (Zhang et al., 2015). For instances, high degree of competence may be linked to high internalized motivation (i.e. identified motivation) while low degree would forecast only partly internalized intrinsic motivation that is referred as introjected motivation (Ryan & Deci, 2000a).

Furthermore, in a controlled surrounding, when an individual feels competent enough to comply with external rewards or threats, he or she may take action because of the existence of external motivations (Ryan & Deci, 2000a). Zhang et al. (2015) defined perceived competence as the level to which individuals believe that assessing online content may provide the chances to demonstrate their ability for performing the activity (Deci & Ryan, 2000). Once individuals choose to assess online content, they will have the opportunity to utilize their knowledge in maintaining the online community, thus creating the sense of competence (Kayhan & Bhattacherjee, 2009). Montero (2004) also assert that once individuals perceive that they are able to perform an activity, they are stimulated to engage themselves in the activity.

Wang and Clay (2012) opined that perceived competence is able to make individuals feel that their engagements are imperative to realize the community value of being a resourceful place. In addition to that, Hong and Park (2011) assert that individuals will be willing to assess online content once they perceive their ratings may influence others' choices about using online content. Similarly, individuals tend to adopt and internalize relevant knowledge to succeed at this activity (Deci & Ryan, 2000). Hence, it is theorized that individuals' perceived competence is likely to stimulate different kinds of extrinsic motivation (Zhang et al., 2015).

From the context of self-governance, empirical evidence has suggested that perceived competence may predict persistence in behaviors (Roca & Gagne, 2008). When individuals choose to take part in self-governance, they will put in their time and apply their knowledge to maintain the community (Zhang et al., 2012). Studies have found that individuals are motivated to increase their involvement when they feel that they are able of assisting with community governance (Montero, 2004). Timely and

positive feedback and reward from the community regarding individuals' participation are likely to make individuals feel that their behaviors are vital and valuable to the community (Wang & Clay, 2010). Huberman, Romero and Wu (2009) suggested that an acknowledgement of contribution may predict users' participation. Hence, perceived competence was theorized to have positive effect on individuals' behavioral intention to participate in self-governance (Zhang et al., 2012).

On the other hand, from the perspective of self-service technologies, competence refers to an individual's beliefs about his or her ability to perform a task (Bandura, 1997). When individuals perceive that they are more competent, they will feel that their behavior is more effective and have a sense of satisfaction when they involve themselves in the activities (Deci & Ryan, 2000a). This feeling of satisfaction enhances internalization and therefore increases self-determination (Deci & Ryan, 2000a). In technology settings, competence is linked to the degrees of job burnout (Salanova, Peiró & Schaufeli, 2002), experience in using technology (Chen, 2012), expectations of the outcomes of using computers, emotional reactions to computers and actual computer use of web-based systems (Compeau & Higgins, 1995). Competence may predict the use of web-based systems (Yi & Hwang, 2003), self-service technologies adoption (Dabholkar & Bagozzi, 2002) and continued use of self-service technologies (Wang, Harris & Patterson, 2013). Studies have validated that competence enhances self-determined motivation in patients (Williams et al., 1998) and medical students (Williams & Deci, 1996) and in experimental research (Higgins & Spiegel, 2004; Twenge & Baumeister, 2005). Hence, perceived competence was theorized and then empirically validated to instill self-determined motivation and adoption intention for self-service technologies (Leung & Matanda, 2013).

Perceived competence is also referred as the need to feel effective in one's efforts and able to achieve desired outcomes (Reis & Patrick, 1996). It is similar to the concept of "personal mastery" defined as a person's active avoidance of mediocrity or poor performance (Austin & Vancouver, 1996, Thomson, 2006). Patrick, Knee, Canevello & Lonsbary (2007) assert that believing that one is effectively making improvement towards one's goal is psychologically beneficial. Ryan and Deci (2000a) concluded that support for competence leads individual to transform the group's values and encourages more efficacious relationships. Competence was found to have positive influence on behavioral intention to participate in virtual communities (Tsai & Pai, 2014).

From the perspective of e-learning, the sense of competence is referred as the level to which users desire to self-regulate (Sørebø et al., 2009). Roca and Gagne (2008) opined that the concept of self-efficacy (Bandura, 1986) is similar to the need for competence in Self Determination Theory. In the field of Information Systems, computer self-efficacy is referred as the ability of an individual to use his or her computer skills to accomplish a specific task (Ho, 2010). Sørebø et al. (2009) argued that in e-learning platform, users will use an e-learning platform when they have the feeling of competent. Perceived competence was found to have significant indirect effect on behavioral intention to continue using e-learning platform (Ho, 2010).

Furthermore, a need for competence among teachers who organize students' e-learning usage reflects their desire to be effective in the e-learning tool (Sørebø et al., 2009). Fulfilling this need would influence the extent of motivation (Deci & Ryan, 1985). Once the need is fulfilled, teachers will feel that they are qualified to organize students' e-learning usage that would influence autonomous forms of motivation (i.e. extrinsic and intrinsic). Sørebø et al. (2009) assert that perceived competence would

also influence teachers' extent of confirmation as e-learning competence would make teachers more effective in their application of the e-learning tool and thus increasing their extent of confirmation (Sørebø et al., 2009). Perceived competence was found to have positive indirect effect on behavioral intention to continue using e-learning (Sørebø et al., 2009).

Besides that, perceived competence also reflects individuals' tendency to be effective in their interactions with the surroundings and when they carry out an activity (Deci & Ryan, 1980; 1985a; Elliot & Thrash, 2002) which is analogous to the concept of self-efficacy (Bandura, 1986). Bandura (1986, p. 391) defined self-efficacy as "people's judgments of their capabilities to organize and executive courses of action required to attain designated types of performances and it is concerned not with the skills one has but with the judgments of what one can do with whatever skills one possesses". Self-efficacy is an individual's belief that he or she is able to accomplish a particular behavior or task and it is similar to the concept of competence enshrined within the Self Determination Theory (Deci & Ryan, 1985). In IS literature, computer self-efficacy is referred to self-evaluation of individual ability to use computer skills in order to accomplish specific tasks (Compeau & Higgins, 1995). Internet self-efficacy may be differentiated from computer self-efficacy as it is the belief that an individual is able to successfully demonstrate a distinct set of behaviors needed to build, uphold and apply effectively the Internet over and beyond elementary personal computer skills (Eastin & LaRose, 2000). Perceived competence has positive indirect effect on behavioral intention to continue using e-learning (Roca & Gagne, 2008) and this is consistent with other prior studies (Baard et al., 2004; Deci et al., 2001; Ilardi, Leone, Kasser & Ryan, 1993).

3.6.6 Influence of Perceived Competence on Trust in Website

The effect of perceived competence on trust in the context of online shopping has been examined by Chen and Dillon (2003), Cheung and Lee (2000; 2003), Mayer, Davis and Schoorman (1995), Sadi and Al-Khalifah (2012), Zahara and Harris (2015). These showed that the capabilities and expertise of Internet vendors to provide good service to its clients is very important. Good service include fully informed, easy to understand and shop online at attractive innovation in order to increase clients' trust in online shopping (Zahara & Harris, 2015).

From the context of blogs, attachment is defined as the intensity of the emotional bond that an individual develops towards an object (Thomson, 2006). Following Self Determination Theory, attachment to an object is established if the object fulfills the requirements of autonomy, relatedness and competence (Deci & Ryan, 2000; Vansteenkiste, Lens, Soenens & Luyckx, 2006). Competence is referred as the innate tendency to seek feelings of effectiveness, achievement and challenge in an individual's activities (Deci & Ryan, 2000). The effect of attachment on development of trust has been examined by Rufin, Medina and Rey (2013), Thomson (2006) and Thomson, MacInnis and Park (2005).

Perceived competence is similar to self-efficacy which is defined as individuals' judgments of their abilities to organize and perform courses of action needed to achieve designated forms of performance (Bandura, 1986). Research efforts on self-efficacy can be seen in many IS studies (Compeau & Higgins, 1999; Johnson & Marakas, 2000; Hong, Thong, Wong & Tan, 2002). Self-efficacy was found to have positive effect on trust perception in Internet banking acceptance (Song & Wang, 2010).

From the Facebook context, Bandura (1977) proposed for the first time the theory of self-efficacy which is defined as the belief of individuals in their capability to organize and execute actions. In accordance with this theory, self-efficacy reflects the extent of self-confidence possessed by individuals that enables them to deal with stressors (Wu, Wang, Liu, Hu & Hwang, 2012). Hence, self-efficacy is treated as a resource to cope with stress (Jerusalem & Schwarzer, 1992).

The self-efficacy theory has been modified and applied in various domains like teacher efficacy (Topkaya, 2010; Tschannen-Moran et al., 1998), student self-efficacy in learning subjects (Liu and Lin, 2010; Liu et al., 2010) or social self-efficacy (Wu, Wang, Liu, Hu & Hwang, 2012). Social self-efficacy is defined as the belief of an individual in his or her ability to initiate social contact and establish new friendships (Wu et al., 2012). Social self-efficacy is normally applied in domains such as counseling for college students, health psychology, adult social interaction and social interaction among students studying abroad (Fan, Meng, Gao, Lopez & Liu, 2010; Hagedoorn & Molleman, 2006; Lin & Betz, 2009; Wei, Russel & Zakalik, 2005).

Many researchers believe that trust may reduce interpersonal tension and conflict besides promoting intra-community collaboration, cohesiveness and identification (Gambetta, 1988; Mitzal, 1996) as well as enhancing interpersonal harmony and cooperation (Coleman, 2000; Fukuyama, 1995; Leana & Van Vurenn, 1999). Hsu, Ju, Yen and Chang (2007) found that trust is correlated with self-efficacy in knowledge sharing. Wu et al. (2012) further validated the significant positive effect of social self-efficacy on social trust in Facebook indicating that in an online community, individuals possess the confidence to interact with others, to make new friends and built a good sense of social trust among those with whom they interact.

From the e-commerce perspective, online transaction self-efficacy is defined as an individual perception of efficacy in engaging in a certain behavior and task (Kim & Kim, 2005). The more self-efficacious consumers are with a web vendor, the more favorable expectations they are likely to possess and the more they are likely to trust a web vendor. If consumers have low self-efficacy, they are less confident that they are capable of returning it without any problem in case the merchandise they have purchased online turns out to be defective (Kim & Kim, 2005). If consumers are confident that they are able to take care of the problems on their own in case their orders do not come through in a satisfactory manner, they are more likely not to be reluctant to make a purchase from a web vendor (Kim & Kim, 2005). In conclusion, consumers who are highly self-efficacious tend to make a transaction with any web vendor whereas those with low self-efficacy are more likely not to transact with any web vendor (Kim & Kim, 2005). Online self-efficacy was found to have positive effect on trust (Dash & Saji, 2008; Kim & Kim, 2005).

In the context of online shopping, Internet self-efficacy is defined as the performance of specific online tasks also the overall internet usage (McKnight, Cummings & Chervany, 1998; Lam & Lee, 2005). It is referred as the belief that an individual may use effectively the Internet over and beyond basic personal computer skills (Yao & Li, 2009). Bandura (1985) opined that self-efficacy may reduce anxiety and individuals who have higher internet self-efficacy will experience less online shopping anxiety (Yao & Li, 2009). Internet self-efficacy was found to have indirect effect on trust towards online shopping (Yao & Li, 2009).

3.6.7 Influence of Trust in Website on Behavioral Intention

In the context of mobile purchase, trust refers to a willingness to be vulnerable based on the positive expectation towards another party's future behavior (Mayer et al., 1995). Trust generally encompasses three beliefs namely ability, integrity and benevolence (McKnight et al., 2002). Ability refers to mobile vendors having necessary knowledge and skills to satisfy their tasks, integrity refers to mobile vendors keep their promises and do not deceive consumers and benevolence refers to mobile vendors keep consumers' interests in mind and not just their own benefits (Gao, Waechter & Bai, 2015).

Trust has been validated to be an imperative determinant of behavioral intention to Information Systems use (Lee et al., 2015; Lin & Wang, 2006; Luo, Li, Zhang & Shim, 2010). Liu, Marchewka, Lu and Yu (2004) proposed a "privacy-trust-behavioral intention model" to understand consumers' behavior of electronic commerce. Liu et al. (2004) further stressed that one of the main reasons for many consumers not to conduct online shopping is a lack of trust in electronic transactions. Trust has been found to have positive effect on continuance intention towards mobile purchase (Hung, Yang & Hsieh, 2012; Gao et al., 2015).

From the perspective of e-government services, trustworthiness is defined as the perception of confidence in the electronic marketer's reliability and integrity (Belanger et al., 2002). The decision to engage in e-government transactions needs the trust of the citizen in the state government agency providing the service and trust of the citizen in the technology through which electronic transactions are executed, namely the Internet (Lee & Turban, 2001). Carter and Belanger (2005) found that trust in Internet is a significant predictor of e-government adoption where perceptions of trust in the Internet

implies that citizen who perceive the reliability and security of the Internet to be low will be less likely to adopt e-government services (Carter & Belanger, 2005).

From the context of e-commerce, trust has always been an essential element in influencing consumer behavior and has high significance in uncertain environments such as the Internet-based e-commerce (Gefen & Straub, 2003, Jarvenpaa, Tractinsky & Saarinen, 1999; Jarvenpaa, Tractinsky & Vitale, 1999a; Moon & Kim, 2001). Lack of trust has been one of the key reasons for consumers not to engage in e-commerce (Keen, Balance, Chan & Schrump, 1999). Trust has a direct effect on consumers' purchase intention in multiple cultures (Jarvenpaa et al., 1999). It is instrumental in the acceptance of Internet technologies (Gefen, 2000).

Trust has been described as the belief that the other party will behave in a socially responsible manner and by doing so, will satisfy the trusting party's expectations without taking advantage of its vulnerabilities (Gefen, 2000; Mayer et al., 1995). Trust in B2C e-commerce may be defined as the belief that enables consumers to willingly become vulnerable to Web retailers after having the retailers' characteristics into consideration (McKnight & Chervany, 2002; McKnight et al., 2002). In line with the Theory of Reasoned Action, trust builds positive attitudes toward Web retailers that are likely to reduce fears of retailer opportunism and attenuate infrastructure concerns. Therefore, trust in Web retailer is viewed as a salient behavioral belief. By influencing positive attitude in consumers, it has an effect on behavioral intentions for online transactions with Web retailers (Pavlou, 2003). It has been a consensus based on the large body of literature that trust is related to positive attitudes (Gefen, 1997; Jarvenpaa et al., 1999, Jarvenpaa et al., 1999a; Song & Zahedi, 2002). Hence, trust is likely to influence transaction behavioral intentions (Pavlou, 2003).

In term of Internet banking, trust is referred as the belief that the promise of another can be relied upon and that in unexpected situations, the other will act in a spirit of kindness and in a benevolent manner towards the trustor (Grazioli & Jarvenpaa, 2000). Hence, customers' trust is the confident belief in supplier (Crosby, Evans & Cowles, 1990; Gefen, 2000). Trust has three components: ability, benevolence and integrity (Mayer et al., 1995, McKnight & Chervany, 2002).

Ability is the trustor's belief that the trustee has the power to do for him or her on what he or she needs to be done, benevolence is the degree to which a trustee is believed to want to do good to a trustor besides the egocentric profit motive and integrity is a trustor's belief that a trustee makes good-faith agreements, tells the truth, acts ethically and fulfills promises (Suh & Han, 2003).

Researchers in marketing field have validated empirically the causal relationship between trust and behavioral intention (Suh & Han, 2003). Crosby et al. (1990) found that the quality of the relationship has a positive effect on the expectation of future interaction in the service sales context. Doney and Cannon (1997) found that customer trust is associated to intentions to use the vendor in the future. Gefen (2000) proposed that trust in e-commerce vendor may increase consumers' intention to use the vendor's Web site. Suh and Han (2003) found that trust has positive effect on behavioral intention to use Internet banking.

From the perspective of online travel, trust is defined as the subjective belief that the online service provider will fulfill transactional obligations (Kim, Ferrin & Rao, 2008; Kim, Lee & Law, 2008a). Previous studies have considered trust as a main factor of success in the online service context (Corritore, Kracher & Wiedenbeck, 2003; Elbeltagi

& Agag, 2016; Flavian, Guinaliu & Gurrea, 2006; Koufaris & Hampton-Sosa, 2004) due to the high risk that customers perceived in online environment (Harris & Goode, 2004).

Various studies have been conducted to investigate and determine the importance of trust in online environment (e.g. Bart, Shankar, Sultan & Urban, 2005; Casalo, Flavian & Guinaliu, 2011; Flavian et al., 2006; Schlosser, White & Lloyd, 2006). From the cognitive component of trust, trust consists of three distinct factors including honest, competence and benevolence, which contribute to consumers' perception of trust in an online community (Flavian et al., 2006; McKnight et al., 2002; Casalo et al., 2011). Honesty is the belief that other community members will fulfill their promises and keep their word (Doney & Cannon, 1997). Competence is the consumers' perceived skill and knowledge of the other community members whereas benevolence means that community members intend to help, support and care for other community members (Ridings, Gefen & Arinze, 2002).

The positive links between trust and behavioral intention to purchase online have been confirmed in several e-commerce studies (Chiu, Huang & Hui, 2010; Gefen et al., 2003; Kim, Xu & Gupta, 2012). Similarly, the significant positive relationship between trust and purchase intention were supported in several tourism studies (Agag & El-Masry, 2016; Amaro & Duarte, 2015; Bigne, Sanz, Ruiz & Aldas, 2010; Escobar-Rodriguez & Carvajal-Trujillo, 2014; Kim, Chung & Lee, 2011; Ponte, Carvajal-Trujill & Escobar-Rodr, 2015; Sanz-Blas, Ruiz-Mafe & Perez, 2014). Agag and El-Masry (2016), Alsajjan and Dennis (2010) found that trust affects consumers' attitude and intention to engage in behavior. This is further supported by several studies which

found that trust has effects on consumers' attitude and repurchase intention (Amaro & Duarte, 2015; Ashraf, Thongpapanl & Auh, 2014; Agag & El-Masry, 2016a).

Besides that trust has been found to have significant effect on behavioral intention in various contexts including hotel booking intentions (Agag & El-Masry, 2016a), intention to purchase travel online (Ponte et al., 2015), intention to use electronic medical records exchange (Hsieh, 2015) and e-government services (Belanche, Casaló, & Flavián, 2012; Susanto & Aljoza, 2015). The strong relationship between trust and behavioral intention with r = 0.483 (Wu et al., 2011) shows that trust is generally important in adoption of new technologies (Fukuyama, 1995).

3.6.8 Influence of School Support on Behavioral Intention

From the perspective of teaching blog adoption (Lai & Chen, 2011), school support is defined as the extent to which a teacher believes that his or her school is committed to successful blog implementation and use (Venkatesh & Bala, 2008). Earlier studies have indicated that top management support plays an imperative role in the adoption of information technology because assistance for the required resources could be easily attained (Huang et al., 2009). When teachers are encouraged by school authorities to use a web-based learning system, their behavioral intention to use the system increases (Franklin, 2007). School support was found to have positive effect on intention to adopt teaching blogs (Lai & Chen, 2011).

In terms of computer usage intention, Smarkola (2008) found that experienced teachers depend on both equipment resources and personal support from school administrators in order to successfully integrate technology into their classroom teaching as psychologically, teachers who obtain more school support would appreciate

the support and feel good about giving their students opportunities to enhance their learning. Teachers have indicated that they feel confident about integrating computers into their classrooms when they are supported by their school administration (Smarkola, 2008). Several studies (Dawson & Rakes, 2003; Granger, Morbey, Lotherington, Owston & Wideman, 2002) have shown that K-12 school principals do have influence on the level of technology integration into their school's curriculum.

From the context of e-learning, facilitating conditions is referred as the extent to which an individual perceives that he possesses the organizational resources and infrastructure support to use the system (Venkatesh & Bala, 2008). In the e-learning acceptance model, Selim (2006) have identified support as the key determinant with respect to reliability and availability of technical support and online resources. The role of support has been emphasized in various studies (Abdul-Wahab, 2008; Carlson, Henningsson, Hrastinski & Keller, 2008; Jong & Wang, 2009; Nanayakkara & Whiddett, 2005; Umrani-Khan & Iyer, 2009). Facilitating conditions have been found to have positive influence on behavioral intention to use e-learning system (Agudo-Peregrina, Hernández-García & Pascual-Miguel, 2014).

Facilitating conditions is also defined as the individual's perception of whether an organizational and technical infrastructure exists to support the use of the system where organizational supporting structures are further categorized into technical and managerial support (Hernández-García, Iglesias-Pradas & Fernández-Cardador, 2015). Technical support means organizations provide users with resources (Weill & Broadbent, 1998) and technical support (Igbaria & Iivali, 1995). Managerial support refers to the management's level of commitment to the implementation and use of a technology according to the individual's point of view (Venkatesh & Bala, 2008).

Jasperson, Carter & Zmud (2005) assert that top management may stimulate and influence workers to use a system. Hernández-García et al. (2015) opined that Web 2.0 collaborative technologies may trigger profound changes in organization and managerial commitment, communication and support are key determinants to legitimate the adoption process within the organization .

From the perspective of computerized reservation system, organizational support is defined as the degree to which employees believe that their organization helps them use a particular system (Jiang & Klein, 1999). Various studies have shown that organizational support has positive influence on employees' technology acceptance and use behavior (Lee, Lee & Kwon, 2005). Mahmood et al. (2001) found that organizational support is the third most important factor influencing technology use behavior. Speier and Venkatesh (2002) also found that management support has positive influence on salesperson's perception of technology. Lee et al. (2005) found that organizational support can strengthen the relationship between technological characteristics and employees' intention to use the technology when they perceive strong organizational support, they tend to use the system.

In the context of tele-health services acceptance, facilitators like access and availability of technical support may substantially increase behavioral intention (Cimperman, Brenčič, & Trkman, 2016) and a higher degree of organizational support such as approval from health institutions, government, etc. may lead to more favorable beliefs regarding health technology use (Rho, Kim, Chung & Choi, 2015; Steele, Lo, Secombe & Wong, 2009). Kijsanayotin, Pannarunothai and Speedie (2009) found that an increase in facilitating conditions may increase behavioral intention to use tele-health services.

In the context of teleconferencing acceptance, when individuals believe that they are lack of resources to use a technology, they are less likely to consider using the technology (Park, Rhoads, Hou & Lee, 2014) especially during the introductory stage of a technological development (Bergeron, Rivard & De Serre, 1990). Past studies have shown that institutional support has significant effect on technological acceptance (Taylor & Todd, 1995a; Thompson, 2001; Venkatesh, 2000; Venkatesh & Davis, 2000). Since the adoption of teleconferencing systems involves users within organizations and promotes better planning and preparation by meeting participants (Campbell, 1997), it requires more group effort and support from the organization (Park et al., 2014). Institutional support contributes to employees' perception of ease of use and usefulness and the availability of support from the organization on using the teleconferencing systems is a direct driver that leads to actual use of the system (Park et al., 2014).

From the perspective of organizational learning environment (Cheng, Wang, Moormann, Olaniran & Chen, 2012), managerial support is referred as trainers' perception and belief of the degree to which supervisors or managers give them reinforcement and opportunities for acquiring new knowledge sharing activities by participating in continuous learning and development activities (Facteau, Dobbins, Russell, Ladd & Kudisch, 1995). Following the expectancy-theoretical model of training motivation, perceived managerial support may strengthen trainees' perception and belief of the valence of the outcomes obtained through participation in learning (Cheng et al., 2012).

Prior studies have provided the empirical evidences (Chiaburu & Tekleab, 2005; Tharenou, 2001). In terms of technology acceptance perspective, managerial support has been widely studied in technology acceptance models as an antecedent of potential

users' perceived usefulness of a technological system (Lewis et al., 2003). On the other hand, organizational support is referred as the extent to which employees perceived that their employers support their participation in development activities and appreciate their learning through supportive organizational policies like skill-based pay systems and visible rewards (Kozlowski & Farr, 1988; Tharenou, 2001; Tracey & Tews, 2005).

In line with the expectancy-theoretical model, supportive organizational policies for learning may promote employees' belief about the valence and benefits of the outcomes obtained from participation in learning (Cheng et al., 2012). The positive influence of organizational support and perceived usefulness of learning has been empirically validated in prior studies (Maurer & Tarulli, 1994; Tracey, Hinkin, Tannenbaum & Mathieu, 2001). From the perspective of technology acceptance, facilitating conditions at the organizational level (e.g. internal training program, perceived financial resources) have been found to have direct effect on perceived usefulness of using a technology (e.g. Igbaria, Zinatelli, Cragg & Cavaye, 1997; Wang, Lin & Luarn, 2006).

From the e-learning context, organizational support is defined as the degree to which top and middle management allocates sufficient resources to assist employees in achieving organizational goals, including the assistance of computer systems, purposive instruction, and guidance in using computer applications (Grover, 1993). Prior studies have shown positive relationships between organizational support and computer system usage (Kim, 1996; Sharma & Yetton, 2003) and also organizational support has positive effects on computer technology adoption through beliefs and behaviors (Davis, 1989, Igbaria, Pavri & Huff, 1989, Igbaria, Paasuraman & Baroudi, 1996).

Kim et al. (2007), McFarland and Hamilton (2006) also found that organizational support is associated with perceived usefulness, perceived ease of use and social norms. Hence, organizational support is an imperative determinant of computer technology acceptance (Davis et al., 1989) and behavioral intention to use (Igbaria & Parasuraman, 1989). Similarly, management support refers to the encouragement of management in an organization which play a significant role in shaping organizational values, beliefs and behaviors (Lin & Wu, 2004). Management support of computer technology adoption will send a positive signal to employees about the importance of computer technology in the organization (Lee, Jeong, Park & Ryu, 2011).

Support of top management in innovation and technology has been constantly associated with higher levels of success in the areas of change, innovation and the perceptions of technology (Davis et al., 1989; Lin & Wu, 2004). Lack of management support has been assumed as a barrier to implementation of computer technology and discourages the use of technological systems (Igbaria, Guimaraes & Davis, 1995; Phelps & Mok, 1999; Sharma & Yetton, 2003). Hence, organizational support and management support may affect employees' perception of e-learning systems acceptance (Lee, Hsieh & Hsu, 2011).

Besides that the influence of management support towards behavioral intention has also been validated in the context of digital learning environment (Igbaria et al., 1997; Pynoo et al., 2011) whereas the effect of management support on behavioral intention to use electronic medical records has been verified by Abdekhoda, Ahmadi, Gohari and Noruzi (2015).

3.6.9 Influence of VLE Content Design on Perceived Media Richness

In the context of e-learning, pedagogical design has been shown to have significant effect on students' acceptance of e-learning (Martinez, Del Bosch, Herrero & Nuño, 2007). Lederer et al. (2000) also found that ease of understanding and ease of finding various web contents may predict ease of use as learners will be more likely to feel that using e-learning services is easy if the services are provided with bountiful contents designed to satisfy their needs. Design of learning contents has been found to have positive influence towards ease of use (Lee et al., 2009) whereas teaching materials were found to have positive effect on e-learning effectiveness (Littlejohn, Falconer & Mcgill, 2008; Zhang, Zhao, Zhou & Nunamaker, 2004).

Besides that, past research has shown that perceived resources played an imperative role in the success of Information System (IS) adoption (Amoroso & Cheney, 1991; Gabel, 1991; Guimaraes, Gupta & Rainer, 1999; Igbaria et al., 1997; Slyke, Hao & Day, 2002; Thong et al., 1996). Perceived resources is defined as an individual's belief that he or she has the resources needed to use an information technology (Mathieson & Chin, 2001; Oh, Ahn & Kim, 2003; Taylor & Todd, 1995, 1995a). Quite a number of researchers have found evidence that educational resources are one of the vital factors that affects learning effectiveness (Gable, 1991; Guimaraes et al., 1999, Mathieson & Chin, 2001; Oh et al., 2003; Taylor & Todd, 1995a, 1995b) and IS acceptance (Ajzen, 1991; Mathieson, 1991; Mathieson & Chin, 2001; Oh et al., 2003; Taylor & Todd, 1995, 1995a). IS users are highly motivated when they feel the presence of requisite resources that could lead to better learning performance (Cheney & Dickson, 1982; Gable, 1991).

3.6.10 Influence of VLE Content Design on Behavioral Intention

In the context of multimedia instructional resources acceptance, it is asserted that a good teaching system should provide good resource that corresponds to the textbooks and the lower association between instruction resource and textbooks which the teachers use will lead to less teacher's willingness to use the resources (Mao & Hu, 2013). Resource appropriateness is referred as the level to which the multimedia instructional resources match with the textbooks that teachers use. Resource appropriateness was found to have indirect effect on behavioral intention to use multimedia instructional resources with perceived usefulness as the mediator (Mao & Hu, 2013). Ajzen (1991) asserted that the presence of requisite resources and opportunities have direct effect on acceptance of technology. Perceived resources was found to have positive indirect effect on behavioral intention to use e-learning (Lee, 2008).

In the context of computer-based assessment acceptance, content is related to the course' content and the content (questions) during the system usage (Terzis & Economides, 2011). Computer-based assessment acceptance model (CBAAM) has shown that content has a positive influence on perceived playfulness and perceived usefulness (Terzis, Moridis & Economides, 2012). Wang (2003) has found that content is a significant predictor of e-learning satisfaction. Content was found to have indirect effect on behavioral intention to use computer-based assessment with perceived playfulness as the mediator (Terzis et al., 2012).

From the perspective of YouTube acceptance, content richness is defined as the abundance of learning resources that leaners may access to enrich their learning activities (Lee & Lehto, 2013). The content richness has three dimensions namely relevance, timeliness and sufficiency (Jung, Perez-Mira & Wiley-Patton, 2009).

Relevance is defined as "the match between the content provided and users' information needs" (Park, Roman, Lee & Chung, 2009, p.199). Shih (2004) asserted that individuals seek relevant information in order to match their current knowledge state with the capability to perform the task. Timeliness (or currentness as defined by De Wulf, Schillewaert, Muylle & Rangarajan, 2006) refers to the degree to which an information system provides users with up-to-date information (Doll & Torkzadeh, 1988).

Sufficiency is defined as the degree to which an information system provides sufficient amount and variety of information to the users and several studies have shown that higher perception of content richness provided by a system will lead to higher perception of the usefulness of the system (Lee & Lehto, 2013). For instance, content quality (Lee, 2006) which is closely related to content richness was found to be significant determinant of perceived usefulness of e-learning systems. A study by Jung et al. (2009) indicated that perceived content has positive direct influence on perceived usefulness of mobile TV. Eiriksdottir and Catrambone (2011) opined that individuals do not perceive inaccurate or out-of-date procedural instructions as being useful. Content richness was found to have positive indirect effect on behavioral intention to use YouTube (Lee & Lehto, 2013).

In the context of virtual learning environment (VLE), it was found that only adequately designed VLE will be able to provide the promising potential for success while ill-designed systems will even cause harmful disadvantages making focuses on design characteristics of VLE a critical aspect of learning success (Mueller & Strohmeier, 2010). In term of VLE design characteristics, the Information Systems

Success Model (ISSM) has clarifies that learning content of the VLE constitutes essential element of design characteristics (Mueller & Strohmeier, 2010).

In the perspective of website design and usage behavior, general content is referred as characteristics such as content usefulness, completeness, clarity, currency, accuracy and conciseness (Al-Qeisi, Dennis, Alamanos & Jayawardhena, 2014). General content possess an indirect effect on behavioral intention via perceived usefulness (Al-Qeisi et al., 2014).

3.6.11 Influence of Perceived Media Richness on Behavioral Intention

Several studies have discussed the effect of media richness on users' satisfaction which is associated with intention to use (Liu et al., 2009). Other studies have shown the significant effect of perceived media richness on perceived usefulness and perceived ease of use (Liu et al., 2009; Chen, Yen, Hung & Huang, 2008) from the context of e-commerce and e-learning respectively. Perceived media richness was found to be the significant antecedents of perceived usefulness, perceived ease of use and attitude which eventually influenced behavioral intention to use blogs and podcasts (Saeed, Yang & Sinnappan, 2010).

In the perspective of SecondLife acceptance, Saeed, Yang and Sinnappan (2008) found that there were strong relationships between media richness, perceived usefulness and ease of use which ultimately influenced actual usage of SecondLife which indicated that the more the medium is rich , the higher the perception of usefulness and actual usage due to the ability of SecondLife to provide personal focus, immediate feedback, multiple cues and language variation which increases effective communication (Sun & Cheng, 2007).

From the context of e-learning, streaming media is considered as an effective method as it allows large files (e.g. video or audio) to start playing before the entire file has been downloaded therefore creating a more interactive learning environment with various combinations of text, graphics, video, audio and animations (Liu et al., 2009). Learners will benefit from the use of richer media in courses consisting of equivocal and ambiguous content (Sun & Cheng, 2007). When evaluating learner-perceived satisfaction separately from learning achievement, the richer media video and audio were found to be more closely related to learner's satisfaction (Otondo, Van Scotter, Allen & Palvia, 2008) which is related to intention to use (Liu et al., 2009). Different media combinations may provide different degree of media richness which may be associated with the perceived usefulness of the e-learning experience (Lim & Benbasat, 2000).

In the perspective of Multimedia Messaging Services (MMS), Daft and Lengel (1986) assert that rich media are more suitable for resolving equivocal situations whereas lean media are more appropriate for reducing uncertainty. Hence, richer media are normally preferred and used for more complicated tasks (Leonard, Brands, Edmondson & Fenwick, 1998). El-Shnnawy and Markus (1997) opined that the richness continuum is a function of four factor namely feedback capacity, cues, personalization and language variety. Lee, Cheung and Chen (2007) referred media richness as the channel's relative ability to convey messages that communicate rich information. MMS is a very rich but inexpensive communication medium with high capacity to convey multiple cues through the wordings in text messages, tone of voice, inflection in audio messages, gestures and facial expressions in video messages that facilitate language variety and content (Lee et al., 2007). The higher the media richness, the better the communication work can be carried out with less uncertainty and ambiguity leading to less effort and

higher playfulness (Lee et al., 2007). The richness of the medium would enhance users' perception of its usefulness especially with the function for personalized messages using built-in camera for personalized photos which would create enjoyable experiences that will ultimately lead to users' intention to use MMS based on the empirical evidence of the indirect effect of perceived media richness on users' behavioral intention to use MMS (Lee et al., 2007).

The effect of perceived media richness has also been validated in other contexts of study such as acceptance of Web 2.0 technology (Saeed & Sinnappan, 2010) who found that perceived media richness has highly significant influence on users' intentions to use the Web 2.0 technologies and therefore suggested that the richer the medium the more the users will perceive it to be easy to use and finally use it. They also found that the relationship is the strongest in SecondLife followed by blogs and podcasts which indicates that SecondLife is a very rich medium in its capacity to offer immediate feedback, to have personal focus, to transfer multiple cues and to provide language variety. They further confirmed that synchronous media such as SecondLife are richer than asynchronous media such as blogs and podcasts (Kishi, 2008; Newberrry, 2001).

Media richness has been used as an external variable on the behavioral intention to use on-line learning (Agarwal & Prasad, 1999; Al-Gahtani & King, 1999; Davis et al., 1989; Huang, 2005; Liu et al., 2009; Seyal, Rahman & Rahim, 2002).

3.6.12 Influence of VLE Interactivity on Perceived Media Richness

In the computer mediated environment, interactivity is referred as the person-to-person or person-to-technology exchange that influences a change in the knowledge or behavior of at least one person (Chang & Wang, 2008). Person-interactivity is defined

as the interactivity between a person and a website administrator that occurs through a medium. Machine-interactivity is defined as the degree to which individuals can participate in modifying the form and content of a mediated environment in real time (Chang & Wang, 2008). Kling (1994) opined that interactive attributes such as online dialogue and search engines may reduce the time and effort needed for users to seek what they want from the Web.

Increased interactivity may contribute to time saving (Cross & Smith, 1996). It is also found that interactivity may enable effective delivery of available information by engaging users' attention, increasing their involvement and enriching their experiences (Schaffer & Hannafin, 1986; Szuprowicz, 1996). The use of hypertext systems which is a type of machine-interactivity may also bring about higher effectiveness to the users (Chen & Rada, 1996). Ghose and Dou (1998) assert that higher degree of interactivity in website may lead to higher attractiveness. Interactivity was found to have indirect effect on behavioral intention to use computer mediated environment (Chang & Wang, 2008).

From the perspective of e-learning, interactivity has been an emerging key determinant being considered under the empirical lenses and studies on e-learning interactivity have increased over the years (Rodriguez-Ardura & Meseguer-Artola, 2015). Several studies have examined the influence of interactivity on attitude and satisfaction (e.g. Grigorovici et al., 2003; Lee et al., 2011; Lyons, Reysen & Pierce, 2012) while others have evaluated the influence of interactivity on e-learning quality and effectiveness (e.g. Blasco-Arcas, Buil, Hernández-Ortega & Sese 2013; Johnson et al., 2008; Liu, Gupta & Zhang, 2006;, Lustria, 2007; Kettanurak et al., 2001; Wang, Vaughn & Liu, 2011; Young, DeSarbo & Morwitz, 1998) and e-learning outcomes

(Evans & Gibbons, 2007; Mahle, 2011; Peltier, Schibrowsky & Drago, 2007; Wessels, Fries, Horz, Scheele & Effelsberg, 2007).

E-learners' interactivity has been a critical success factor in virtual learning environments (Johnson et al., 2008; Paechter, Maier & Macher, 2010; Selim, 2007; Wang, 2003) where teaching and learning processes are mediated by digital technologies rather than face to face with instructors, university staff or classmates (Mahle, 2007; Paechter et al., 2010). Steuer (1992, p.84) defined interactivity as "the extent to which users can participate in modifying the form and content of a mediated environment in real time". Interactivity may be influential in e-learning experiences which facilitates users' flow states (Rodriguez-Ardura & Meseguer-Artola, 2015).

The positive effect of interactivity on flow has been validated in several studies (Cheng, 2011, 2013; Choi & Baek, 2011; Choi, Kim & Kim, 2007; Coursaris & Sung, 2012; Davis & Wong, 2007; Rha, Williams & Heo, 2005). This is attributed to the e-learning systems which are perceived as interactive and tend to offer greater perceived control and freedom that are envisaged as more attractive and enjoyable (Sicilia, Ruiz & Munuera, 2005). Flow was found to have positive effect on attitude which is also having positive effect on behavioral intention (Rodriguez-Ardura & Meseguer-Artola, 2015).

Interactivity in online learning has been examined in previous studies which showed that higher degrees of interactivity are linked to more positive learning outcomes (Gao & Lehman, 2003; Kettanurak et al., 2001; Sims, 2003; Swan, 2002). Rafaeli (1989) suggested that interactivity is a message exchange process and stressed the relationships between messages, the levels to which users participate and the capability of the users to

adapt the messages and exchange roles throughout the communication process (Kiousis, 2002). It is also seen as the outcome of technological integration which designates the attributes of the new media (Sun & Hsu, 2013).

The concept of interactivity has been associated with researches in business (Ghose & Dou, 1998; Ha & James, 1998; Teo et al., 2003), communication (Kiousis, 2002; Koolstra & Bos, 2009; Rafaeli, 1989), education (Chou, 2003; Liaw & Huang, 2000; Northrup, 2001; Thurmond & Wambach, 2004) and human-computer interaction (Dillon & Zhu, 1997; Preece et al., 1994). In web-based instruction, hypermedia information is integrated with well-designed Internet resources to build a learning environment that supports learning activities by means of interactive components and features such as hyperlinks, multimedia, real-time response and etc. (Khan, 1997).

Interactivity has been acknowledged as a process of information exchange between learners and both the media and the instructors with the aim of creating a better environment for learning (Chou, 2003; Thurmond & Wambach, 2004). Several studies have shown that higher interactivity levels may provide users more choice, control, feedback and positive perceptions of websites (Ghose & Dou, 1998; Kettanurak et al., 2001; Sundar et al., 2003). Kettanurak et al. (2001) found that users with higher interactivity will have more positive attitude and thus promoting their motivation to learn.

Other studies have shown that interactivity may produce better learning outcomes and learner perceptions (Evans & Gibbon, 2007; Gao & Lehman, 2003; Lustria, 2007; Northrup, 2001; Swan, 2002; Thorson & Rodgers, 2006). Positive attitudes would increase users' intention to use a computer system (Sutton, 2001) as shown by prior

studies (e.g. Johnson et al., 2008; Jung et al., 2002; Kettanurak et al., 2001; Teo et al., 2003).

From the perspective of micro-blogging service, interactivity is defined from four different angles; as a feature of technology, as a user's perception after using a technology or going through a process, as a process of message exchange and the combination of the above three entities (McMillan & Hwang, 2002). From a perception-based perspective, perceived interactivity is defined as the degree to which individuals perceive their experiences as a simulation of interpersonal interaction and sense they are in the presence of a social other (Thorson & Rodgers, 2006). Interactivity may be categorized into three types namely human-to-human, human-to-document and human-to-system interactivity (McMillan, 2000). Based on previous studies, Zhao and Lu (2012) used four constructs as the dimensions of perceived interactivity namely control, playfulness, connectedness and responsiveness. All four dimensions were found to have indirect effects on users' satisfaction and continue intention to use the micro-blogging service (Zhao & Lu, 2012).

Newhagen and Rafaeli (1996) assert that if interactivity is implemented appropriately, it is instrumental in differentiating between successful and fail websites. Ha and James (1998) opined that the quest for improvement in interactivity would guide future technological development for the web. Williams, Rice and Rogers (1988) have defined interactivity as the extent to which participants in a communication process have control over and can exchange roles in their mutual discourse. Studies have shown that user control and information exchange are two main features of interactivity (Novak & Hoffman, 1997; Bretz, 1984). Increase in interactivity may enhance satisfaction (Rafaeli, 1989), performance quality (Schaffer & Hanafin, 1986;

Szuprowicz, 1995) and time saving (Cross & Smith, 1996). Berthon, Pitt & Watson (1996) opined that interactivity level of a website is crucial in transforming site visitors from interested contacts into interactive customers. Interactivity level has been found to have significant indirect effect on users' attitude towards websites (Teo et al., 2003).

Unlike other studies, in the context of smartphone, interactivity is divided into five factors namely network quality which refers to the consumers' perception of the capability of a network to provide real-time interaction; system quality which refers to the perceived utility of the attributes of an interactive smartphone; content quality which refers to the perceived utility of digital services added to a given smartphone medium; customer support which refers to the perceived timely feedback interaction between user and the mobile service provider; and compatibility which refers to the interactivity required for the personal business and task (Kim, Chang, Park & Lee, 2015). Except for network quality, all dimensions of interactivity are significant predictors of users' satisfaction but only network quality and customer support were found to have significant effects on continuance intention to use iOS, however there was strong effect of customer satisfaction on continuance intention (Kim et al., 2015).

Similarly, higher interactivity can lead to more positive attitude toward mobile government services as a positive attitude may follow from a user's belief evaluations about mobile interactive communication due to the association of mobile communication with user's perceived interactivity of m-government services (Hung, Chang & Yu, 2006). This association has been validated in several studies (Jiang, Chan, Tan & Chua, 2010; McMillan & Hwang, 2002; Sicilia et al., 2005). In the Theory of Planned Behavior, attitudes toward behavior is found to accurately predict individual's behavioral intention (Ajzen, 1991, 2001) which is further validated in other studies on

the influence of attitudes toward intention to use new Information Systems (Bhattacherjee, 2000; Taylor & Todd, 1995). Attitude is one of the main determinants of the intention to accept mobile government services (Hung et al., 2006). This is consistent with prior studies on IS services acceptance (Bhattacherjee, 2000; Pavlou & Fygenson, 2006; Taylor & Todd, 1995).

In mobile learning; a form of learning tool that employs the mobile devices to integrate with ubiquitous computing technologies to support learning activities and delivery of learning materials (Cheng, 2015), navigation is referred as the process whereby users may explore all levels of interactivity by themselves via the content and interface screens (Tucker, 2008). Navigation was found to have positive indirect effect on behavioral intention to use mobile learning (Cheng, 2015).

In the perspective of digital media product (Kirk, 2010, 2011; Kirk & Gopalakrishna, 2011) it was found that even though the importance of the effects of interactivity have been examined in online shopping (Dholakia & Zhao, 2009; Fiore, Jin & Kim, 2005; Song & Zinkhan, 2008; Yoo et al., 2010; Yoon, Choi & Sohn, 2008), interactive advertising (Fortin & Dholakia, 2005; Sundar & Kim, 2005), mobile advertising (Choi, Hwang & McMillan, 2008) and website (Cui, Wang & Xu, 2010; Liu & Shrum, 2009; Lustria, 2007), however limited studies have examined the role of interactivity in the digital information product context.

Generally, interactivity has been viewed as having positive effects in website and electronic shopping contexts (Dholakia & Zhao, 2009; Lustria, 2007; Yadav & Varadarajan, 2005), therefore interactivity should also elicit the same positive effect on digital products. Even though interactivity is an important component of modern

computer interfaces, however its appearance in digital information products is relatively new especially in tablet computers like iPad (Kirk, Chiagouris & Gopalakrishna, 2012). Interactivity helps users to process and organize information and increases their motivation to process information (Sicilia et al., 2005).

Interactivity is also an indicator of perceived website quality as users believe it may help them accomplishing their tasks (Kim & Neihm, 2009). Interactivity has been found to influence users' intention to return to an online store (Lee, Fiore & Kim, 2006) and attitudes toward website (Liu & Shrum, 2009; Lustria, 2007; Sohn, Ci & Lee, 2007). Giving the pleasurable effects (Fiore et al., 2005; Kim et al., 2007; Kourfaris, 2002) linked to interactivity, Kirk et al. (2012) anticipated that addition of interactivity to digital information products will increase adoption intention.

From the perspective of online shopping environments, Liu and Shrum (2002) have specified three dimensions of interactivity namely active control (i.e. user's ability to voluntarily participate in and instrumentally influence a communication), two-way communication (i.e. user's ability to reciprocal communication between the company and the user) and synchronicity (i.e. the degree to which users' input into a communication and the response they receive from the communication are simultaneous. The third dimension is regarded as real-time interactivity which is referred as the extent to which users may take part in modifying the form and content of a mediated environment in real-time (Steuer, 1992).

Holzwarth, Janiszewski and Neumann (2006) assert that the use of avatar can provide more positive attitude towards the company and a greater purchase intention. Van Noort, Voorveld and van Reijmersdal (2012) further stressed that higher level of

website interactivity will increase website visitors' online flow experience which will lead to positive outcomes of concern to marketers such as favorable attitudes toward the website and the brand and increased number of product-relevant thoughts and behavioral intentions. Interactivity has been found to have significant effect on behavioral intention in online shopping environment (Etemad-Sajadi, 2016).

According to activity theory, when the students' engagement is increased, there will be improvement in learning outcomes like promoting critical thinking and problem solving skills (Liaw et al., 2007). Prior studies have shown that learner engagement is higher with multimedia instruction and interactive communication where higher interactivity may bring about better learning outcome and higher learner engagement (Northrup, 2001). In the context of Blackboard, learners have mentioned that they required more interactive and communicative functions and activities (Liaw, 2008).

In the context of commercial website, perceived interactivity is defined as the degree to which an operator engaged in a communication perceive it as reciprocal, responsive, fast and characterized by the use of non-verbal information (Chniti & Bouslama, 2015). From the perspective of Internet, non-verbal communication refers to the application of graphics, images, videos, audio, animations and paralinguistic codes to present information (Johnson, Bruner II & Kumar, 2006). Perceived interactivity increases the perceived level of control and interest (Alba, Lynch, Weitz, Janiszewski, Lutz, Sawyer & Wood, 1997; Ghose & Dou, 1998; Weiberg, Butt, Knight & Jackson, 2003). Active control of interaction is stimulated by reciprocity, rapid feedback, responsiveness and non-verbal information (Chniti & Bouslama, 2015). Commercial websites are interactive environments of consumption where visiting and shopping through these websites is an appealing experience that may lead to experiential value. Experiential

value is define as a relative, personal, situational, preference characterizing the experience of a subject interacting with an object (Holbrook, 1996, 1999).

In the online learning context, interactivity has been assumed as a central tenet as using online instructional tools will provide unique opportunities for the instructors to engage students in numerous activities and provide new dimension for interaction that is more active and of higher order (Balaji & Chakrabarti, 2011). The use of online resources will expand the opportunities for students to reflect upon their thinking skill and experience the process with other students and instructors thus providing individualized learning experience and new knowledge structures (Anderson, 2004).

The interactions in the online environment promotes a sense of community or social connectivity between the learners and the instructors and the level of connectedness will result in establishment of productive relationships among the class members and in collaborative exploration of the subject matter (Balaji & Chakrabarti, 2011). Using web-based resources will enable students to have communicative exchanges with other participants through multiple mediums and thus provide a richer communication context than a traditional lectures approach (Balaji & Chakrabarti, 2011). Dennis and Valacich (1999, p.9) opined that "choosing a single medium for any task may prove less effective than choosing a medium or set of media which the groups uses at different times performing the tasks, depending on the current communication process".

From the perspective of web navigation behavior, interactivity has been identified as one of the main advantages of the Internet (Rafaeli & Sudweeks, 1997; Morris & Ogan, 1996; Pavlik, 1996). For example, the greater the interactions between users and the Web, the more they visit a site that is important, relevant and useful because

interactivity allows them to construct the information they would like to be exposed to (Luna, Peracchio & de Juan, 2002). Hence, this will create a perception that the site's information is relevant (Ducoffe, 1996; Fortin & Dholakia, 2000) and increases the likelihood of positive attitude formation (MacInnis & Jaworski, 1989; Wu, 2000; Yoo & Stout, 2001).

The effect of interactivity in websites has been examined by Sicilia et al. (2005) from the context of web advertising. In web, navigation entails visiting a series of websites and interacting with them to search for information and/or advertising about products or consumer content or to place an order (Hoffman & Novak, 1996). Websites are based on information and communication technologies that allow rapid and easy interaction between consumers and advertisers (Coyle & Thorson, 2001; Ha & James, 1998). Similar to the Internet, the main factor of a website is its interactivity (Ghose & Dou, 1998; Macias, 2003).

Interactivity reflects the facility for individuals and organizations to communicate directly with each other regardless of time and distance (Berthon, Pittb & Watson, 1996a). Interactive systems may assist consumers to process information as they are capable of reducing and eliminating unwanted or superfluous information and organize that information in a way that facilitates the process (Widing & Talarzyk, 1993). High interactivity will lead to more intense information processing (Ariely, 2000; Cho, 1999; Coupey, 1994; Dijkstra & van Raaij, 2001; Eveland & Dunwoody, 2002; Rodgers & Thorson, 2000).

Daft and Lengel (1986) and Daft, Lengel and Trevino (1987) have suggested that different media vary in their capability to improve communication and therefore can be characterized as high or low in 'richness' according to their ability to facilitate shared meanings based on the dimensions of immediacy of feedback, language variety, multiple cues and personal focus. However, in some Computer Mediated Communications (CMC) literature, interactivity has been referred as one of the dimensions i.e. immediacy of feedback (Teeni, 2001). Furthermore, interactivity is also considered as a technical attribute of the medium by some Human-Computer-Interaction (HCI) scholars (e.g. Hoffman & Novak, 1996; Steur, 1992). Hence, it is anticipated that interactivity may influence the level of media richness.

3.6.13 Influence of Specialization, Educational Level and Teaching Experience on Behavioral Intention

The term individual differences may be interpreted as dissimilarities among people including differences in perceptions and behaviors, traits and personality characteristics and variables that connote differences attributable to circumstances like education and experience (Agarwal, 2000). Individual differences play a vital role in the implementation of any technological innovation in a wide range of research streams including Information Systems, production, and marketing (e.g. Harrison & Rainer, 1992; Majchrzak & Cotton, 1988; Zinkhan, Joachimsthaler & Kinnear, 1987). Various individual difference variables have been examined including gender, age, experience and personality (Harrison & Rainer, 1992; Taylor & Todd, 1995b; Thompson, 2001).

Teachers' characteristics such as educational level, teaching experience and subject area can influence the adoption of an innovation (Rogers, 1995; Schiller, 2003). Many studies have focused on finding the role of teachers' personal characteristics and demographics variables such as years of teaching experience, age and gender in their

ICT use in the classroom (Robinson, 2003; Bebell, Russell & O'Dwyer, 2004). Among many factors, teacher-related variables are the most powerful predictors of technology integration (Becker, 2000) as indicated by the number of studies which have produced an extensive overview of these teacher-related factors (Mumtaz, 2000; Tondeur, Hermans, Van Braak & Valcke, 2008).

Teachers' training and their subject area or specialization have substantial effect on adoption of ICT in secondary schools as based on the work of Rotumoi (2005) who found that teachers' qualification plays an imperative role in teaching because they affect instructional competence and may also determine the existence of instructional problems in specific subjects. Bauer and Kenton (2005) found that teachers who were highly educated and skilled with technology were innovative and adept at overcoming obstacles but did not integrate technology on a consistent basis due to students did not have enough time at computers and teachers needed extra planning time for technology lessons.

Rogers (1995) suggested that an individual's educational level influences his or her adoption of an innovation. It is suggested that the higher the educational level, the more familiarity an individual may have with the new technologies (Komen, 2013). The education level is an indicator of a potential adopter's capability to learn and therefore should be positively associated with beliefs (Agarwal & Prasad, 1999). Educational level has been found to have positive effects on perceived usefulness, perceived ease of use and behavioral intention toward technological innovation (Agarwal & Prasad, 1999).

Even though some studies found that teachers' experiences in teaching do not influence their use of computer technology in teaching (Niederhauser & Stoddart, 2001), however, most researches showed that teaching experience does influence the

successful use of ICT in classrooms (Giordano, 2007; Hernandez-Ramos, 2005; Wong & Li, 2008). Gorder (2008) found that teacher's experience is significantly associated with the actual use of technology. Baek, Jung and Kim (2008) asserted that experienced teachers are less ready to integrate ICT into their teaching.

Similarly, U.S. National Center for Education Statistics (Smerdon, Cronen, Lanahan, Anderson, Iannotti & Angeles, 2000) reported that teachers with less experience in teaching were more likely to integrate computers in their teaching than teachers with more experience in teaching with the reason that fresh teachers are more experienced in using the technology.

However, Lau and Sim (2008) who conducted a study on the extent of ICT adoption among 250 secondary school teachers in Malaysia found that older teachers frequently use computer technology in the classrooms more than the younger teachers with the reason that older teachers have richer experience in teaching, classroom management and also competent in the use of computers in integrating ICT into their teaching. This finding is consistent with the work of Russell, Bebll, O'Dwyer and O'Connor (2003) who found that new teachers who were highly skilled with technology more than the older teachers did not incorporate ICT in their teaching with the reasons that new teachers' focus could be on how to use ICT instead of how to incorporate ICT into their teaching and new teachers could experience some challenges in their first few years of teaching and spend most of their time in familiarizing themselves with school's curriculum and classroom management.

Nevertheless, Russell, O'Dwyer, Bebell and Tao (2007) also argued that the quality of ICT integration was associated to the years of teacher service which is contrary to the work of Granger et al. (2002) who found no relationship between teachers' teaching experience and experience in the use of ICT. Teaching experience has been found to have significant effect on behavioral intention (Cigdem & Topcu, 2015).

3.6.14 Influence of Behavioral Intention on Perceived Instructional Effectiveness

The primary difference between e-learning and conventional learning models lies in the engagement of digital technologies (Wu & Hwang, 2010). Scholars of e-learning adopt the view of technology use and consider the uniqueness of technology use in e-learning and therefore recommended that 'use' should be entailed in the e-learning framework (Davis, 1986, DeLone & McLean, 2003). Use of e-learning has been found to have direct effect on e-learning performance (Wu & Hwang, 2010).

From the perspective of constructivist theory, it is assumed that learning activities in which learners play active roles will engage and promote students' learning more effectively than learning activities where learners are passive (Liaw, 2008). Learners are assumed to learn better when they discover things by themselves and when they can control the pace of learning (Leidner & Jarvenpaa, 1995). Thus, it is anticipated that self-directed, interactive learning will improve learning outcome (Liaw, 2008).

A lot of constructivists have called for richer learning environments that are different from the typical, less interactive classroom environments which rely on textbooks, lectures and instructors (Zhang, Briggs & Nunamaker, 2006). With the help of graphics, videos and other media, learners are encouraged to engage in interactive communication, multimedia learning materials and self-directed activities in constructing knowledge.

With richer and more interactive media, a learner who favors an interactive and self-directed learning style will have more flexibility to satisfy individual needs and therefore may provide a richer media and greater variety of interactions for more effective instruction (Liaw, 2008).

In the e-learning environment, instructors and learners are separated physically and according to the activity theory, increase in students' engagement will enhance learning outcomes (Liaw et al., 2007). Northrup (2001) opined that learner engagement is higher with multimedia instruction and interactive communication where higher interactivity may bring about better learning outcome and higher learner engagement. Liaw (2008) assert that e-learning effectiveness is affected by system quality, interactive learning activities and multimedia instruction. Liaw (2008) also found that there was substantially high correlation (r = 0.70) between behavioral intention and e-learning effectiveness.

3.7 The usage of technology for educational purposes

Under the Malaysian school system, the usage of technology for educational purposes spreads across a wide spectrum. According to Umar and Hassan (2015), based on the random sample of 7320 teachers selected from primary and secondary schools in Malaysia, the usage of technology can be categorized into two categories namely pre-integration and integration. Pre-integration entails activities such as searching for teaching and learning material, preparing lesson plan and producing presentation slides whereas integration involves teaching and learning process and teaching computer skills.

On the other hand, Singh and Mohamed (2016) categorized the purposes of technology usage into five categories which include typing letters or other documents, playing computer games, preparing teaching materials, administering record safekeeping (marks, students' information etc.) and class presentations (PowerPoint, CD/DVD).

Nevertheless, Ghavifekr et al. (2016) assert that technology may be used for educational purposes in the following ways:

a) To produce a text using a word processing program
b) To communicate with other using emails
c) To capture and edit digital photos, movies or other graphics
d) To edit text online containing internet links and images
e) To create database
f) To edit a questionnaire online
g) To email a file to someone, another student or teacher
h) To organize computer files in folders and subfolders
i) To use a spread sheet
j) To use a spread sheet to plot a graph
k) To create a presentation with simple animation functions
l) To create a presentation with video or audio clips
m) To participate in a discussion forum on the Internet
n) To create and maintain blogs or websites
o) To download and install software in computer
p) To download or upload curriculum resources from/to website or learning platforms for student to use
q) To teach students how to behave safely online

r) To teach students how to behave ethically online

s) To prepare materials to for use with an interactive whiteboard

Last but not the least, Ab Hadi, Mohamad and Jaafar (2010) classified the usage of technology for educational purposes as follows:

a) To set up examination paper

b) To finish job assignment

c) To present teaching material

d) To find teaching material

e) To prepare teaching material

f) To keep confidential information

g) To solve teacher's duty

h) To use PowerPoint slide in teaching activity

i) To use computer as a teaching aid tool

j) To encourage students to use computer in learning process.

3.8 Summary of Literature Review

Table 3.3 shows the summary of the grid-based VLE related studies.

Table 3.3: Summary of grid-based VLE related studies

Author(s)	Sumak et al. (2010)	Van Raaij & Schepers (2008)	Sánchez & Hueros (2010)	Chou & Liu (2005)	Eom (2012)	Motaghian et al. (2013)	Sun & Hsu (2013)	Liaw (2008)	Shin et al. (2013)	Cobo et al. (2014)
Context of the study	Moodle	CassLearn	Moodle	Technology-mediated VLE	e-Learning Management System	Web-based Learning System	Web-based Instruction	Blackboard	3D VLE prototype	Moodle
Country	Slovenia	China	Spain	Taiwan	USA	Iran	Taiwan	Taiwan	South Korea	Spain
English back-translation	No	No	No	No	N/A	No	No	No	No	No
Sampling procedure	Convenient sample of 235 undergraduates.	Convenient sample of 40 Chinese managers.	Convenient sample of 226 undergraduates.	Convenient sample of 210 high school students.	Convenient sample of 674 undergraduates.	Cluster sampling of 115 instructors from two universities.	Convenient sample of 42 undergraduates.	Convenient sample of 424 undergraduates.	Convenience sample of 264 undergraduates.	Convenience sample of 343 undergraduates.
Model/Theory	UTAUT	TAM2, SN, PIIT & CA	TAM, technical support & perceived self-efficacy	Component Display Theory (CDT)	E-learning System Success (ELSS)	TAM, ISSM, Self-efficacy & SN	Perceived interactivity, ATT, Satisfaction & Perceived learning	Three-tier Use Model (3-TUM)	TAM, ECT	None
Type of scale	7-point Likert scale	7-point Likert scale	7-point Likert scale	5-point Likert scale	7-point Likert scale	7-point Likert scale	5-point Likert scale	7-point Likert scale	7-point Likert scale	N/A (only data on students' interactivity)
Expert Panel review (Face Validity)	No	No	Yes	No	No	No	Yes	No	Yes	N/A

Table 3.2 continued

Author(s)	Sumak et al. (2010)	Van Raaij & Schepers (2008)	Sánchez & Hueros (2010)	Chou & Liu (2005)	Eom (2012)	Motaghian et al. (2013)	Sun & Hsu (2013)	Liaw (2008)	Shin et al. (2013)	Cobo et al. (2014)
Content Validity Index (CVI)	No	No	No	No	No	No	No	No	No	N/A
Q-sort (Cohen's Kappa) & Hit ratio	No	No	No	No	No	No	No	No	No	N/A
Instrument Validation (Pre-test & Pilot test)	Pre-test, Pilot test	Pilot test	Pre-test	Pre-test	No validation. All items were adopted from published studies.	No validation. All items were adapted from validated studies.	Pilot test	No validation. All items were adopted from Wang & Wang (2009)	Pretest, Pilot test,	N/A
Number of instruments	Single instrument	Single instrument	Single instrument	Single instrument	Single instrument	Single instrument	Single instrument	Single instrument	Single instrument	N/A
CMB test	No	No	No	No	No	No	No	No	No	N/A
Non-Response Bias test	No	No	No	No	No	No	No	No	No	N/A
Normality test	No	No	No	Yes	No	No	No	No	No	N/A
Linearity test	No	No	No	No	No	No	No	No	No	N/A
Multicollinearity test	No	No	No	No	No	No	No	No	Yes	N/A
Homoscedasticity test	No	No	No	Yes	No	No	No	No	No	N/A

Table 3.2 continued

Author(s)	Sumak et al. (2010)	Van Raaij & Schepers (2008)	Sánchez & Hueros (2010)	Chou & Liu (2005)	Eom (2012)	Motaghian et al. (2013)	Sun & Hsu (2013)	Liaw (2008)	Shin et al. (2013)	Cobo et al. (2014)
Statistical analyses	SEM	SEM	SEM	Factor analysis, independent samples t-test, paired t-test	SEM	SEM	One-way ANOVA and ANCOVA	Stepwise multiple regression	SEM	Analytical Hierarchy Process (AHP) & Data Mining (DM)
Key Findings	PE and SI affect ATT. SI and ATT affect BI. BI and FC affect AU. R^2 is not stated.	PIIT affects PEOU and CA. CA affects PEOU. PU is affected by PEOU and SN. AU is influenced by PU and PEOU. R^2 for AU is 31%, PU 54%, PEOU 59% and PIIT 10%.	Technical support affects PEOU and PU. PEOU and ATT affect AU. The R^2 for PU, ATT and AU are 54%, 77% and 41%.	Students in TVLE showed improved learning performance, greater levels of computer self-efficacy, satisfaction and learning climate.	Self-efficacy affects AU. SQ and InfQ affect user satisfaction. User satisfaction affects system effectiveness. R^2 for AU is 50.9%, user satisfaction 75.4% and system effectiveness 82.1%.	InfQ and SN affect PU. InfQ, SerQ, SN and Self-efficacy affect PEOU. BI is affected by PU, PEOU and SQ. BI directly affects AU. The R^2 for BI is 53% and AU 16%.	Perceived interactivity affects ATT and Satisfaction.	Perceived self-efficacy, multimedia instruction and SQ affect Satisfaction (R^2= 0.613). PU and Perceived satisfaction affect BI (R^2= 0.619). Multimedia instruction, interactive learning activities and SQ affect Learning effectiveness (R^2 = 0.681).	Satisfaction and Experience influence intention, Confirmation affects satisfaction, PU, PEOU. Immersion, flow and presence influence Confirmation,	Behavioral patterns in LMS give certain indicators as to students' academic performance.

Note: N/A=Not Applicable, FC=Facilitating Conditions, PEOU=Perceive Ease of Use, SI=Social Influence, PU=Perceived Usefulness, SN=Subjective Norm, InfQ=Information Quality, ServQ=Service Quality, SQ=System Quality, ATT=Attitude, CA=Computer Anxiety; BI=Behavioral Intention, AU=Actual Use, LMS=Learning Management System, CMB=Common Method Bias, IVs=Independent variables, DVs=Dependent variables

3.9 Construct Analysis

The construct analysis is shown in Table 3.4.

Table 3.4: Construct Analysis

Relationship	**Author(s)**									
	Sumak et al. (2010)	Van Raaij & Schepers (2008)	Sánchez & Hueros (2010)	Chou & Liu (2005)*	Eom (2012)	Motaghian et al. (2013)	Sun & Hsu (2013)*	Liaw (2008)	Shin et al. (2013)	Cobo et al. (2014)*
PIIT → ANX		-								
EE → AT	**ns**									
PE → AT	+									
PEOU → AT			+							
PU → AT			+							
SI → AT	+									
TS → AT			**ns**							
AT → BI	**ns**									
EE → BI	**ns**									
EXP → BI									+	
IQ → BI						**ns**				
PE → BI	**ns**									
PEOU → BI						+				
PU → BI						+		+		
SAT → BI								+	+	
SE → BI						**ns**				

Table 3.3 continued

Relationship	Author(s)									
	Sumak et al. (2010)	Van Raaij & Schepers (2008)	Sánchez & Hueros (2010)	Chou & Liu (2005)*	Eom (2012)	Motaghian et al. (2013)	Sun & Hsu (2013)*	Liaw (2008)	Shin et al. (2013)	Cobo et al. (2014)*
SerQ → BI						**ns**				
SI → BI	+									
SN → BI						**ns**				
SQ → BI						+				
Flow → CFM									+	
IMS → CFM									+	
PU → CFM									+	
PEOU → CFM									+	
PRS → CFM									+	
ILA → ELE								+		
MI → ELE								+		
SQ → ELE								+		
ANX → PEOU		-								
CFM → PEOU									+	
IQ → PEOU						+				
PIIT → PEOU		+								
SE → PEOU						+				
SerQ → PEOU						+				
SN → PEOU						+				
SQ → PEOU						**ns**				

Table 3.3 continued

Relationship			Author(s)									
			Sumak et al. (2010)	Van Raaij & Schepers (2008)	Sánchez & Hueros (2010)	Chou & Liu (2005)*	Eom (2012)	Motaghian et al. (2013)	Sun & Hsu (2013)*	Liaw (2008)	Shin et al. (2013)	Cobo et al. (2014)*
TS	→	**PEOU**			+							
CFM	→	**PU**									+	
ILA	→	**PU**								+		
IQ	→	**PU**						+				
MI	→	**PU**								+		
PEOU	→	**PU**		+	+			**ns**				
PIIT	→	**PU**		**ns**								
SE	→	**PU**						**ns**		+		
ServQ	→	**PU**						**ns**				
SN	→	**PU**		+				+				
SQ	→	**PU**						**ns**		+		
TS	→	**PU**			+							
CFM	→	**SAT**									+	
InfQ	→	**SAT**					+					
MI	→	**SAT**								+		
SE	→	**SAT**					**ns**			+		
SML	→	**SAT**					**ns**					
SQ	→	**SAT**					+			+		
SAT	→	**SEF**					+					

Table 3.3 continued

Relationship			Author(s)									
			Sumak et al. (2010)	Van Raaij & Schepers (2008)	Sánchez & Hueros (2010)	Chou & Liu (2005)*	Eom (2012)	Motaghian et al. (2013)	Sun & Hsu (2013)*	Liaw (2008)	Shin et al. (2013)	Cobo et al. (2014)*
U	→	**SEF**					**ns**					
AT	→	**U**			+							
BI	→	**U**	+					+				
FC	→	**U**	+									
IQ	→	**U**					**ns**					
PEOU	→	**U**		**ns**	+							
PU	→	**U**		+	**ns**							
SAT	→	**U**					**ns**					
SE	→	**U**					+					
SML	→	**U**					**ns**					
SN	→	**U**		**ns**								
SQ	→	**U**					**ns**					

Note: + indicates significant positive relationship; - indicates significant negative relationship; ns = not significant; * indicate no causal relationships, CFM=Confirmation, PIIT=Personal Innovativeness in IT; ANX=Anxiety; PE=Performance Expectancy, EE=Effort Expectancy, EXP= Experience, SI=Social Influence, AT=Attitude, IMS=Immersion, PU=Perceived Usefulness, PEOU=Perceive Ease of Use, PRS=Presence, SN=Subjective Norm, SE=Self Efficacy, SQ=System Quality, InfQ=Information Quality; ServQ=Service Quality; SE=Self Efficacy; SML=Self-Managed Learning; SAT=Satisfaction; SEF=System Effectiveness; TS=Technical Support; MI=Multimedia Instruction; ILA=Interactive Learning Activities; ELE=E-Learning Effectiveness; U=Use; * indicates no causal relationships were examined.

3.10 Chapter summary

This chapter has presented the literature review on the previous studies related to VLE. In addition to that, the chapter has also explained in detail the theoretical underpinnings of Self Determination Theory and Channel Expansion Theory. Then, the variables in this study were elucidated together with the relationships between these variables. These included the independent variables of perceived relatedness, perceived competence, perceived autonomy, school support, content design and interactivity; the mediating variables which include attitude toward knowledge sharing, perceived media richness and trust in website as well as the dependent variables of VLE behavioral intention and instructional effectiveness. Then, the summary of the literature review and construct analysis were presented.

The next chapter will elaborate on the research methodology used in this study.

CHAPTER 4: METHODOLOGY

4.1 Introduction

This chapter explains the research methodology adopted in the study. The following subsections will provide more details on the methodology being used.

4.2 Research model development

CET has been examined in mobile instant messaging (Ogara, Koh & Prybutok, 2014) and evolution of online discussion forum (Fernandez et al., 2013) but not in the context of VLE. Conversely, SDT has been examined as the indirect predictors of undergraduate online learner motivation (Chen & Jang, 2010) and university college teachers' e-learning continuance intention (Roca & Gagné, 2008); however its role as direct predictors of intention to use VLE from the perspective of school teachers' remains uninvestigated. UTAUT has been studied in undergraduates' intention to use Moodle (Sumak et al., 2010) and part time undergraduates' continuance intention to use web based learning (Chiu & Wang, 2008) but it has not been examined from the perspective of school teachers' intention to use VLE. Similarly, School Support (Lai & Chen, 2011), Content Design (Lee et al., 2009) and Interactivity (Chen, Chen & Kazman, 2007) have been studied from the context of teaching blogs, e-learning and e-CRM correspondingly. The effects of these constructs from the VLE context has not been examined. Thus, these theories and constructs are included in developing the research model.

In this study, the variables of perceived competence, relatedness and autonomy are extracted from SDT whereas perceived media richness is extracted from CET. The variable of attitude towards knowledge sharing is drawn from knowledge management

literature while trust in website is drawn from the trust literature. The variables of VLE interactivity and content design is based on the VLE context specific attributes. The variable of school support is related to IDT while behavioral intention is drawn from UTAUT. Finally, the variable of perceived instructional effectiveness is drawn from VLE literature.

4.3 Hypotheses development

4.3.1 Perceived relatedness and attitude toward knowledge sharing

Perceived relatedness may be referred as the sense of identification and connectedness an individual feels with others. Based on SDT, individuals are more inclined to support their groups' goals when they are connected to members of the group. Once the individuals are in an autonomy-supportive setting, they will possess a sense of connectedness that will boost their motivation (Yoon & Rolland, 2012). This sense of identification and connectedness will positively affect knowledge sharing behaviors (Shen et al., 2010). Furthermore, Bock and Kim (2002) opined that expectation to enhance work relationships (i.e. perceived relatedness) and to contribute to the organizational performance were positively associated to attitude towards knowledge sharing, behavioral intention and behavior. Likewise, Chiu et al. (2006) suggest that individuals' perception of social togetherness and unity of the community may enhance their activeness in knowledge sharing and increase the breadth and depth of shared knowledge. Cho et al. (2010) further stressed that when individuals possess strong attachment to or social bonding with other members of the community, they have tendency to share knowledge would increase. In the context of electronic database, the sense of belonging was found to promote cooperation in information sharing (Kalman et al., 2002). Hence, the perception of togetherness will drive an individual's activeness to share knowledge and therefore the researcher suggests the following hypothesis:

H1a: Perceived relatedness has positive influence on attitude toward knowledge sharing.

4.3.2 Perceived relatedness and behavioral intention

The need for relatedness for teachers who manage learners' adoption of e-learning indicates the longing to get connected with and supported by individuals in the social environments (Sørebø et al., 2009). Fulfilling the desire for support and connectedness within a social perspective will influence the degree of motivation (Deci & Ryan, 1985). The indirect effect of perceived relatedness on BI has been validated by Sørebø et al., (2009), Roca and Gagne (2008). Following SDT, individuals tend to support their group's objectives more when they are connected with other members. Deci and Ryan (2000) opined that when actions are not naturally enjoyable or appealing, the essential rationale why they execute them is due to the appreciation by significant others (i.e. colleagues, friends or family) to whom they feel connected.

SDT also proposed that individuals' perceived relatedness is vital in understanding the internalization of extrinsic motivation. Hence, individuals are more likely to be motivated by endorsing community goals if they have the sense of connectedness with others (Ryan & Deci, 2000a). If behaviors are not innately interesting, individuals' main reason to perform such behaviors willingly is due to the behaviors being valued by significant others to whom they feel connected. Perceived relatedness has been found to have significant relationship with introjected, identified and external motivations in health (Gourlan et al., 2013) and education (Koh et al., 2010). Furthermore, perceived relatedness has been found to have significant effect on continuance intention in e-learning (Deci & Ryan, 2000), intention to participate in self-governance in social-technical communities (Zhang et al., 2012) and virtual communities (Tsai & Pai, 2014).

Perceived relatedness also has indirect effect on behavioral intention to use Qboard (Lee et al., 2015).

In the context of cloud-based Frog VLE which allows sharing of knowledge and information in a converged network, the researcher argues that teachers perceived relatedness with significant others may predict their use behavior. For example, by getting connected in the Frog community, teachers may build new relationships and get connected with other counterparts across the nation in sharing their instruction resources and ideas. Hence, their needs for relatedness are fulfilled. In this study, the researcher defined perceived relatedness as the extent to which teachers believe that they may create and maintain connections with others by using the Frog VLE. It is anticipated that the degree of perceived relatedness will positively affect the degree of intention to use VLE. Hence, the hypothesis is constructed as follows:

H1b: Perceived relatedness positive influences behavioral intention to use VLE.

4.3.3 Attitude toward knowledge sharing and behavioral intention

The Frog VLE is a cloud-based instructional platform which supports collaborative instruction methods (Thorsteinsson et al., 2010). For example, teachers may collaborate through the Forum and Community applications to share their creative ideas and instructional experiences. Since "personal attitudes towards behavior are significant antecedents of intention to engage in that behavior hence an individual's behavioral intention to share knowledge may be determined by the attitude towards knowledge sharing" (Chow & Chan, 2008, p. 460). A positive attitude may increase the positive intention of knowledge sharing that will lead to actual behaviors (Chen et al., 2009; Kwok & Gao, 2005). Individuals who possess positive feelings about knowledge sharing are more likely to involve themselves in sharing of knowledge (Ibragimova et

al., 2012). Attitude towards knowledge sharing has been found to have indirect effects on behavioral intention to use course blogs (Cheng & Chen, 2011), website (Lin & Lu, 2000), virtual community of practice (Gang & Ravinchandran, 2011) and electronic knowledge repository (Hung et al., 2011). Hence, it may be theorized that when the level of teachers' attitude towards knowledge sharing is high, their behavioral intention will also increase. Thus the researcher hypothesize that:

H1c: Attitude towards knowledge sharing positively influences behavioral intention to use VLE.

4.3.4 Perceived autonomy and behavioral intention

Gagné and Deci (2005) opine that autonomy affects the level of intrinsic motivation as it stimulates integration and internalization of extrinsic motivation that can bring about authentic intrinsic motivation. Moreover, Sørebø et al., (2009), Roca and Gagne (2008) found that there is indirect effect of perceived autonomy on behavioral intention. In the context of mobile-based assessment, Nikou and Economides (2014) also found significant indirect effect of perceived autonomy on users' behavioral intention. Zhang et al. (2015) also found that perceived autonomy indirectly influenced behavioral intention to evaluate online content. Likewise, the indirect effects were also found in the context of Q-board acceptance (Lee et al., 2015) and ICT continuance (Ho, 2010).

Gagne´ et al. (2000) found that management autonomy support directly affects acceptance of organizational changes. A need of autonomy indicates a desire to self-regulate teachers' engagement in using VLE (Sørebø et al., 2009). It is anticipated that autonomy will affect the level of intrinsic motivation as it stimulates integration and internalization of extrinsic motivation that will bring about authentic intrinsic motivation (Gagné & Deci, 2005).

The researcher adapted the definition of Zhang et al. (2015) and defined perceived autonomy as the extent to which teachers believe that they are capable of making their own choices pertaining to their use behaviors in Frog VLE. Basically, the use for Frog VLE is a voluntary act whereby teachers will have the freedom to do an activity on their own free will without any pressure from any one and therefore fulfilling their autonomy need. Therefore, the researcher argues that the perceptions of perceived autonomy may predict the propensity in Frog VLE use behavior. It is therefore hypothesized that when teachers perceive that they have the autonomy in using VLE, their intention to use VLE will also increase. Based on these justifications, the researcher would like to propose the subsequent hypothesis:

H2: Perceived autonomy has positive influence on intention to use VLE.

4.3.5 Perceived competence and behavioral intention

Sørebø et al., (2009) also assert that instructors will feel more qualified to manage learners' adoption of e-learning if the need for e-learning competence is satisfied. Roca and Gagné (2008) found that perceived competence has significant indirect effect on behavioral intention. The effect of perceived competence has been validated in a variety of contexts such as web-based systems (Yi & Hwang, 2003), virtual communities (Tsai & Pai, 2014), self-service technologies adoption (Dabholkar & Bagozzi, 2002), continuance of e-learning (Sørebø et al., 2009) and continuance of self-service technologies (Wang et al., 2013). It is presumed that the level of perceived competence will affect the teachers' level of confirmation (Sørebø et al., 2009).

Ryan and Deci (2000) believed that individuals' perceived competence may facilitate the internalization of extrinsic motivation based on the rational that to transform an extrinsic goal into individuals' own, the individuals need to feel competent with regards to the understanding of the goal (Ryan & Deci 2000). A high degree of competence may lead to high internalized motivation (e.g. identified motivation) while lower degree may bring about introjected motivation and if the individuals feel competent enough to comply with external threats or rewards, external motivation may exist (Ryan & Deci 2000a). Wang and Clay (2012) opined that perceived competence may make individuals feel that their involvements are essential in realizing the community value of being a resourceful place. Besides that, when teachers choose to use the Frog VLE they need to apply their knowledge and skill therefore triggering the feeling of competence. For example, teachers need to know how to create departmental sites, post assignment, mark students work, send email attachments, upload files, share sites, save documents in Google drive and etc. Hence, the researcher argues that perceived competence may predict the use behavior of Frog VLE among teachers. In this study, perceived competence is defined as the degree to which teachers believe that using the Frog VLE offers them the opportunities to show their abilities in carrying out the instructional activities. The researcher expects that VLE competence will make teachers more effective in using VLE and increase teachers' behavioral intention. Therefore, the hypothesis is suggested as follows:

H3a: Perceived competence has positive influence on behavioral intention to use VLE.

4.3.6 Perceived competence and trust in website

Perceived competence in Frog VLE encompasses teachers' capabilities in using the VLE platform to carry out various instructional activities. Moreover, these competencies will allow them to understand the contents and operations of the VLE system. It is with this understanding comes the trust and confidence to use the system. The researcher anticipates that a teacher with low perceived competency will have less confidence and trust on the VLE compared to a teacher that have high level of perceived competency. Perceived competence was found to have significant effect on trust in online shopping (Chen & Dillon, 2003;, Cheung & Lee, 2000, 2003; Mayer et al., 1995; Sadi & Al-Khalifah, 2012; Zahara & Harris, 2015), corporate brand (Sichtmann, 2007), Internet vendors (Cheung & Lee, 2001) and food suppliers (Selnes, 1998). Furthermore, self-efficacy (i.e. similar to perceived competence) was found to have significant influence on trust perception in Internet banking (Song & Wang, 2010) and e-commerce (Dash & Saji, 2008; Kim & Kim, 2005; Yao & Li, 2009). Hence, the researcher comes up with the subsequent hypothesis:

H3b: Perceived competency positively influences trust in website.

4.3.7 Trust in website and behavioral intention

Hsu et al. (2011) proposed that online trust may be classified into two groups based on the nature of trust namely, interpersonal trust and system trust. Interpersonal trust is "the belief resulting from the feeling of secure for other parties in the social exchange while the system trust is the belief resulting from the reliability and reliance of an information system" (Hsu et al., 2014, p. 237). The effect of trust as a determinant of behavioral intention to IS use has been validated in several studies (Agag & El-Masry, 2016; Carter & Belanger, 2005; Chiu et al., 2010; Hsieh, 2015; Jarvenpaa et al., 1999; Kim et al., 2012; Lee et al., 2015; Lin & Wang, 2006; Luo et al., 2010, Ponte et al.,

2015; Suh & Han, 2003). It is understood that the more the teachers perceive that the VLE system is trustable, the more probable the intention for them to use the system. Hence, the hypothesis is established as follows:

H3c: Trust in website has positive influence on behavioral intention.

4.3.8 School support and behavioral intention

School support is defined as the extent to which a teacher perceives that schools are dedicated to successful implementation and use of VLE (Venkatesh & Bala, 2008). Huang et al. (2009) assert that earlier studies have shown that management support is vital in the acceptance of technology innovation assistance as the required resources can be attained effortlessly. If top management is supportive of Information Systems (IS), more resources are anticipated to be provided to develop and support the IS (Yap, 1989) and hence enhancing the facilitating conditions for the IS (Thong et al., 1996). Franklin (2007) found that when teachers are encouraged by school authorities to use a web-based learning system, their behavioral intention to use the system will increase. A number of studies have found that K-12 school principals may influence the level of technology integration in the school curriculum (Dawson & Rakes, 2003; Granger et al., 2002). Jasperson et al. (2005) opined that top management can stimulate and influence employees to use a system. Moreover, studies have shown that organizational support has positive effect on employees' technology acceptance and use behavior (Igbaria & Parasuraman, 1989; Lee et al., 2005, 2011; Mahmood et al., 2001). Similarly, past studies also showed that institutional support has significant influence on technological acceptance (Park et al., 2014; Taylor & Todd, 1995a; Thompson, 2001; Venkatesh, 2000; Venkatesh & Davis, 2000). Besides that managerial support was found to have direct effect on technology acceptance (Abdekhoda et al., 2015; Chiaburu & Tekleab, 2005; Lewis et al., 2003; Tharenou, 2001). Hence, it is theorized that when the

management of the school strongly supports teachers to use VLE, this will increase the level of facilitation for teachers to use the VLE system. Therefore, the following hypothesis is formulated:

H4: School support positively influences behavioral intention to use VLE.

4.3.9 VLE content design and perceived media richness

Pedagogical design has been found to have significant influence on acceptance of e-learning (Martinez et al., 2007). This is further verified by Lederer et al. (2000) who found that learners are more likely to perceive that using e-learning is easy if the services are provided with plentiful of contents. To enrich the VLE content design, a lot of photos, pictures, graphics, videos, animations, sound and other means of instructional media can be incorporated into the establishment of departmental sites in the Frog VLE. Given the media richness of these contents, the researcher forecasts that the extent of perceived media richness will also be increased accordingly. Thus, the next hypothesis is developed as:

H5a: VLE content design has positive influence on perceived media richness.

4.3.10 VLE content design and behavioral intention

Lee et al. (2009) opined that users are more likely to perceive that using e-learning services is easy when e-learning services are equipped with plentiful contents custom-made to fulfill their needs. The indirect effects of content design on behavioral intention have been corroborated by Lee et al. (2009). Furthermore, Hong et al. (2002) also found that screen design has positive indirect effect on intention to use digital libraries. Moreover, Mao and Hu (2013) found that resource appropriateness has significant effect on behavioral intention to use multimedia instructional resources.

In the context of YouTube, Lee and Lehto (2013) found that perceived content has significant influence on behavioral intention. It is theorized that when teachers perceive the content design is suitable and inclusive, the intention to use VLE will be higher. Conversely, teachers may be unwilling to use VLE if the system is incapable of providing inclusive and sufficient content in accordance with the national curriculum. Hence, the hypothesis is suggested as follows:

H5b: VLE content design positively influences behavioral intention.

4.3.11 Perceived media richness and behavioral intention

Dennis and Kinney (1998) assert that richer media may enable users to communicate faster and to better understand ambiguous or equivocal messages and therefore would result in better performance. Besides that, Saeed et al. (2010) opined that perceived media richness has direct effect on attitude and attitude has direct effect on intention to use blog/podcast. Saeed et al. (2008) however found that perceived media richness influences perceived usefulness while perceived usefulness directly influences intention to use Second Life. Furthermore, Saeed and Sinnappan (2010) have verified the effect of perceived media richness on behavioral intention of podcast, blog and Second Life. Since media richness is defined as the capacity of carrying information of a medium or its capability to facilitate understanding and shared meaning (Daft & Lengel, 1983), it is assumed that media richness positively influences user's intention to use a technology. Therefore, it is hypothesized that when users perceived VLE to be rich with diversity of media such as text, graphic, audio, video, animation and etc., the intention to use VLE will be intensified.

The multi-media environment tends to entice learners' attention more easily compared to the traditional chalk-and-talk instructional approach. The richer the media, the greater the degree of satisfaction among learners (Otondo et al., 2008) and the higher the media richness, the better the communication can be carried out with less ambiguity thus leading to higher playfulness (Lee et al., 2007). Perceived media richness has been found to have significant influence on behavioral intention to use Web 2.0 technologies (Saeed & Sinnappan, 2010) and on-line learning (Agarwal & Prasad, 1999; Al-Gahtani & King, 1999; Davis et al., 1989; Huang, 2005; Liu et al., 2009; Seyal et al., 2002). Hence, teachers may perceived that utilizing a media rich platform may create a more interesting and conducive environment for learning. Therefore, the researcher would like to posit the next hypothesis as:

H5c: Perceived media richness has influence on behavioral intention to use VLE.

4.3.12 VLE interactivity and perceived media richness

The Frog VLE comes with a media rich interface that enables easy interaction between the teachers and the Frog OS. Teachers will be able to capture videos, animations, pictures, sound and etc. from the cloud and engage various media channels to disseminate the knowledge to the students. In addition, interactivity facilitates the collection of considerable amount of information (Richard & Chandra, 2005) which improves the hedonic and utility values of the system (Chniti & Bouslama, 2015). Kling (1994) assert that interactive attributes like online dialogue and search engines may reduce the time and effort required to find what users want. The increase in interactivity will lead to time saving (Cross & Smith, 1996).

Interactivity may also allow effective delivery of information by engaging users' attention, increasing their engagement and enriching their experiences (Schaffer & Hannafin, 1985; Szuprowicz, 1996). Higher degree of interactivity may lead to higher degree of attractiveness (Ghose & Dou, 1998). Studies (e.g. Ghose & Dou, 1998; Kettanurak et al., 2001; Sundar et al., 2003) have shown that higher interactivity levels will provide users with more control, options, feedback and positive perceptions on websites. With the usage of web-based resources, it will enable communicative exchanges in multiple mediums and therefore provide a richer communication context than traditional lectures approach (Balaji & Chakrabarti, 2011). Hence, it is expected that when interaction between teachers and the VLE increases, the sense of media richness will also increases as a result of the experiences gained in using the numerous media. Hence, the researcher would recommend the hypothesis as:

H6: Interactivity has positive influence on perceived media richness.

4.4 Influence of control variables

Control variables are variables with weak theoretical foundations but are anticipated to have confounding effects to the dependent variable. In the next subsequent sections, further explanations are given about these control variables.

4.4.1 Specialization

Teacher's subject area or specialization has important effect on adoption of ICT in schools based on the findings by Rotumoi (2005) who argued that specialization has influence on instructional competence and may determine the existence of instructional problems in specific subjects. Since VLE requires some computer and IT skills, teachers with specialization related to these skills may have higher intention to use VLE

in comparison to other non-computer or non-IT specialized teachers. Therefore, it is theorized that specialization will have some confounding effect on behavioral intention.

4.4.2 Teaching experience

User experience has been found to have a positive influence on system usage (DeLone, 1988). Many studies have found that teaching experience have influence on the use of ICT in classrooms (Giordano, 2007; Hernandez-Ramos, 2005; Wong & Li, 2008). Teachers' experiences are associated to the actual use of technology (Gorder, 2008). Baek et al. (2008) found that experienced teachers are less ready to integrate ICT into their teaching. Russell et al. (2007) found that the quality of ICT integration is linked to the years of teaching experience. Hence, it is assumed that teaching experience will have some confounding effect on behavioral intention.

4.4.3 Educational level

Individual differences are assumed to be most pertinent to both IS success (Harrison & Rainer Jr., 1992) and human-computer interaction studies (Dillon & Watson, 1996). Rogers (1995) asserts that individuals' educational levels influence their adoption of innovation. Leong et al. (2011) found that there is indirect effect of academic qualification on behavioral intention. Educational level has been found to have direct effect on behavioral intention toward technological innovation (Agarwal & Prasad, 1999). Hence, it is theorized that educational level will have some confounding effect on behavioural intention.

4.5 Relationship between behavioral intention and perceived instructional effectiveness

Behavioural intention is considered to be an immediate antecedent of usage behaviour and give indication about an individuals' readiness to perform a specific behaviour (Šumak et al., 2011). Although the effect of behavioural intention on effectiveness of e-learning has been studied from the context of the employees of financial services companies (Cheng, 2011) and university students (Liaw, 2008), however, there has been scarcity in the number of studies conducted on the effects of behavioural intention on perceived instructional effectiveness from the school teachers' perspective. Nevertheless, since the school environment is different from those of the universities and financial service companies, the expected influence behavioural intention on instructional effectiveness in the context of school requires further investigation. It is believed that when teachers are inclined to adopt the VLE system, they may perceive that their objectives can be accomplished more easily based on the justification that the VLE is a media-rich system which can capture students attention more easily in comparison to the traditional "chalk and talk" method.

Furthermore, teachers may have a selection of tools such as interactive web pages, forum, animation, online quiz and etc. that can further improve their teaching effectiveness. With more interactive and richer media, teachers will have more flexibility to satisfy their needs and therefore may lead to greater interaction and richer media for effective instruction (Liaw, 2008). Northrup (2001) also argued that user's engagement is higher with multimedia instruction and interactive communication where higher interactivity will lead to better learning outcomes and higher engagement. Liaw (2008) found that there is substantially high correlation between behavioural intention and e-learning effectiveness. Therefore, in this research, it is hypothesized that the

increase in behavioural intention will lead to intensification of perceived instructional effectiveness. With these justifications, the subsequent hypothesis is proposed:

H7: Behavioral intention has positive influence on perceived instructional effectiveness of VLE.

4.6 Research model

Based on the above hypothesis development, the following research model (Figure 4.1) was developed.

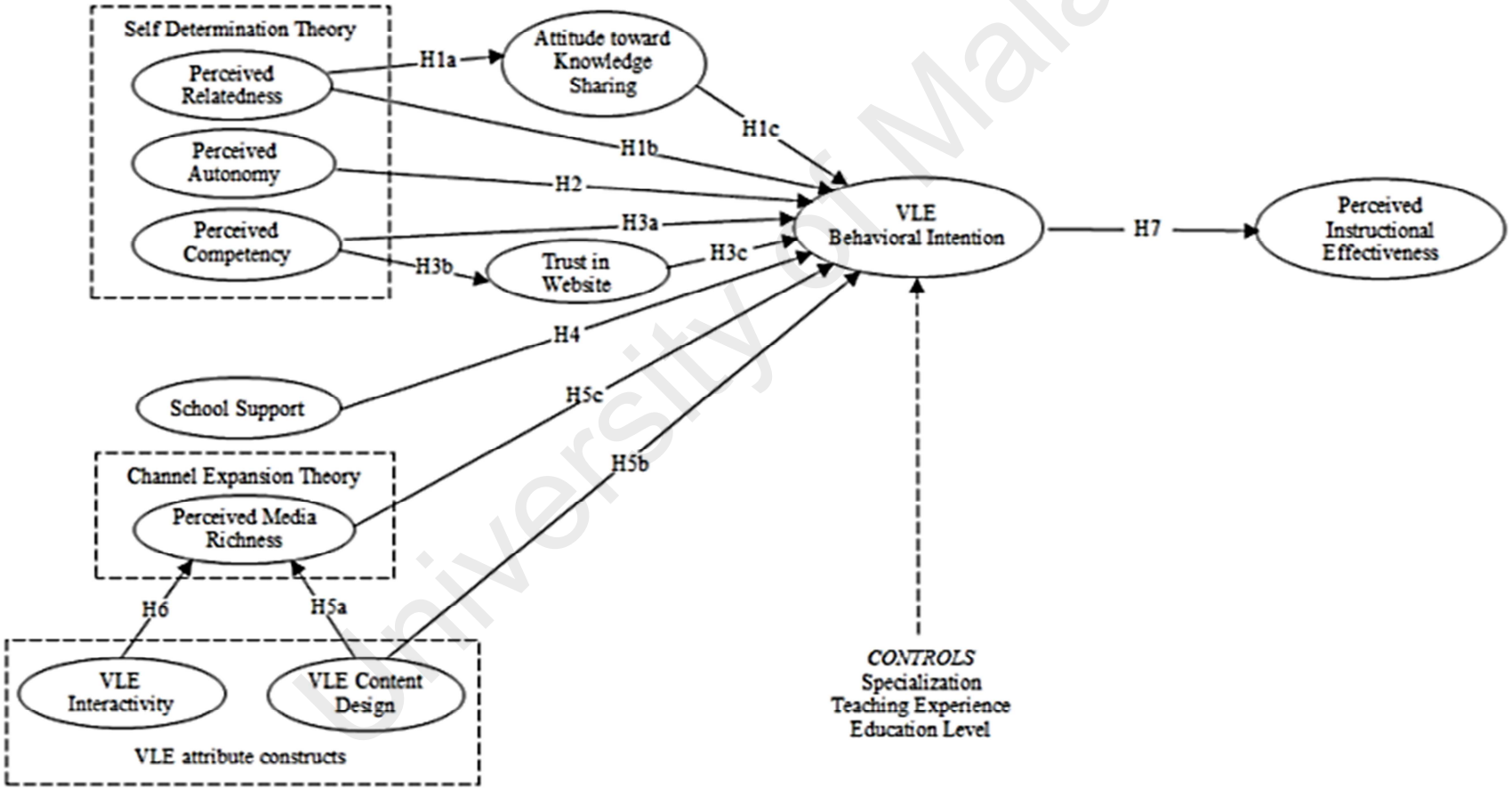


Figure 4.1: Research model

4.7 Research paradigms

Research paradigm is the philosophies and beliefs that serve as a roadmap of how the research is to be conducted (Ticehurst & Veal, 2000). It may be assumed as a set of assumptions that the investigation commences with (Deshpande, 1983). It also signifies a group of individuals' opinions that defines the original thoughts about how the phenomenon occurs. Paradigms on the other hand reflect what practitioners think is reasonable, imperative and legitimate and they generate a set of standards to guide what should be carried out (Patton, 1990). Hence, paradigms determine what problems are worth studying and what methods are used to find the answer (Deshpande, 1983).

Basically, there are three main justifications for the need to understanding the importances of these kinds of philosophical issues. It not only embroils decisions on what type of proof is required and how it is to be understood, but also how this will offer substantial answers to the list of queries being studies. Secondly, the relevant knowledge may assist researcher to comprehend which design is the best of all. This would allow the researcher to evade common problems. Finally, it may also assist researcher to develop a design that may go beyond and above his or her prior experience.

Generally, there are several forms of paradigms to guide the progress of the research. For instance, inquiries may be divided into quantitative and qualitative paradigms (Bonoma, 1985). However, Guba and Lincoln (1994) divided various kinds of paradigms recommended by other scholars into four categories, namely realism, positivism, constructivism and critical theory. Among the elements of paradigm is ontology. Ontology refers to the question of whether social entities can and should be considered objective entities that have a reality external to social constructions built up from the perceptions and actions of social actors (Cooper & Schnindler, 2003). Another

element of paradigm is epistemology. Epistemology refers to the acceptable knowledge in a discipline, whether social world can and should be studied according to the same principles, procedures, and ethos (Cooper & Schnindler, 2003). Table 4.1 shows the differences between these four types of paradigms.

Table 4.1: Research paradigms

Paradigm element	Positivism	Realism	Critical theory	Constructivism
Ontology	"Real reality" but apprehensive	Critical realism – "real" reality but only imperfectly and probabilistically	Historic realism - virtual reality shaped by social, political, cultural, economic, ethnic and gender values.	Relativism - local and specific constructed realities
Epistemology	Dualist/objectivist; findings true	Modified dualist/ objectivist; critical tradition/ community findings probably true	Transactional/ subjectivist; value-mediated findings	Transactional/ subjectivist; created findings
Common Methodology		Experiment/ manipulation; critical multiplism; hypothesis falsification; qualitative methods; case studies/ convergent interviewing	Dialogic/ dialectical; "transformative intellectual"; action research/ focus groups	Hermeneutical/ dialectical; "passionate participant"; consensus/ dialogue

Source: Perry, Riege & Brown (1999, p.17), based on Guba & Lincoln (1994).

According to Hussey and Hussey (1997), the positivist paradigm is grounded on the approach applied in the natural and social science. Positivism advocates the applications of the natural sciences' methods to study social reality and beyond (Bryman & Bell, 2015). Positivists explore the world from the unidirectional perspective (Guba & Lincoln, 1994). They repudiate that their presence will influence the phenomenon. In a nutshell, the positivist paradigm is grounded on the assumptions that the world is an observable reality and the theoretical propositions about this reality may be established and verified (Guba & Lincoln, 1994). Hence, logical questioning is deployed to the research so that the objectivity, accuracy and rigor may substitute initiation and experience as the approaches of examining research problems (Hussey & Hussey, 1997). In addition, the hypotheses are deduced from accepted principles to be statistically verified. Once this is done, human behavior is explored by data gathering (Perry et al. 1999). The epistemology of the positivist paradigm concentrates on present theories to find truth rather than on construction of new theory (Perry et al., 1999). Questionnaires and experiments are the most common positivist methods (Hussey & Hussey, 1997).

The realist paradigm is grounded on the idea that there is an external reality (Guba & Lincoln, 1994). It adopts triangulation of research methods to create knowledge and considers research findings to be comparatively true rather than absolutely true (Guba & Lincoln, 1994; Perry et al., 1999). Epistemologically, the researcher discovers that the values of the objective while being of the view that the study of numerous outcomes in relation to the incentives and teams does profoundly contribute to the subjective (Guba & Lincoln, 1994). Realists attempt to use both quantitative and qualitative designs (Perry et al., 1999) which include convergent interviews and case studies (Guba & Lincoln, 1994; Healy & Perry, 2000).

The critical theory paradigm takes it ground on the analysis of common historical happenings from the perspectives of social, political, economic, gender, ethical and cultural values (Perry et al., 1999). The fundamental principle of critical theory is that the researcher understands the happenings and creates a logical discussion of views and ideas (Guba & Lincoln, 1994). Most of the times it has been engaged to directly compare different qualitative research findings (Perry et al., 1999).

The constructivist paradigm advocates that truth is subjective and according to people's perceptions of reality, which lead to multiple realities (Guba & Lincoln, 1994; Perry et al., 1999). Furthermore, this may also bring about certain problematic philosophical outcomes which researchers may find it hard to elucidate the reality of a research topic (Guba & Lincoln, 1994). Constructivist devotes more time recounting the phenomenon instead of measuring it. Sometimes, constructivist researchers may be passionate participants during the interview process (Guba & Lincoln, 1994).

Based on the above review on research paradigms, this study takes on a positivist paradigm as it is the most appropriate paradigm for testing the hypotheses developed based on existing theories instead of developing a novel theory (Guba & Lincoln, 1994). This study attempts to examine the interplay between Self Determination Theory, Channel Expansion Theory and VLE related constructs towards behavioral intention and instructional effectiveness. To answer the research question, quantitative data was gathered using survey questionnaire. This process embroils quantitative methods and statistical tests based on deduction (Hussey & Hussey, 1997; Perry et al., 1999). The sample data were used by the researcher to test the proposed hypotheses. Therefore, positivist paradigm is appropriate for this study since quantitative method encompasses

population, sample and statistical analyses on the relationships between the variables (Perry et al., 1999).

4.8 Research design

A research design is a plan for the whole research project and is a strategy of enquiry (Myers, 2013). It encompasses specifying the philosophical assumptions, the research method, data gathering techniques, data analysis approach, write up approach and publication plan of the findings (Myers, 2013). Churchill (1999) classifies business studies into three categories namely descriptive, exploratory and causal. Gay and Diehl (1992) further extended the classification to include associative and historical research. Each research design may be used in dissimilar research circumstances and conditions (Sarantakos, 2005; Zikmund, 2003).

According to Zikmund (2003), the main purpose of descriptive research is to describe the nature and composition of a population or circumstances. The research process attempts to find answers to question of what, when, who, where and how. The outcome is a structured and well-prepared description appropriate for statistical calculations (Zikmund, 2003). Data gathered and analyzed from descriptive research may help researchers to understand the characteristics of a group and may offer a holistic portrait of all facets of the study areas and form new ideas (Sekaran, 2003). This kind of research design is usually used to assess the dimensions of a population with common interests and understand the association between the different components in the research (Emory & Cooper, 1991). Moreover, descriptive research focuses on finding out the answers to questions with what, when, where, who and how (Zikmund, 2003). The most widely applied research techniques for descriptive research are fill-in-the-blank and open-ended surveys (Davis, 2004). Descriptive research entails

structured and formal interviews based on some prior assumptions and understanding of the current nature of the research problems (Ghauri, Gronhaug & Kristianslund, 1995).

The main objective of causal research is to examine the variables that may establish the cause-and-effect associations between the variables causing specific actions and responses (Hussey & Hussey, 1997). Majority of the causal research depends on simulation programs and designed experimentation (Cooper & Schindler, 1998). To corroborate causality, a variable is kept constant while another variable is changed. Nevertheless, many scholars find that causal research is not practical especially when dealing with human behaviors (Cooper & Schinder, 1998). In some circumstances, causal research is feasible but is pretty complex. It may happen in the laboratory or in the real world as a portion of a field experiment. For example, in a laboratory, the researcher creates a situation that is analogous to the situation in the real world. Furthermore, causal research is used to identify the cause-and-effect associations for the chosen research variables based on the research problems previously defined (Zikmund, 2003). After the association has been validated, the proven causality can be utilized to predict the outcome of the examined problem.

On the other hand, Gay and Diehl (1992) assert that exploratory research is usually used to clarify an ambiguous problem or to argue that a problem does not exist or when the scholars do not have a clear image or idea of the problem and hope that exploratory research will produce a clearer image and starting point for the novel research. For instance, exploratory research may assist the organizations to evaluate the market acceptance of new services or products. The widely used methods for exploratory research comprise of in-depth interview, case studies, focus groups, pilot studies and projective studies (Ticehurst & Veal, 2000). If not much is understood about the

situation or no adequate information is obtainable on similar research issues that have been previously resolved, exploratory research would be the good answer. The methods of exploratory research are grounded on qualitative studies using data collection from focus groups, interviews, observations or surveys (Sekaran, 2003). Hence, exploratory researchers are useful in obtaining better understanding on the nature of a problem that occurred previously but not well addressed. Zikmund (2003) describes exploratory research as the preliminary stage for research project that aims to explore the nature of an issue before proceeding to the next stage of research. Moreover, Wong (1999) opined that exploratory research is also frequently used to divide a big problem into several smaller and more exact sub-problems before making a more in-depth study. Table 4.2 presents a summary of the different research designs.

Table 4.2: Research designs

Dimension	**Exploratory**	**Descriptive**	**Causal**
Objective	Discovery of ideas and insights (ambiguous problem)	Describe characteristics and functions (partially defined problem)	Determine cause-and-effect relationships (clearly defined problem)
Characteristics	Flexible, versatile, often the front end of a total research design	Prior formulation of hypotheses and research problems pre-planned and structured design	Manipulation of one or more independent variables, control of other variables
Methods	Expert surveys, pilot survey, secondary data analysis, qualitative research	Secondary data, surveys, panels, observational data	Experiments

Source: Zikmund (2003, p. 58)

4.9 Research methodology

Once the research paradigm has been chosen, the next step is to select a methodology. According to Creswell (2003), there are three major methodologies namely qualitative, quantitative and combined methods. Qualitative and quantitative methods vary in the subsequent perspectives:

1. Qualitative results are frequently stated using verbal descriptions whereas quantitative results are reported in figures or numbers (Creswell, 2003).
2. Qualitative research is normally deeper but with less structure, therefore it is beneficial in exploratory research (Jarratt, 1996)
3. Qualitative research depends on insight and observation based on the capability of the researcher whereas quantitative research is based on formalized statistical formulas and structures (Cooper & Emory, 1995).

4.9.1 Qualitative methodology

Van Maanen (1983) assert that qualitative method encompasses describing, expressing, analyzing, interpreting and explaining the meaning of a phenomenon. Nevertheless, researchers are not confined by any specific methodology would use numerous instruments and methods based on the need of the problem resolution (Denzin & Lincoln, 1994). Creswell (2003) stated that widely used qualitative research methods comprise of case studies, narrative research, grounded theory, phenomenological research, ethnographies and critical theory. The shortcoming of qualitative research is that it is more subjective than quantitative research.

In two of the commonly used qualitative methods - interviews and focus groups, participants' answer setup questions and the interviewer explores their responses to identify and explain their perceptions, feelings and ideas about the research topic

(Neuman, 2003). The quality of the outcomes from qualitative research relies on the experience, skills, techniques and sensitivity of the interviewer and is usually cheaper than questionnaire research (Bryman, 2004; Neuman, 2003). Qualitative research is an examination of what is assumed to be dynamic reality and it measures static reality hoping to unveil universal laws or theories (Sarantakos, 2005).

4.9.2 Quantitative methodology

Quantitative research is defined as the quantification of associations between variables such as work performance, age and height (Ticehurst & Veal, 2000). These associations are explicated by using statistical analyses like frequency distributions, mean variance or linear correlations. Quantitative methods frequently entail complex experiments with multiple variables as well as structural equations (Creswell, 2003). Majority of the quantitative research methods are likely to be sequential due to the nature of data gathering (Ticehurst & Veal, 2000). In addition, quantitative research is appropriate for variables that can be quantified and measured whereby hypotheses can be tested and validated by statistical calculations and when generalization can be made based on samples of the population (Gay & Diehl, 1992).

According to Cooper and Schindler (1998), experiments, observations and surveys are common quantitative methods. Experiments can be real experiments set up with random assignment or quasi-experiments that involve non-randomized sampling designs (Keppel, 1991). On the other hand, surveys can be administered to a sample of a population with a longitudinal or cross-sectional design (Babbie, 1990). For this purpose, statistical power calculations may help in determining the sample size a research needs to test the hypotheses (Neuman, 2003). Generally, researchers choose

sample sizes that will give them 95% confidence level on the differences they are looking at (Neuman, 2003; Zikmund, 2003).

4.9.3 Combine methodology

The merits of combined method have been discussed by Campbell and Fiske (1959). Creswell (2003) found that the biases in any method can be compensated for or neutralized by the other method. Generally, it would be good to engage both qualitative and quantitative methods and Creswell (2003) has identified 3 procedures frequently adopted by combined methodologies:

1. Concurrent procedures - researchers merge qualitative and quantitative data to integrate into a comprehensive analysis
2. Sequential procedures - researchers adopt one method to confirm the outcomes of the other method
3. Transformative procedures - a theoretical check offers a research design structure with both methods used to gather and analyze the data

A comparison between quantitative and qualitative methods is shown in Table 4.3.

Table 4.3: Quantitative and qualitative research

Quantitative research focuses on:	**Qualitative research focuses on:**
Deduction	Induction
Explanation via analysis of causal relationships and explanation by previously formulated research problem	Explanation of subjective meaning systems and explanation by understanding a prior set of concerns.
Generation and use of quantitative data	Generation and use of qualitative data
Use of various controls – physical or statistical in order to test the hypotheses	Commitment to research in everyday settings: minimizes reactivity among participants

Source: Malhotra (2004) and Miles & Hubeman (1994)

The main objective of this study is to examine causal associations between Self Determination Theory, Channel Expansion Theory and the VLE-related constructs with behavioral intention and perceived instructional effectiveness. Therefore, quantitative research is suitable for this study. Quantitative research is defined as the gathering and analyzing numerical data in order to explain and/or control phenomena of interest (Gay et al., 2006). A quantitative research method was chosen as it can measure the strengths of the cause-and-effect (causal) associations between independent variables and dependent variables. Besides that the study also engaged descriptive research as it does not embroil new ideas or concepts. Descriptive research is deployed to provide the characteristics of the teachers in the school setting.

4.10 Research techniques

Basically, there are three major research techniques namely experimentation, observation and questionnaires. For experimentation, the researcher controls and operates an independent variable to determine its influence on the dependent variables. Spector (1990) asserts that the aim of experimentation is to control at least one independent variable and establish the causal association in the research. Experiments may be performed in the natural setting or laboratory setting to test the hypotheses (Aldridge & Levine, 2001; Bordens & Abbott, 2005).

According to Sekaran (2003), observational techniques may be applied in both qualitative and quantitative research. Zikmund (2003) assert that the researcher directly observes the behavior, or registers the behavior and then analyzes later. An advantage of observation is that the respondents may behave naturally instead of reacting to questions (Tiecehurst & Veal, 2000). Generally, observation occurs in a natural setting (Spector, 1990). It can produce a thorough record of events or people in the

relationships between the variables in the study (Zikmund, 2003). Moreover, observational research is beneficial because it is flexible and less formal (Montgomeray & Duck, 1991).

Questionnaires are the common method of gathering primary data (Kumar, 2005). Information gathered from questionnaires can be perceptual, behavioral, attitudinal or motivational (Gay & Diehl, 1992). Generally, survey is an instrument for collecting data from a huge sample of a population instead of focusing on an individual. Questionnaire is especially appropriate for querying sensitive questions (Butler & Howell, 1980) since the researcher can mail the questionnaires to the respondents requesting them to answer anonymously (Montgomery & Duck, 1991; Sarantakos, 2005; Zikmund, 2003). The questions in the survey must be clearly structured, easy to understand, simple and self-explanatory since no one will be available to explain the questions to the respondents (Kumar, 2005). Surveys normally get low response rates since respondents may not be interested in them or because the questionnaire is too long (Aldridge & Levine, 2001). When the questionnaires are collected, they have to be coded, analyzed with statistical tools and interpreted (Zikmund, 2003). If a survey is well designed according to an appropriate literature review and statistical assumptions, the outcomes may be generalized to the larger population (Butler & Howell, 1980). Questionnaire data may be gathered in various different ways such as email, drop-off and pick-up, direct mailing, telephone interviews and face-to-face interviews (Bordens & Abbott, 2005).

In this study, data was collected using surveys. Surveys are more preferable because it yields research data based on real world observation (Kelly, Clark, Brown & Sitzia, 2003). It is also more preferable type of data collection because survey has the ability

to collect generalized-able data from a large population (Osman, Talib, Sanusi, Shiang-Yen & Alwi, 2012). Furthermore, survey is relatively easy and save time and may produce large amount of data within a short period (Kelly et al., 2003). It is also suitable for studying attitudes and behaviors, relatively reliable and accurate (Zikmund, 2003). Therefore, based on these justifications, survey is suitable to be used for data gathering in this study.

4.10.1 Survey administration

A questionnaire survey may be administered using several administration methods such as direct mailing, telephone interview, electronic interviews or face-to-face interview (Burns & Bush, 2003; Malhotra, 2004; Sekaran, 2003). The selection of method depends on factors like research environment, research objective, time, budget, information accuracy, the characteristics of the subjects, the sensitivity of the research topic, sampling as well as questionnaire structure (Ranchhold & Zhou, 2001; Sekaran, 2003; Skjak & Harkness, 2003).

Direct-mailing surveys are comparatively economical method where subjects may fill in the questionnaires anywhere and anytime. Normally, subjects receive the questionnaire directly and they return them through the mail. Nevertheless, usually the response rate is low (Bordens & Abbot, 2005). Internet surveys involve distribution of survey to the respondents using email and web pages. A problem with Internet surveys is that the subjects may not be representing the target population. Even though Internet surveys are easy to manage and able of getting a large number of subjects, however they are most appropriate for relatively uncomplicated and simple surveys (Bordens & Abbott, 2005).

Questionnaires may be administered by interactive voice response system or via telephone. Nonetheless, telephone surveys have a risk of high failure rate as people may not like to respond to undesirable incoming calls. On the other hand, telephone surveys are efficient, low cost, convenient and suitable for studies that only need to ask a few questions. This study is relatively long and therefore, telephone survey is not appropriate.

Face-to-face surveys permit the researcher to ask questions directly to the respondents. Generally, face-to-face surveys have high response rates. Nevertheless, a common disadvantage is that the interviewers may influence the respondents or the respondents may be biased against the interviewers' body or gestures appearance (Bordens & Abbott, 2005). Hence, the interviewers must be well-trained with techniques that may minimalize their influence on the respondents. Hence, well-trained interviewers may help in solving this problem but this may incur high cost.

Household drop-off or self-completion questionnaires have advantages over mail questionnaires. For this method, researchers go to the organizations or households and ask them to fill in the survey and send it back later through mail. Alternatively, researchers may go back to collect the surveys personally. The respondents may fill in the questionnaires anytime and anywhere. They may contact the questionnaire collectors or the researcher if there are any questions or problems. Generally, the response rates are poorer than the face-to-face interviewers nevertheless they may still be acceptable (Bordens & Abott, 2005).

A self-administered survey questionnaire refers to a pre-written set of questions for respondents to choose their answers within narrowly designated alternatives (Sekaran, 1999). In this study, self-administered direct mailing was used based on the following justifications (Zikmund, 2003, p. 244):

1. Geographical flexibility – the sample can be gathered from the respondents in various logistic places across the nation
2. Comparatively fast
3. Low cost
4. The quality of the sample gathered relies on the content and the quality of the questions instead of the techniques of the interviewer
5. Able to avoid respondents' biases toward the appearance of the interviewer

4.10.2 Sampling techniques

Sampling technique refers to a procedure of choosing a sample from a targeted population (Aldrige & Levine, 2001). Generally, there are two common methods of sampling namely non-probability sampling and probability sampling (Aaker, Kumar & Day, 1998; Krueger, 1988). Majority of quantitative researchers adopt probability sampling (Buckingham & Saunders, 2004) and if the aim of the research is to estimate the population as a whole, then probability sampling would be the best suitable method (Babbie, 1990). The advantage of probability sampling is that each member of the population has an equivalent probability of being selected and this will minimize selection bias while improving accuracy (Zikmund, 2003).

There exist several categories of probability sampling which include simple random sampling, stratified sampling, cluster sampling, systematic sampling and multistage sampling. In simple random sampling, the researchers assign every member of the

population with a number and then pick sampling unit at random based on random numbers with equivalent chance. In systematic sampling, researchers may use the natural order of sampling frame and pick a random starting point and then choose items at a pre-determined interval. In stratified sampling, the researchers split the population into several groups and then randomly pick subsamples from each group. The variations may be disproportional, proportional and optimal distribution of subsample sizes. In cluster sampling, the researchers pick sampling units at random and survey entire members in the group. Finally, in multistage sampling, the researchers pick smaller areas in every stage and integrate the first four techniques mentioned previously (Kumar, 2005).

In non-probability sampling, the probability of any specific member of the population to be selected is unknown in advance (Sekaran, 2003) and the selection of members is not organized and the researchers may apply personal experience to make their choices (Zikmund, 2003). Non-probability sampling consists of convenience sampling, quota sampling, snowball sampling and judgmental sampling. In convenience sampling, the researchers just adopt the most convenient or economical samples. In judgmental sampling, the researchers pick samples based on their experience to accomplish a task such that they ensure that all members have similar features. In quota sampling, researchers limit the sample in every category and pick the suitable respondents. Finally, in snowball sampling, initial respondents are picked at random and these selected respondents will refer additional respondents.

In this study, the sampling frame is known based on the list of 351 Frog Champion schools. Therefore, probability sampling with simple random sampling is chosen.

4.11 Research process

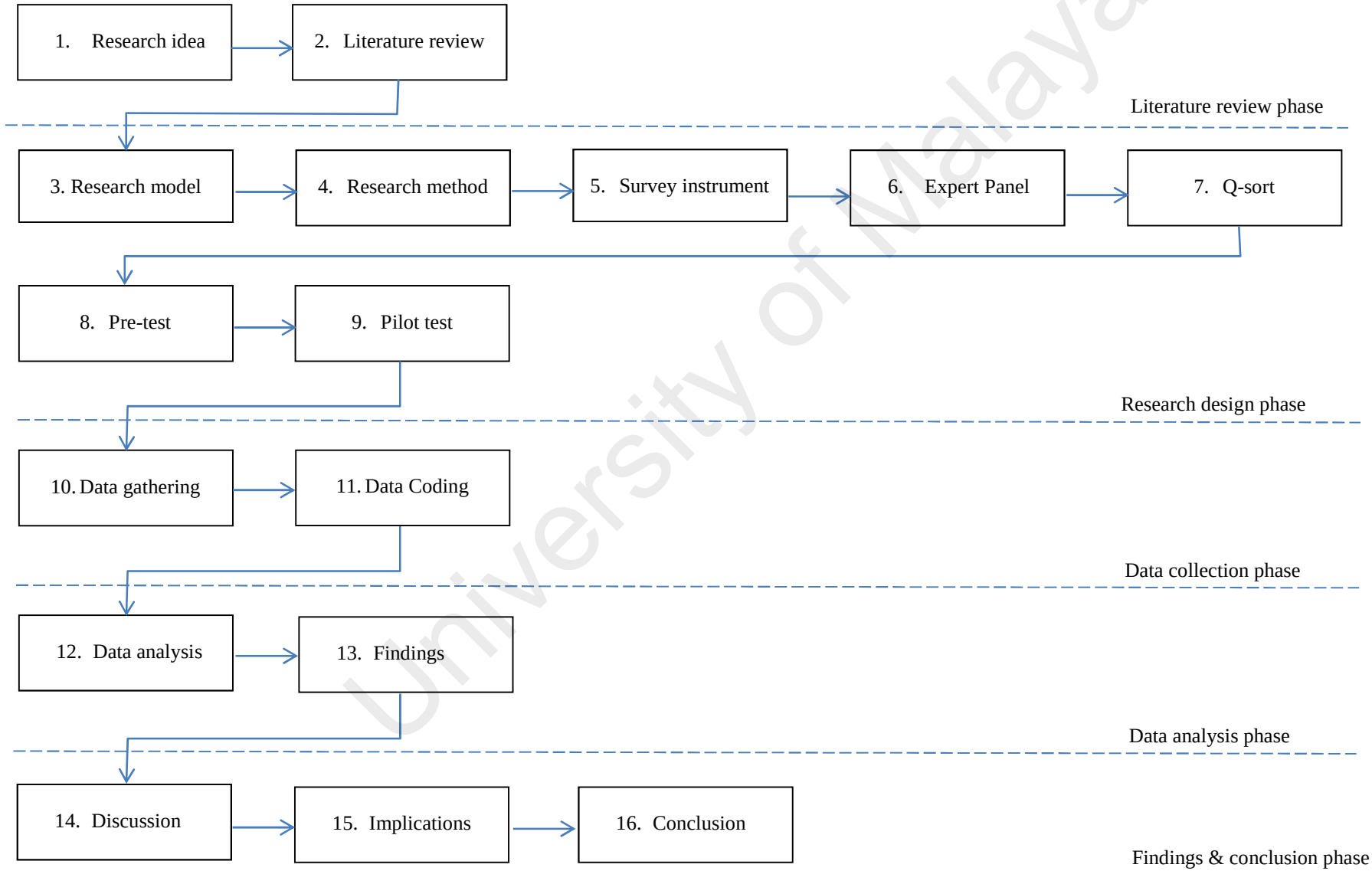
In general, the research process started with the research idea or topic of study followed by extensive literature review to identify the research problems and research gaps. Next, the research model was developed based on the hypothesis development. After the research model has had been developed, the research method was determined. This was followed by the instrument development and validation. Expert panel was deployed to assess the face validity and content validity of the instrument. Content validity index was used as the measure for content validity. After that, practitioners were engaged as judges for the Q-sort procedure to evaluate the inter-rater reliability or Cohen's Kappa in the pre-test stage.

After the instrument has been developed, a pilot test was conducted to evaluate the reliability of the instrument using Cronbach's alpha. A pilot test refers to an official testing of the questionnaire utilising small number of respondents (Malhotra, 2004; Zikmund, 2003). A pilot testing may assist the researcher to make amendments to minimalize any unexpected issues (Zikmund, 2003). Pilot testing can be adopted for the subsequent reasons:

1. To establish correct research techniques and sampling;
2. To ensure proper questionnaire design;
3. To evaluate the research methodology;
4. To obtain professional guidance on the hypothesis and research questions (Zikmund, 2003).

As an outcome of the pilot test, minor amendments were carried out based on the comments and feedback from the respondents. After the final instrument was developed, a fieldwork was conducted to gather the data using simple random sampling method. Survey questionnaires were used to gather the data on respondents' demographic profile, the independent variables and the dependent variables. Once the data has been gathered in two waves of surveys, the data was coded and key in into the SPSS data set. It was then analyzed to test the hypothesis. The findings from the data analysis were then interpreted and discussed. From the discussion, theoretical and practical contributions or implications were suggested. Finally, the limitations and future research direction were presented. The whole research process is depicted in Figure 4.2.

Figure 4.2: Research Process



4.12 Instrument development and validation

Extensive literature review has been carried out to find instrument that measures instructional effectiveness of a cloud-based VLE particularly from the context of Malaysia. However, there is hardly any to be found. Nevertheless, several grid-based VLE measurement instruments were located for example instrument for the measuring the acceptance of Moodle, e-LMS, Blackboard, WBLS and so on (Table 4.4). None of these instruments measured the constructs of SDT and CET as well as instructional effectiveness of VLE. Furthermore, these studies did not engage rigorous instrument development and validation procedures. No translation processes have been carried out even though these studies were conducted in non-English native speaking countries such as Iran, China, Slovenia, Spain and etc. Hence, there is desperate need to develop a specific instrument to measure these constructs from the cloud-based VLE perspective in the Malaysian cultural settings.

Table 4.4: Existing grid-based VLE instruments

Author(s)	Instrument to study	Sampling procedure & target respondent	What is measured	Type of scale	Validation
Sumak et al. (2010)	Moodle acceptance in Slovenia	Online survey using convenient sample of 235 undergraduate students at the Faculty of Electrical Engineering and Computer Science in Maribor, Slovenia	UTAUT	7-point Likert scale	Pre-test, Pilot test
Van Raaij & Schepers (2008)	CassLearn acceptance in China	A convenient sample of 40 Chinese managers enrolled in Executive MBA program	TAM2, SN, PIIT and Computer Anxiety	7-point Likert scale	No validation. All items were adapted from published studies.
Sánchez & Hueros (2010)	Moodle acceptance in Spain	A convenient sample of 226 students of the Faculty of Business Sciences and the Faculty of Educational Science at the University of Huelva, Spain	TAM, technical support and perceived self-efficacy	7-point Likert scale	Pre-test No pilot test
Chou & Liu (2005)	Technology-mediated VLE (TVLE) in Taiwan	A convenient sample of 210 Hsing-Kuo High School students	Learner control, Learning performance, Self efficacy, Satisfaction and Climate	5-point Likert scale	No validation. All items were adapted from validated studies.

Table 4.4 continued

Author(s)	Instrument to study	Sampling procedure & target respondent	What is measured	Type of scale	Validation
Eom (2012)	e-Learning Management System (e-LMS) in US	A convenient sample of 674 university students in Midwest USA using online survey.	E-learning System Success (ELSS)	7-point Likert scale	No validation. All items were adopted from Wang et al. (2007)
Motaghian et al. (2013)	Web-based Learning System (WBLS) in Iran	115 university instructors from two Iranian universities were selected using cluster sampling	TAM, ISSM, Self-efficacy and SN	7-point Likert scale	No validation. All items were adopted from Wang & Wang (2009)
Sun & Hsu (2013)	Web-based Instruction (Moodle) in Taiwan	A convenient sample of 42 undergraduate students using experimental setting	Perceived interactivity, ATT, Satisfaction and Perceived learning	5-point Likert scale	Pre-test, Pilot test
Liaw (2008)	Blackboard system in Taiwan	A convenient sample of 424 university students	Three-tier Use Model (3-TUM)	7-point Likert scale	No validation. All items were developed by the authors.
Shin et al. (2013)	3D VLE	A convenience sample of 264 undergraduates	TAM, ECT	7-point Likert scale	Pre-test, Pilot test

4.12.1 Operationalization of measurement scales

In order to generate higher level of dispersion and reduce neutral responses, 7-point Likert scales were used to measure the constructs of the study. Even though larger Likert scales may be useful in discriminating opinions more precisely however they may also confuse the respondents (Bass, Casccio & O'Conner, 1974). Generally, 7-point Likert scales may reduce inaccuracy whereas 5-point Likert scales limits the option too much (Burns & Bush, 2000). Hence, 7-point Likert scales were adopted in this study as it offers more choices for respondents with less skewed distribution (Burns & Bush, 2000). Likert scale requires less time to complete compared to open-ended question (Churchill, 1979). The Likert scale ranges from strongly disagree (1) to strongly agree (7). Age and teaching experience were measured by using ratio scale whereas educational level was measured using ordinal scale. Gender was measured with nominal scale. Use behavior was measured using 7-point Likert scale ranging from (1) never to (7) all the times. All the items of the constructs are either adopted or adapted from previous studies. The summary of variables, number of items and their sources are indicated in Table 4.5.

Table 4.5: Variables and their sources

Variable	**Number of items**	**Source**
Perceived Media Richness	7	Fernandez et al. (2013)
VLE Content Design	6	Lee et al. (2009)
VLE Interactivity	4	Chen et al. (2007)
Perceived Relatedness	8	Sørebø et al. (2009)
Perceived Autonomy	7	Sørebø et al. (2009)
Perceived Competence	6	Sørebø et al. (2009)
School Support	4	Lai & Chen (2011)
Attitude toward Knowledge Sharing	5	Chow and Chan (2008)
Trust in Website	3	Hsu et al. (2014)
Behavioral Intention	3	Venkatesh et al. (2003)
Perceived Instructional Effectiveness	6	Limniou & Smith (2010)

Perceived Media Richness is defined as the degree to which a teacher believes that the VLE features are capable of carrying a wide variety of media based on the criteria of capacity in immediate feedback, personal focus, multiple cues and language variety and consist of the following 7 items adapted from Fernandez et al. (2013):

PMR1: The VLE features allow me to give and receive timely feedback.

PMR2: The VLE features allow me to tailor my teaching to my own personal requirements.

PMR3: The VLE features allow me to communicate a variety of different cues (such as emotional tone, attitude, or formality) in my teaching.

PMR4: The VLE features allow me to use a rich and varied language in my teaching.

PMR5: I could easily explain concepts using the VLE features.

PMR6: The VLE features help me to communicate quickly and effectively.

PMR7: The VLE features help me to better understand others.

VLE Content Design is referred as the degree to which learning and assignment contents are designed and developed to fit students' needs and consists of the following 6 items adapted from Chen et al. (2007) as follows:

VCD1: The level of difficulty of the learning contents is appropriate.

VCD2: The content of assignments is easy to be understood by the students.

VCD3: The amount of learning contents is appropriate.

VCD4: The delivery schedule of learning contents is flexible.

VCD5: VLE provides individualized learning management.

VCD6: VLE provides a variety of learning methods.

VLE Interactivity is defined as the degree of interaction that a teacher perceives as having with the VLE system, and the extent to which the system is perceived to be responsive and sensitive to his/her needs and comprises of 4 items adapted from Chen et al. (2007) as follows:

VI1: Interacting with VLE is like having a good conversation with a knowledgeable representative from my school.

VI2: While navigating the VLE, I feel as if VLE talked back to me.

VI3: The VLE to be sensitive to my needs for information.

VI4: I always interact with the VLE.

Perceived Relatedness is the degree of the desire to feel connected to others and it encompasses 8 items adapted from Sørebø et al. (2009). The items are as follows:

PR1: I really like the people I work with.

PR2: I get along with people at work.

PR3: I pretty much keep to myself when I am at work.

PR4: I consider the people I work with to be my friends.

PR5: People at work care about me.

PR6: There are not many people at work whom I am close to.

PR7: The people I work with do not seem to like me much.

PR8: People at work are pretty friendly towards me.

Perceived Autonomy refers to the degree of the desire to self-initiate and self-regulate own behavior such as making own decisions and expressing own ideas or opinions and it has 7 items adapted from Sørebø et al. (2009). They are:

PA1: I can make my own decision in how I use VLE in my teaching profession.

PA2: I feel pressured at using VLE in my teaching profession.

PA3: I am free to express my ideas and opinions on using VLE in my teaching profession.

PA4: When I am using VLE, I have to do what I am told.

PA5: My feelings toward VLE are taken into consideration at work.

PA6: I feel like I can pretty much use VLE as I want to at work.

PA7: There is not much opportunity for me to decide for myself how to use VLE in my teaching profession.

Perceived Competence is defined as the degree of the desire to feel effective in attaining valued outcomes and this variable is measured using 6 items adapted from Sørebø et al. (2009) as listed below:

PC1: I do not feel very competent when I use VLE in my teaching profession.

PC2: My colleagues tell me I am good at using VLE in my teaching profession.

PC3: I have been able to learn interesting new skills in VLE through my profession.

PC4: Most of the times, I feel a sense of accomplishment from working with VLE.

PC5: I do not get much of a chance to show how capable I am in VLE.

PC6: When I am using VLE I often do not feel very capable.

School Support refers to the degree to which a teacher believes that his/her school is committed to successful VLE implementation and use and it has 4 adapted items from Lai and Chen (2011) as follows:

SS1: My school is committed to the vision of using VLE in teaching.

SS2: My school is committed to supporting my efforts in using VLE for teaching.

SS3: The school strongly encourages the use of VLE for teaching.

SS4: My school will recognize my efforts in using VLE for teaching.

Attitude toward Knowledge Sharing refers to the degree of a teacher having positive feelings about sharing ideas and resources with those with whom they have developed a close relationship and is measured using 5 items adapted from Chow and Chan (2008) as follows:

AT1: Sharing of my knowledge with other teachers is always good.

AT2: Sharing of my knowledge with other teachers is always beneficial.

AT3: Sharing of my knowledge with other teachers is always an enjoyable experience.

AT4: Sharing of my knowledge with other teachers is always valuable to me.

AT5: Sharing of my knowledge with other teachers is always a wise move.

Trust in Website is defined as the degree of the belief resulting from the reliability and reliance of the VLE website and 3 items adapted from Hsu et al. (2014) were used to measure these variables as follows:

TW1: I think the VLE website is secure.
TW2: I think the VLE website is reliable.
TW3: I think the VLE website is trustworthy.

Behavioral Intention is defined as the degree to which a teacher has formulated a conscious plan to use or not to use VLE system in the future and it consists of 3 items adapted from Venkatesh et al. (2003) as listed below:

BI1. I intend to use VLE in the coming months.
BI2. I predict I would use VLE in the future.
BI3. I plan to use VLE in the future.

Perceived Instructional Effectiveness is defined as the degree a teacher believes that using VLE is able to enhance his/her instructional effectiveness such as improvements in students' performances and understanding of subject content, students' self-motivations and control of the teaching and is comprising of 6 items adapted from Limniou and Smith (2010) as follows:

PIE1: I believe that I could improve my teaching by using the VLE.

PIE2: I believe that I could improve students' performance by using the VLE.

PIE3: I believe that the students could better understand the content of their subjects through the use of VLE.

PIE4: I believe that I have control of teaching by using the VLE.

PIE5: I believe that the VLE is the best way for teaching and learning.

PIE6: Overall, I believe that students will be more self-motivated if they use the VLE.

4.12.2 Population and sample size

A population is any complete group of entities that shared some common set of characteristics (Bryman & Bell, 2015). The population of teachers as of 31 December 2014 is 419,820 (KPM portal, 2014). The sampling frame is the list of 351 Champion Schools obtained from MoE (Appendix A) and the unit of analysis is Malaysian school teacher.

A sample is a subset or some part of a larger population (Bryman & Bell, 2015). A sample is necessary because it is impractical to survey the entire population due to budget and time constraints and results are needed quickly. As recommended by the PLS literature, a common "10 times" rule of thumb for PLS suggests that a sample size of 10 times the most complex relationship within a research model is required. According to Peng and Lai (2012, p. 469), "the most complex relationship is the larger value between (a) the construct with the largest number of formative indicators if there are formative constructs in the research model (i.e. the largest measurement equation (LME) and (b) the dependent latent variable (LV) with the largest number of independent LVs influencing it (i.e. the largest structural equation (LSE))". Since there

is no formative construct in the research model and the most complex dependent LV (i.e. behavioral intention) has 11 independent LVs, the rule of thumb says that the minimum sample size required is 110. The final sample size of 608 is six times larger than the minimum sample size recommended for PLS analysis and is considered deem adequate to generate reliable and valid generalization of findings.

4.12.3 Questionnaire design and distribution

In order to conduct this research, approval was first be obtained from the Educational Planning and Research Division (EPRD), Ministry of Education Malaysia, using the *BPPDP1 Form* together with this proposal, research instrument and sample list via the *Education Research Application System* portal (eRAS portal, 2014). Further approvals were obtained from all the State Education Departments (JPNs), District Education Departments and School administrators.

The data for this study was gathered using survey questionnaires. For theory confirmation that aims at testing the hypotheses derived from existing theories, which is a common practice in the field of social science; questionnaire survey is the most suitable method for quantitative research (Punch, 2000). The advantage of a questionnaire survey is the lower cost in comparison to other methods in terms of geographical coverage, wider scope in the sample population and large samples (Zhang, 2000).

Questionnaires were mailed to the selected Frog champion schools which have implemented the VLE system using self-addressed courier services. The random sampling technique is used. The full list of these schools is shown in Appendix B.

In order to minimize common method bias, the data was gathered in two phases. In phase one (T1), independent variables were collected together with the demographics profile of the respondents. After a gestation period of four months, the second phase (T2) of survey is done to collect information of the dependent variables. To trace the corresponding respondent for the two waves of survey, the last three digits of the identity card and mobile phone were combined as a tracking number.

The purpose of conducting pre-test is to ensure that all questions are relevant and easy to comprehend. Wong (2002) opines that pre-test may serve as the foundation for amendment in terms of language structure in particular question if needed. With this process, researchers will be able to ensure the relevancy of the items in the survey instrument (Bradburn, Sudman & Wansink, 2004). Besides that, researchers are also able to determine whether the language structure, the length and flow of the survey are appropriate and whether the time allocated to complete the survey is well managed (Xie, 2011).

During this stage, the face and content validity of the instrument is evaluated. These involved review by expert panel members and Q-sort procedure by practitioners. The expert panel comprises of three academic experts and three practitioners experts in commenting and providing suggestions for improvement of the structure and wordings of the instrument. The three academic experts are prominent professors in the IS field while the three practitioners are subject matter experts in the Frog VLE.

One of the expert panel members is Prof. Dr. Ooi Keng Boon. Prof. Dr. Ooi Keng Boon is a Professor of Industrial Management & Information Systems, Deputy Vice-Chancellor (Research and Postgraduate Studies) and the Dean for the Faculty of

Business & Information Science at UCSI University, Malaysia. Dr. Ooi also serves as a Visiting Professor to the Department of Industrial Engineering at Kasetsart University, Bangkok, Thailand and as a Singapore Internet Research Centre (SiRC) Associate with the Wee Kim Wee School of Communication and Information, Nanyang Technological University (NTU), Singapore. Another panel expert is Prof. Dr. Eddy Chong Siong Choy. Dr. Eddy Chong Siong Choy is a former academic professor and Deputy Vice-Chancellor for Academic Affairs and Research at Linton University College, Malaysia. Dr. Eddy Chong has seated on the Malaysian Qualifications Agency's panel for both academic programs and individuals through Accreditation of Prior Experiential Learning since 2009, and more recently as the chair of the Panel of Experts in the development of academic program standards for Business Studies. Also serves as a panel expert is Prof. Dr. Alain Chong Yee Loong. Dr. Alain Chong is a Professor in Information Systems and Faculty Director of Research and Knowledge Exchange at Nottingham University Business School China (NUBS China). Prior to joining University of Nottingham Ningbo China, he was a postdoctoral research fellow in the Department of Industrial and Systems Engineering at The Hong Kong Polytechnic University. Alain is also a visiting fellow at Greenwich University, United Kingdom, Hong Kong Polytechnic University, Hong Kong and SIRC Research Associate at Nanyang Technological University, Singapore. He was also an adjunct professor at Linton University College (Malaysia) and Zhejiang University of Finance and Economics. The full biography of the expert panel members is listed in Appendix P.

Besides the academic professors, three experience practitioners were also engaged as members of the panel expert. Mdm. Zahurin Bt. Asma is a Frog VLE Champion Teacher trained by FrogAsia and also serves as a Smart Coordinator in charge of ICT facilities and resources in her school. She has given numerous trainings and workshops

to her school teachers and attended various immersion courses and trainings conducted by FrogAsia. Mr. Mas Hanafiah B. Tengah is an experienced IT teacher who has also attended various trainings and courses conducted by FrogAsia. He is also the school's head for vocational and technical department. He is in charged with the operation and maintenance of the Frog VLE system in his school. Last but not least, Mdm. Koid Lee Fung is a master teacher for the STPM General Knowledge subject in her school. She has been trained by FrogAsia and is an active user of the Frog VLE in delivering her lessons in the classrooms. She also serves as the secretary of the school curriculum committee as well as the school resource center teacher. Based on their comments and suggestions, several minor amendments were carried out. Table 4.6 shows the responses and amendments done in accordance to their comments and suggestions.

Table 4.6: Responses and amendments to the panel experts' comments or suggestions

Panel Expert Member	**Comments/Suggestions**	**Responses/Amendments**
Prof. Dr. Ooi Keng Boon	1. Overall the statements above looks fine except PIE1 and PIE4 2. PIE1: I believe that I could improve my 'teaching' by using the VLE. In which aspect of teaching? Perhaps 'quality' to be included after teaching?	The items have been revised as follows: PIE1: I believe that I could improve my teaching effectiveness by using the VLE. PIE4: I believe that I have control of my teaching process by using the VLE.
Prof. Dr. Alain Chong Yee Loong	Use ratio scale for age.	Ratio scale is used to measure respondent's age.
Prof. Dr. Eddy Chong Siong Choy	A8 spelt out many options. Are those options confined to the availability of subjects' contents on Frog VLE?	Explanation was given in the use of "other option" to capture all the teaching options.
Mdm. Zahurin bt. Asma	Use ratio scale for teaching experience.	Ratio scale is used to measure respondent's teaching experience.
Mr. Mas Hanafiah b. Tengah	Provide more teaching options.	More teaching options are provided.
Mdm. Koid Lee Fung	Teaching options should be expanded.	Teaching options have been expanded.

4.12.4 Face validity, content validity and expert panel

To ensure content validity, items in the instruments were adapted from prior studies based on the findings from an extensive literature review. The selected items were then reviewed by an expert panel to validate its content validity. The expert panel consists of three Malaysian professors in the IS field and three experienced practitioners. Malaysian experts were chosen as they were born and raised up in Malaysia and hence are very familiar to the Malaysian culture. The professors include editor-in-chief or guest editor of ISI journals in IS field. The Harzing's H-index of these professors ranges from 20 to 40. The three practitioners include a Frog Champion teacher, a Frog VLE coordinator and a master teacher who are capable of providing practical suggestions from the context of the Frog VLE users.

Face validity refers to the condition when items should represent what they are supposed to measure (Hardesty & Bearden, 2004). To assess face validity, expert panel was engaged whereby they were tasked to review the instrument to determine whether the measure measures what it supposedly measures. The expert panel was satisfied with the face validity of the instrument. However, minor amendments and formatting were done based on the comments and feedbacks from these expert panel members.

Content validity refers to the state where items should appropriately cover the construct's domain (Lynn, 1986). It also indicates the degree to which the items reflect the construct being measured. To ensure content validity, existing published items were used and an item-by-item review by expert panel members were conducted during the pre-test stage (Dinev, Xu, Smith & Hart, 2013). To validate content validity of the instrument, content validity index (CVI) was computed. There are two categories of CVI, namely the item-level CVI or I-CVI and the scale-level CVI or S-CVI (Lynn,

1986). By convention, a 4-point ordinal scale of (1) not relevant, (2) somewhat relevant, (3) quite relevant and (4) highly relevant were used. Items rated as 3 or 4 are considered as relevant items whereas items with rating of 1 or 2 are assumed to be irrelevant items. The content validation form is shown in Appendix C.

4.12.5 Item-level CVI

I-CVI is the proportion of panel experts who rated them as relevant items (i.e. rating of 3 or 4). Lynn (1986) suggested that for a panel expert of six members, the I-CVI should be at least 0.83. Based on the ratings by the expert panel members, it is concluded that all items have sufficient degree of content validity as their I-CVI are greater than 0.83 (Table 4.7).

4.12.6 Scale-level CVI

S-CVI is the ratio of expert panel members who rated the items as relevant (i.e. rating of 3 or 4). Generally, there are two types of S-CVI whereby the universal agreement S-CVI or S-CVI/UA is the proportion of items rated as 3 or 4 by all expert panel members while the average S-CVI or S-CVI/Ave is the average proportion of items rated as 3 or 4 by expert panel members. However, the requirement of S-CVI/UA is too stringent when there are a large number of expert panel members as a 100% agreement would be very difficult to achieve. Thus, the S-CVI/Ave was used instead (Polit & Beck, 2006). The minimum value for S-CVI/Ave is 0.90 for a scale to be accepted as relevant (Lynn, 1986). Based on this recommended threshold, it is concluded that all scales do possess adequate content validity as all S-CVI/Ave are above 0.90 (Table 4.7).

Table 4.7: I-CVI and S-CVI results

Item	Expert Panel Member						Number of Agreement	I-CVI	S-CVI/Ave
	1	2	3	4	5	6			
PR1	X	X	X	X	X	X	6	1.00	0.98
PR2	X	X	X	X	X	X	6	1.00	
PR3	X		X	X	X	X	5	0.83	
PR4	X	X	X	X	X	X	6	1.00	
PR5	X	X	X	X	X	X	6	1.00	
PR6	X	X	X	X	X	X	6	1.00	
PR7	X	X	X	X	X	X	6	1.00	
PR8	X	X	X	X	X	X	6	1.00	
Proportion of Relevant	1.00	0.88	1.00	1.00	1.00	1.00			
PA1	X	X	X	X	X	X	6	1.00	0.95
PA2	X	X	X	X	X	X	6	1.00	
PA3	X	X	X	X	X	X	6	1.00	
PA4	X		X	X	X	X	5	0.83	
PA5		X	X	X	X	X	5	0.83	
PA6	X	X	X	X	X	X	6	1.00	
PA7	X	X	X	X	X	X	6	1.00	
Proportion of Relevant	0.86	0.86	1.00	1.00	1.00	1.00			
PC1	X	X	X	X	X	X	6	1.00	0.97
PC2	X	X	X	X	X	X	6	1.00	
PC3	X	X	X	X	X	X	6	1.00	
PC4	X	X	X	X	X	X	6	1.00	
PC5		X	X	X	X	X	5	0.83	
PC6	X	X	X	X	X	X	6	1.00	
Proportion of Relevant	0.83	1.00	1.00	1.00	1.00	1.00			

Table 4.7 continued

Item	Expert Panel Member 1	2	3	4	5	6	Number of Agreement	I-CVI	S-CVI/Ave
PMR1	X	X	X	X	X	X	6	1.00	1.00
PMR2	X	X	X	X	X	X	6	1.00	
PMR3	X	X	X	X	X	X	6	1.00	
PMR4	X	X	X	X	X	X	6	1.00	
PMR5	X	X	X	X	X	X	6	1.00	
PMR6	X	X	X	X	X	X	6	1.00	
PMR7	X	X	X	X	X	X	6	1.00	
Proportion of Relevant	1.00	1.00	1.00	1.00	1.00	1.00			
VCD1	X	X	X	X	X	X	6	1.00	1.00
VCD2	X	X	X	X	X	X	6	1.00	
VCD3	X	X	X	X	X	X	6	1.00	
VCD4	X	X	X	X	X	X	6	1.00	
VCD5	X	X	X	X	X	X	6	1.00	
VCD6	X	X	X	X	X	X	6	1.00	
Proportion of Relevant	1.00	1.00	1.00	1.00	1.00	1.00			
VI1	X	X	X	X	X	X	6	1.00	0.97
VI2	X	X	X	X	X	X	6	1.00	
VI3	X	X	X	X	X	X	6	1.00	
VI4	X		X	X	X	X	5	0.83	
VI5	X	X	X	X	X	X	6	1.00	
Proportion of Relevant	1.00	0.80	1.00	1.00	1.00	1.00			
SS1	X	X	X	X	X	X	6	1.00	1.00
SS2	X	X	X	X	X	X	6	1.00	
SS3	X	X	X	X	X	X	6	1.00	
SS4	X	X	X	X	X	X	6	1.00	
Proportion of Relevant	1.00	1.00	1.00	1.00	1.00	1.00			

Table 4.7 continued

Item	Expert Panel Member 1	2	3	4	5	6	Number of Agreement	I-CVI	S-CVI/Ave
AT1	X	X	X	X	X	X	6	1.00	1.00
AT2	X	X	X	X	X	X	6	1.00	
AT3	X	X	X	X	X	X	6	1.00	
AT4	X	X	X	X	X	X	6	1.00	
AT5	X	X	X	X	X	X	6	1.00	
Proportion of Relevant	1.00	1.00	1.00	1.00	1.00	1.00			
TW1	X	X	X	X	X	X	6	1.00	1.00
TW2	X	X	X	X	X	X	6	1.00	
TW3	X	X	X	X	X	X	6	1.00	
Proportion of Relevant	1.00	1.00	1.00	1.00	1.00	1.00			
BI1	X	X	X	X	X	X	6	1.00	1.00
BI2	X	X	X	X	X	X	6	1.00	
BI3	X	X	X	X	X	X	6	1.00	
Proportion of Relevant	1.00	1.00	1.00	1.00	1.00	1.00			
PIE1	X	X	X	X	X	X	6	1.00	1.00
PIE2	X	X	X	X	X	X	6	1.00	
PIE3	X	X	X	X	X	X	6	1.00	
PIE4	X	X	X	X	X	X	6	1.00	
PIE5	X	X	X	X	X	X	6	1.00	
PIE6	X	X	X	X	X	X	6	1.00	
Proportion of Relevant	1.00	1.00	1.00	1.00	1.00	1.00			

Note: X indicated item is rated 3 or 4 by the expert; I-CVI=Item level content validity index; S-CVI/Ave=Average scale level content validity index; PR=Perceived Relatedness; PA=Perceived Autonomy; PC=Perceived Competency; PMR=Perceived Media Richness; VCD=VLE Content Design; VI=VLE Interactivity; SS=School Support; AT=Attitude toward knowledge sharing; TW=Trust in Website; BI=Behavioral Intention; PIE=Perceived Instructional Effectiveness.

The questionnaire was first created in English and reviewed for face validity and content validity by a group of practicing teachers and a group of IS academics and experts (Venkatesh, Thong, & Xu, 2012). As the questionnaire was administered in Malay, the official language and the language used predominantly by the Malaysian teachers, the questionnaire was translated from English to Malay and then back to English to ensure translation equivalence (Brislin, 1970 as cited in Venkatesh et al., 2012).

Three rounds of translation processes were conducted. In the first round of translation, the original English version was translated into Malay by an English subject matter expert and in the second round it is then translated back to English by another English subject matter expert. In the final round, the translated versions were then double-checked by several other independent subject matter experts for translation equivalence and consistency until both versions converged (Al-Gahtani et al., 2007).

The subject matter experts engaged are very experienced and well verse in both English and Malay languages. After going through rigorous and careful checking, all subject matter experts were satisfied with the final translated version and acknowledged that there are no differences in terms of interpretations and meanings of words and phrases between the Malay and the English versions of the instrument. The two instruments were justified as equivalent in its contents, interpretations and meanings.

4.12.7 Construct validity

In order to assess the construct validity and reliability of the items in the questionnaire at the pre-testing stage, a classifying method similar to the Q-sort method was engaged (Moore & Benbasat, 1991; Nahm, Rao, Solis-Galvan & Ragu-Nathan,

2002). Two rounds of classification procedures with four practitioners for each round were conducted to obtain the overall hit ratios in order to assess for construct validity (i.e. convergent validity and discriminant validity) and the inter-rater reliability was evaluated according to the Cohen's Kappa values (Warren, Sulaiman & Jaafar, 2015). The judges of practitioners were tasked to sort the items into their relevant constructs according to the definitions of the constructs. Items that are too ambiguous were dropped and the less ambiguous items were examined and modified (Warren, Sulaiman, Jaafar, 2014). The Q-sort forms are shown in Appendix D.

The overall hit ratios of first and second round of Q-sort procedure are presented in Table 4.8 and 4.9. The hit ratios for items range from 68% to 100% for round one and 83% to 100% for round two. On the other hand, the hit ratios of the instrument have improved from 89% in round one to 94% in second round. In terms of inter-rater reliability which is measured by Cohen's Kappa coefficient, round one has a Kappa of 0.71 and the value improved to 0.80 for round two. As these Kappa values are greater than the recommended threshold of 0.65 (Warren et al., 2015), it is concluded that the instrument possesses very good degree of construct validity.

Table 4.8: Q-sort classification result (round one)

		Actual											N/A	Total	Hit Ratio (%)
		PMR	**VCD**	**VI**	**PR**	**PA**	**PC**	**SS**	**AT**	**TW**	**BI**	**PIE**			
Theoretical	**PMR**	23		3			1							27	85%
	VCD	1	21								1			23	91%
	VI			19				1						20	95%
	PR				28				2		1			31	90%
	PA				1	15	2	1		1			1	21	71%
	PC					2	13				1	2	1	19	68%
	SS							16						16	100%
	AT								19					19	100%
	TW									12				12	100%
	BI										12			12	100%
	PIE					2						21		23	91%

Note: N/A=Not Applicable

Item placements: 223 **Hits: 199** **Overall Hit Ratio: 89%**

Table 4.9: Q-sort classification result (round two)

		Actual											N/A	Total	Hit Ratio (%)
		PMR	**VCD**	**VI**	**PR**	**PA**	**PC**	**SS**	**AT**	**TW**	**BI**	**PIE**			
Theoretical	**PMR**	27												27	100%
	VCD		24											24	100%
	VI		2	16	1				1					20	80%
	PR				31	1								32	97%
	PA		1		2	20					1			24	83%
	PC		1			1	16	1						19	84%
	SS							16						16	100%
	AT								20					20	100%
	TW									12				12	100%
	BI										12			12	100%
	PIE			1								23		24	96%

Note: N/A=Not Applicable

Item placements: **230** **Hits:** **217** **Overall Hit Ratio:** **94%**

4.13 Pilot study

The purpose of conducting pilot test is to determine the reliability of the survey instrument. Reliability is concerned with the level of consistency in measurement instrument. A pilot test is analogical to conducting a trial run to identify potential problems that may occur during the actual data gathering phase. It can also unveil the fundamental design issues of the survey instrument. The questionnaire was pilot tested among teachers from one primary and one secondary school who were not included in the main survey. Modifications and amendments were carried out based on the comments and feedbacks from the respondents of the pilot test study before the instrument is finally ready for use in the final survey study. The sample size for pilot test may range between 25 to 100 but does not need to be statistically chosen (Cooper & Schindler, 2003). Rossi, Wright and Anderson (1983) opined that 20 to 50 respondents in a pilot test are adequate in finding questionnaire errors. Therefore, in this study, a targeted sample size of 100 respondents was chosen. From the 100 samples, 75 were usable hence the response rate is 75%. The aim of the pilot test is to assess construct reliability and clarity of the instrument. Minor amendments and changes were performed based on the comments and feedbacks from the respondents of the pilot study before the instrument is used for the final field work.

4.13.1 Construct reliability

Construct reliability refers to the fact that "a scale should always reflect the construct it is measuring" (Leong et al., 2011, p. 506). The reliability test was carried out using SPSS Statistics 21 software based on the Cronbach's alpha coefficient. Using an iterative procedure, items that are poor in contribution to the alpha coefficient were dropped. The preliminary alpha values for the constructs in the pilot study are shown in Table 4.10. These alpha values range from 0.713 to 0.976 which are greater than the

recommended threshold of 0.70 (Hair, William, Barry & Rolph, 2010). Therefore, it is concluded that the instrument possesses a very good degree of construct reliability.

Table 4.10: Construct reliability (Cronbach's alpha)

Construct	Initial number of items	Initial Cronbach's Alpha	Final number of items	Final Cronbach's Alpha
PR	8	0.792	8	0.792
PA	7	0.713	7	0.713
PC	6	0.526	3	0.730
PMR	7	0.940	7	0.940
VCD	6	0.932	6	0.932
VI	4	0.902	4	0.902
SS	4	0.943	4	0.943
AT	5	0.976	5	0.976
TW	3	0.946	3	0.946
BI	3	0.962	3	0.962
PIE	6	0.968	6	0.968

Note: N=75; PR=Perceived Relatedness, PA=Perceived Autonomy, PC=Perceived Competence, PMR=Perceived Media Richness, VCD=VLE Content Design, VI=VLE Interactivity, SS=School Support, AT=Attitude toward knowledge sharing, TW=Trust in Website, BI=Behavioral Intention, PIE=Perceived Instructional Effectiveness.

4.13.2 Final survey instrument

Based on the rigorous validation processes, the final version of the survey instrument was developed. The instruments consisting of phases one and two are shown in Appendix E.

4.14 Steps involved in instrument development

The summary of the steps taken in developing the instrument are illustrated in Figure 4.3.

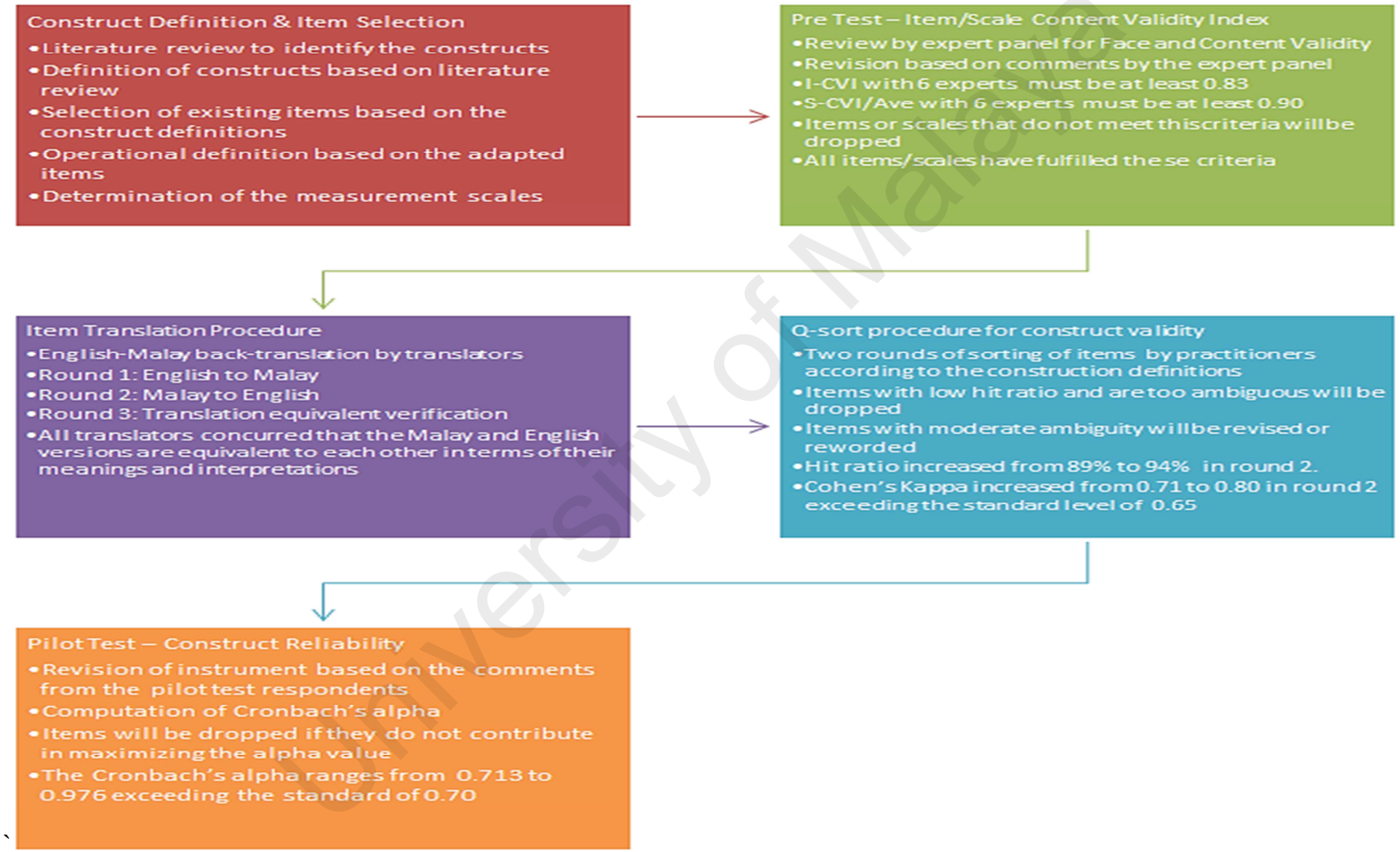


Figure 4.3: Instrument development steps

4.15 Fieldwork study

4.15.1 Population and sample

As on 31 Dec 2014, the population of the Malaysian school teachers is 419,820 in 10,154 schools. For the study, the sampling frame is the list of 351 Frog champion schools (Appendix A). Champion schools are selected as these schools are given priority in obtaining training from FrogAsia and serve as the benchmarks for other schools to emulate. Out of this, 50 schools were randomly selected across the country (Appendix B). The random selection was scientifically conducted using simple random numbers generated by online random number generator. Based on the 50 random numbers generated, champion schools with the corresponding numbers were selected as the samples for this study.

4.15.2 Consent of study

Before data collection can commence, approvals were obtained from the Educational Planning and Research Division (EPRD) of the Ministry of Education (MoE), Malaysia. The approval letter from MoE was attached with the application for consent of study letters to all state education departments (JPN). For state education departments that required approvals from the district education departments, copies of the letters from EPRD and JPNs were attached with the application letters to the relevant district education offices (PPD). While for PPDs that required approvals from the school administrators (headmasters / principals), copies of the approval letters from EPRD, JPN and PPD were attached with the application letters to the relevant schools.

The application for the EPRD was done through the online Education Research Application Portal (ERAS) available at http://eras.moe.gov.my/eras/. After registration process, information about the study is entered into the portal with supporting

documents of research proposal, survey instrument, support letter from University of Malaya (Appendix F) and the list of sample schools. Once the approval was granted, the approval letter was downloaded from the portal and then copies of the letters were sent as attachments to all JPNs in all the states and federal territories, relevant PPDs and schools. A sample of this approval letter is shown in Appendix G. A sample copy of application letter to the JPNs is shown in Appendix H while sample copy of application letter to PPDs and schools are shown in Appendix I and J respectively. The copies of approval letters from JPNs, relevant PPDs and schools are shown in Appendix K, L and M respectively.

4.15.3 Data gathering procedure

Data gathering was conducted in two phases with a gestation period of four months. In phase one (T1), the demographic profiles and exogenous variables were collected while in phase two (T2), data on endogenous variable was collected. Initially, 1720 questionnaires were sent out and 1325 and 950 were returned in T1 and T2 respectively. However as a result of mismatch in the tracking numbers, double entries and incompleteness of responses (Chou, Seng-cho, Jiang & Klein, 2013; Hu, Zhang, Ngai, Cai & Liu, 2013; Wang et al., 2009), 615 final samples were used for the final data analyses.

4.15.4 Unit of analysis

Zikmund (2000) defined unit of analysis as the degree of exploration the study focuses on and the type of analysis including individuals, groups or dyads. It is imperative to disclose the unit of analysis prior to the commencement of this study as all variables is encompassed in the research model; the data gathering procedure and sample size are affected by the unit of analysis (Zikmund, 2000). In this study, the unit

of analysis is the Malaysian school teacher. Since the school teachers are the direct users of the Frog VLE system, they are the most suitable to answer all the questions in the survey instruments.

4.15.5 Data analysis plan

The quantitative approach in this study requires data to be collected and then analyzed statistically to test the hypotheses. Generally, two major statistical softwares were engaged, namely Statistical Packages for Social Science (SPSS) and SmartPLS.

SPSS was used for the following analyses:

a) descriptive statistics (i.e. demographic profiles of the respondents)
b) construct reliability (i.e. Cronbach's alpha)
c) multivariate assumptions (normality, linearity, homoscedasticity, multicollinearity)
d) common method bias (i.e. Harman's single factor)
e) non-response bias (i.e. independent t-test, chi-square test)
f) correlation analysis (i.e. Pearson's correlation coefficients)

Partial Least Square or PLS refers to "a predictive statistical approach for modeling complex multivariate relationships between observed and latent outcomes" (Vinzi, Chin, Henseler & Wang, 2010, p. 1). PLS enables for the estimation of "causal theoretical network of relationships linking latent complex concepts, each measured by means of a number of observable indicators" (Vinzi et al., 2010, p. 2). PLS was originally developed by Herman Wold in 1982 who originally structured PLS as soft modeling (Hair, Hult, Ringle & Sarstedt, 2014) technique for estimating Structural Equation Model (SEM). Soft modeling is the ability of PLS to handle modeling with more

flexibility than the traditional multivariate analysis. Traditional SEM enables the estimation and analysis of relationships that exist between latent and observed variables.

Lately, the popularity of PLS has risen and the attractiveness is due to the fact that PLS may be adopted when theories are less established, and for explaining particular pre-specified constructs when causal effects are used for complicated models with many variables that are estimated without making assumptions about prior data distribution (Hair et al., 2014). Generally, there are four matters related to PLS-SEM approach namely, the data, PLS-SEM algorithm, model properties and model evaluation issues (Hair et al., 2014). PLS is a technique that allows formative measurement of constructs. However, it is unsuitable for theory testing or when rigorous confirmatory structuring is mandatory.

A PLS path model is separated into three sections namely the measurement model, the structural model and the weighting scheme. The measurement model is also known as the outer model; links manifest (observed) variables to latent variables (LV). In addition, manifest variables are also known as indicators while LV also known as factors and the association between constructs and manifest variable are known as weights or formative measures and the link of constructs to indicator in reflective measures is known as loadings. When indicator variables are linked to one LV, they are known as a block and a block can only hold a LV. Indicator variables can only be associated to one LV. Hence, each LV links to one block that has manifest variables.

The linkage of a block to LV can either be formative or reflective. In reflective measurement, each block of indicator variable reflects the LV (Monecke & Leisch, 2012). Reflective measures indicate that causation is directed from the construct to the

measures. In the reflective measures, the indicators are the consequences and the items are mutually interchangeable, which means that all indicator items are highly correlated and have the same association. On the other hand, for formative measures, it is presumed that constructs are caused by the indicators and the construct becomes the consequences (Rossiter, 2002).

The structural model is also known as the inner model, is a set of LV (unobserved constructs) linked to each other through an applicable theory. LV may be further categorized into endogenous (no external cause) and exogenous (having external cause).

SmartPLS is professional software for path modeling. Path models are "diagrams used to visually display the hypotheses and variable relationships that are examined when a structuring equation model is applied" (Hair et al., 2014, p. 27). SmartPLS allows for drag and drop of unobserved (latent) variables and apportions them to the indicators to the unobserved variables. The assessment tools for SmartPLS include PLS algorithm, bootstrapping as well as blindfolding methods. The PLS algorithm "estimates the path coefficients and other model parameters in a way that maximizes the explained variance of the dependent construct" (Hair et al., 2014, p. 74).

The computation of the PLS algorithm encompasses the estimation of the construct scores and then the computation of the estimated loadings and weights. Bootstrapping is utilized to test the coefficients for their significance without depending on distribution assumptions and it uses resampling method that gathers random sampling with replacement from the data sample to estimate the path models. At every run, samples yield different outcomes due to the random process. In addition, weights are the relationships between the constructs and the indicator whereas loading is the association

between constructs in reflective models. Furthermore, the weighting scheme estimates the inner weights, detecting three forms of weighting schemes, namely a path weighting scheme, centroid weighting scheme and factorial weighting scheme.

In formative measurement model, the latent variable is created from the manifest variables through ordinary least multiple regressions (Monecke & Leisch, 2012). If all latent variables are measure using reflective model, they are known as a reflective model and if all latent variables are measured formatively, they are called a formative model. A mixture of both reflective and formative models is known as Multi-block Model or MIMICS (Monecke & Leisch, 2012). After the data is imported into the SmartPLS, the 10 times rule of thumb was observed. The rule ensures a statistical power of 80% at 5% significant level.

In the structural model, SmartPLS forecasts the capacity of a model and the associations between constructs (Hair et al., 2014). Moreover, structural models are inspected to estimate path coefficients and the main measures are significant path coefficients and the degree of R^2 values explicates the amount of variance of the endogenous constructs in the structural model. The Geisser-Stone's predictive relevance (Q^2) is obtained using blindfolding of resamples.

In this study, SmartPLS is used for the following analyses:

a) assessment of the measurement model (i.e. convergent validity, discriminant validity, composite reliability, square correlation, cross-loadings)
b) path analysis of the structural model (i.e. bootstrapping)
c) mediation effect (i.e. Baron-Kenny's approach, Sobel's test)
d) direct, indirect and total effect

Descriptive statistics

To describe the demographic profile of the respondents, descriptive statistical analysis was engaged. The basic statistics include frequency and percentage. This constitutes the first section of the survey and it contains information about the age, gender, educational level, teaching experience and etc.

Testing multivariate assumptions

To perform multivariate data analysis, there are several basic assumptions that need to be fulfilled and these include normality in data distribution, linearity in relationships, homoscedasticity of variance and multicollinearity problem. To assess normality of the distribution, one sample Kolmogorov-Smirnov test was conducted and a p-value of at least 0.05 indicates normal distribution (Hair, Hult, Ringle & Sarstedt, 2013). For linearity, p-value greater than 0.05 on deviation from linearity implies existence of a linear relationship. If p-value is less than 0.05, further verification was performed using Ordinary Least Squares and if the p-value is less than 0.05 then linearity is validated. To evaluate homoscedasticity, scatter plot of standardized residuals was engaged and evenly distributed residuals along a straight line show the existence of homoscedasticity. Finally, multicollinearity problem is examined using Pearson's correlation analysis and a correlation coefficient larger than 0.90 indicates existence of multicollinearity problem. To further rule out the issue of multicollinearity, Variance Inflation Factor (VIF) less than 10 and tolerance greater than 0.10 were also used (Malhotra & Birks, 2007).

Reliability analysis

Reliability analysis is used to ensure consistency of the measurement instrument. Reliability is measure using Cronbach's alpha and to achieve an adequate level of reliability, the Cronbach's alpha must be greater than 0.70 (Hair et al., 2013; Sekaran, 2003). If not, items of the variable may need to be deleted as suggested by the analysis in order to raise the alpha value.

Even though the items of the instrument were adapted from previous studies, reliability analysis is needed. This is because the context, scope and the target population of the study is different from the previous studies.

4.16 Covariance-based SEM vs. Variance-based SEM vs. ANN

In order to perform further statistical analyses, the appropriate approach needs to be determined first. Generally there are three statistical approaches to be engaged namely the covariance-based structural equation modeling (CBSEM), the variance-based SEM (VBSEM) and artificial neural network (ANN). For each of these approaches dedicated statistical package is used. For instances, LISREL, AMOS, EQS, MPlus and etc. are statistical packages for CBSEM while SmartPLS, PLS-Graph, Visual PLS, WarpPLS, 'R' and etc. are specifically tailored for VBSEM. Finally, SPSS Clementine Neural Network module, SAS Neural Network Add-On, Tiberius, WinNN and etc. are designed for ANN analysis. Figure 4.4 depicts the comparison between these three statistical approaches.

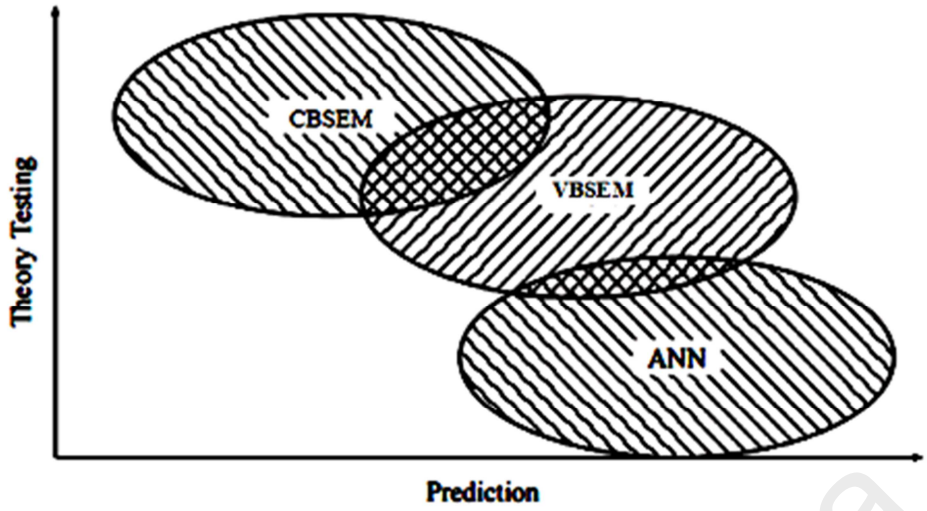


Figure 4.4: Comparison between CBSEM, VBSEM and ANN (Henseler, Ringle & Sinkovics, 2009)

4.16.1 Criteria for CBSEM, VBSEM and ANN approach

Basically, there are two main criteria to be used in determining which statistical approach is the most appropriate for a study. These include adherence to the multivariate assumptions and the aim or nature of the study.

4.16.2 Adherence to the multivariate assumptions

CBSEM requires that all multivariate assumptions should be adhered to. Any violations to the multivariate assumptions would lead to invalid statistical results. These assumptions are:

a) Normality of distribution

b) Linearity of relationships

c) Absence of multicollinearity problem

d) Absence of homoscedasticity

e) Absence of outliers

f) Adequate or large sample size

VBSEM requires less stringent multivariate assumptions as it is robust against outliers, non-normality and small sample size. However, ANN is the most lenient statistical approach as it is robust against not only outliers, non-normality but also non-linearity. In fact, ANN is able to detect both linear and non-linear relationships.

4.16.1.2 Aim or nature of the study

The aim or nature of the study will determine which statistical approach is the most appropriate one. If the aim of the study is exploring a new theory (exploratory study) then VBSEM will be the most suitable one as it is capable of maximizing the percentage of variance explained. However, if the aim of the study is to confirm a theory (confirmatory study) then CBSEM will be the best choice as it is capable of assessing the model fit between the hypothesized model and the dataset. Hence, CBSEM requires stronger theoretical basis compared to VBSEM. Nevertheless, sometimes the aim of the study is neither theory building nor theory confirmation but more on prediction of behavior or outcome where there are no or very weak theoretical foundations and underlying hypotheses. This is the time when ANN comes into action. ANN engages artificial neurons that are interlinked with synaptic weights. It is able to learn through iterative training sessions. By minimizing the error terms, it is able to produce prediction with very high degree of accuracy.

4.17 PLS analysis

In order to perform PLS analysis, the data in SPSS need to be exported as comma separated values (CSV) format. After that the data will be imported into the SmartPLS for further analysis. In accordance to Anderson and Gerbing (1988), a two-stage approach was used for the PLS SEM analysis. For the first stage, the quality of the measurement model was evaluated using the PLS Algorithm. This is to assess the

convergent validity, discriminant validity and construct reliability of the measurement. Convergent validity is validated if the Average Variance Extracted (AVE) is greater than 0.50 (Leong, Hew, Ooi & Lin, 2012). Discriminant validity is validated using Fornell-Larcker's criterion. According to the criterion, if the square root of the AVE is greater than its correlation coefficients then discriminant validity is verified. Finally, construct reliability is assessed based on Cronbach's alpha and composite reliability of at least 0.70 (Hair et al., 2013). To measure the predictive power, square correlation or R-square was used. An R-square of 0.10 or more implies acceptable predictive power (Hair et al., 2013).

After the first stage has completed, the second stage starts to analyze the structural model. By using bootstrapping with 5000 samples with no sign changes, the hypothesis is tested based on the p-value. A p-value of less than 0.05 indicates significant relationship between the independent and the dependent variables.

In this study, SmartPLS was used due to several reasons. First of all, since the distribution of data is not normal, therefore it has violated the one of the multivariate assumptions required by CBSEM analysis. Therefore CBSEM software such as AMOS, LISREL and etc. are not suitable to be used. Secondly, since the aim of the study is theory building and not theory testing, VBSEM (i.e. SmartPLS) is more suitable compared to CBSEM. Third, since one of the objectives of the study is to maximize the percentage of variance explained and not maximizing model fit indices, therefore SmartPLS is comparatively more appropriate than CBSEM software like AMOS and etc. Finally, since the research model is complex with 11 constructs and 59 indicators, therefore SmartPLS would be more suitable compared to CBSEM such as AMOS and etc.

4.18 Chapter summary

This chapter has provided detail explanations of the research methodology including the rigorous instrument development and validation processes. It starts with the research design and then followed by the comprehensive instrument development and validation processes. These include an analysis of the existing grid computing VLE instruments, operationalization of scales, sample and population, sample size, pre-test, face validity, content validity, expert panel, English back translation, construct reliability, Q-sort procedure, pilot study, data gathering procedures and a chapter summary. The next chapter will discussed the results from the data analyses from the gathered data.

CHAPTER 5: RESULTS

5.1 Introduction

For the exploratory study in stage 1, SPSS version 21 was used to assess the reliability and validity of the items and constructs. In the full study, the variance based SmartPLS 3.0 (Ringle, Wende & Will, 2015) was used because the aim of the research is for theory building rather than theory confirmation. Post-hoc qualitative analysis via personal face-to-face interview will be conducted if there is no strong indicator of a particular factor.

5.2 Data screening

Data screening was carried out to ensure that all data is indeed reliable and valid for statistical analyses. Missing data and outliers were examined during the data screening process.

5.2.1 Missing data

Since the data are missing at random without any particular patterns, therefore incomplete questionnaires with missing data were removed prior to data entry (Tabachnick & Fidell, 2013). Besides that, questionnaires with double entries were also discarded. This leads to a usable sample of 615 questionnaires.

5.2.2 Outliers

To detect outliers, Mahalanobis distance, d^2 is examined using SPSS 21. The Chi-square cumulative distribution function's p-values are then computed. The data set is then sorted in ascending order according to the p-values. Based on the p-values that are

less than 0.001, seven outliers were detected and removed from the data set. Therefore, the final usable sample is 608 questionnaires.

5.3 Tests of multivariate assumptions

Prior to further statistical analyses, several multivariate assumptions need to be fulfilled. These include normality, linearity, multicollinearity and homoscedasticity tests.

5.3.1 Normality test

To test normality of the distribution, the one-sample Kolmogorov-Smirnov normality test was performed as the sample size is larger than 30. If the p-values are greater than 0.05 then normal distribution is assumed. Appendix T shows that all items are not normally distributed as their p-values are less than 0.05.

5.3.2 Linearity tests

To test the linearity assumption, the p-value of the deviation from linearity was used. If the p-value are greater than 0.05 then linearity is assumed. If the p-value is less than 0.05 then further validation was done using the Ordinary Least Squares (OLS) test. Appendix U shows results of the deviation from linearity tests while Appendix V shows the results of the OLS tests. Based on these results it is concluded that the assumption of linearity has been fulfilled.

5.3.3 Multicollinearity tests

Multicollinearity is the condition where two or more independent variables are highly correlated. The problem of multicollinearity may lead to diminish of the independent variables' effects due to their strong inter-relationships.

Variance Inflation Factor and Tolerance

The common measure to evaluate multicollinearity is the Variance Inflation Factor (VIF) with tolerance. The standard recommended values of VIF less than 10.0 and tolerance more than 0.10 are taken as the criteria for non-existence of multicollinearity problem. Table 5.1 shows that all VIFs are less than 10.0 and all tolerances are greater than 0.10. Therefore, it is concluded that there is no problem of multicollinearity.

Table 5.1: Multicollinearity test

Coefficients[a]			
Model		Collinearity Statistics	
		Tolerance	VIF
1			
	PMR	0.335	2.984
	VCD	0.349	2.866
	SS	0.570	1.754
	AT	0.488	2.050
	TW	0.541	1.848
	PR	0.631	1.584
	PA	0.450	2.223
	PC	0.524	1.909
	Specialization	0.971	1.030
	Teaching Experience	0.863	1.159
	Education	0.892	1.121

a. Dependent Variable: BI

Note: PMR=Perceived Media Richness, VCD=VLE Content Design, VI=VLE Interactivity, SS=School Support, AT=Attitude toward knowledge sharing, TW=Trust in Website, PR=Perceived Relatedness, PA=Perceived Autonomy, PC= Perceived Competence, BI=Behavioural Intention.

Pearson's Correlation Analysis

Another method for testing multicollinearity is by using Pearson's correlation analysis. A recommended correlation coefficient of more than 0.80 is used as the criterion of the existence of multicollinearity problem (Hair et al., 2010). Table 5.2 shows that all correlation coefficients are less than 0.80 and therefore it is concluded that there is no problem of multicollinearity.

Table 5.2: Pearson's correlation analysis

Correlations

	PMR	VCD	VI	SS	AT	TW	BI	PIE	PR	PA	PC
PMR	1										
VCD	0.776**	1									
VI	0.778**	0.748**	1								
SS	0.513**	0.537**	0.459**	1							
AT	0.447**	0.477**	0.366**	0.535**	1						
TW	0.586**	0.573**	0.560**	0.494**	0.513**	1					
BI	0.662**	0.645**	0.631**	0.589**	0.545**	0.651**	1				
PIE	0.533**	0.514**	0.517**	0.381**	0.343**	0.420**	0.533**	1			
PR	0.251**	0.278**	0.174**	0.375**	0.575**	0.333**	0.349**	0.204**	1		
PA	0.573**	0.532**	0.512**	0.347**	0.318**	0.441**	0.547**	0.420**	0.266**	1	
PC	0.446**	0.424**	0.392**	0.252**	0.290**	0.353**	0.441**	0.337**	0.298**	0.666**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Note: PMR=Perceived Media Richness, VCD=VLE Content Design, VI=VLE Interactivity, SS=School Support, AT=Attitude toward knowledge sharing, TW=Trust in Website, PR=Perceived Relatedness, PA=Perceived Autonomy, PC= Perceived Competence, BI=Behavioural Intention, PIE=Perceived Instructional Effectiveness.

5.3.4 Homoscedasticity test

Homoscedasticity is the condition when the variance of the dependent variable is not evenly distributed and concentrated in a limited range only. The existence of homoscedasticity is indicated by uneven shapes of scatter plot. The opposite for homoscedasticity is heteroscedasticity. To assess homoscedasticity, scatter plot was used to identify any uneven shapes such as cone or circle. Appendix W shows that all standardized residuals of the dependent variables are scattered evenly along straight diagonal lines. Thus, it is concluded that there is no existence of homoscedasticity and the heteroscedasticity is therefore supported.

5.4 Demographic profile

The demographic profile of the respondents in the study is listed in Table 5.3. The 608 respondents are consisting of 36.5% primary and 63.5% secondary school teachers. 19.7% of them are male teachers and 80.3% are female teachers. This reflects the actual gender imbalanced population whereby female teachers are the dominant sex (The Star, 2 June, 2015). In terms of age brackets, the sample is almost normally distributed with 41.9% aged between 31 to 40 years old. In terms of salary schemes, 85.6% of them are drawing the graduate salary schemes from DG41 to DG54 and the remaining 14.6% are drawing the salary schemes of DG29 to DG38. In terms of highest educational qualification, 86.1% are graduates and only 13.9% are non-graduates. From the perspective of specialization, 68.1% of the teachers specialized in Arts and 31.9% specialized in Science. Almost half of the teachers (49.6%) have less than 10 years of teaching experience, 15.5% with 11 to 15 years of experience, 16% have 16 to 20 years of experience and 18.9% have more than 20 years of teaching experience.

Among the respondents, 564 or 92.8% have already attended VLE training and only 44 or 7.2% have yet to attend the training. 56.9% of the respondents have attended 1 to 3 times of VLE trainings, 20.1% attended 4 to 6 times of trainings and 6.2% attended 7 to 10 times of trainings. In terms of use experience, 91% of the teachers have experience in using the VLE and only 9% are inexperience. This may happen as some of the teachers are newly posted, replacement or temporary teachers and have yet to be exposed to the system. In terms of experience duration, 36% have less than 10 months of experience, 22.9% have 11 to 20 months of experience, 30.6% have 21 to 30 months of experience and 10.6% have more than 31 months of experience in using the VLE.

In terms of readiness to use the VLE, 41% of the teachers are ready, 29.6% quite ready, 17.3% not sure, 6.7% quite not ready and only 5.4% are not ready. The most popular usage of the VLE is for teaching (35.1%), followed by collaboration or sharing of ideas (23%), communication or discussion (17.1%), evaluation and assessment (11.4%), entertainment, leisure of past times (7%) and guidance and counseling (2.6%). From the context of obstacles encountered in using the VLE, 48.5% are technical problems (no WiFi connection, malfunction, slowness or instability of network connection and lack of computers and other facilities) while 50.7% are related to skill, time and teaching material. In the perspective of weekly teaching periods, 13.7% of the teachers have less than 15 periods, 82.8% has 16 to 30 periods and the rest have more than 30 periods per week. On the other hand, 94.4% of the teachers used less than 5 periods for class room instructions, 4.9% used 6 to 15 periods and the rest used more than 16 periods for weekly class room instructions. Finally, 95.2% of the teachers used less than 5 hours per week for non-class room teaching activities and 3.1% used between 6 to 10 hours and the rest used for more than 10 hours per week.

Table 5.3: Demographic profile of respondents

		Frequency	Per cent
Category of teacher	Primary School	222	36.5
	Secondary School	386	63.5
Gender	Male	120	19.7
	Female	488	80.3
Age (years)	20 - 25	24	3.9
	26 - 30	104	17.1
	31 - 35	140	23.0
	36 - 40	115	18.9
	41 - 45	91	15.0
	46 - 50	77	12.7
	51 - 55	47	7.7
	56 - 60	10	1.6
Scheme of salary (DG)	29	14	2.3
	32	42	6.9
	34	30	4.9
	38	2	0.3
	41	279	45.9
	42	9	1.5
	44	178	29.3
	48	50	8.2
	52	3	0.5
	54	1	0.2
Highest education qualification	SPM (O-Level)	25	4.1
	STPM (A-Level)	18	3.0
	Certificate	1	0.2
	Diploma	40	6.6
	Advanced Diploma	1	0.2
	Bachelor Degree	482	79.3
	Master Degree	40	6.6
	PhD or Doctoral Degree	1	0.2
Specialization	Arts	414	68.1
	Science	194	31.9
Teaching experience (years)	1 - 5	145	23.8
	6 - 10	157	25.8
	11 - 15	94	15.5
	16 - 20	97	16.0
	21 - 25	49	8.1
	26 - 30	50	8.2
	31 - 35	13	2.1
	36 - 40	3	0.5
Attended VLE training	Yes	564	92.8
	No	44	7.2

Table 5.3 continued

Number of trainings attended	0	44	7.2
	1	191	7.2
	2	111	31.4
	3	103	18.3
	4	60	9.9
	5	45	7.4
	6	17	2.8
	7	4	0.7
	8	15	2.5
	10	18	3.0
VLE experience	Yes	553	91.0
	No	55	9.0
Experience in using VLE (months)	0 - 10	219	36.0
	11 - 20	139	22.9
	21 - 30	186	30.6
	31 - 40	52	8.6
	41 - 50	11	1.8
	51 - 60	1	0.2
Readiness to use VLE	Ready	249	41.0
	Quite Ready	180	29.6
	Not Sure	105	17.3
	Quite Not Ready	41	6.7
	Not Ready	33	5.4
Purpose for using the VLE	Teaching	454	35.1
	Evaluation and Assessment	147	11.4
	Communication / Discussion	221	17.1
	Collaboration / Sharing Ideas	297	23.0
	Guidance and Counselling	34	2.6
	Entertainment / Leisure / Past Times	91	7.0
	Others	50	3.9
Obstacles faced in using the VLE	No WiFi Internet connection	84	6.4
	WiFi Internet connection not functioning or frequently out of order	76	5.8
	Slow Network Connection	210	15.9
	Poor Network Stability	185	14.0
	Lack of skills in using the Frog VLE	178	13.5
	Lack of time to prepare the Frog VLE contents due to too many teaching periods	203	15.4
	Lack of time to prepare the Frog VLE materials due to too much administrative work	224	17.0
	Lack of computers and other facilities	84	6.4
	Lack of teaching materials provided in the Frog VLE	63	4.8
	Others	12	0.9

Table 5.3 continued

Weekly teaching periods	0 - 5	37	6.1
	6 - 10	14	2.3
	11 - 15	32	5.3
	16 - 20	83	13.7
	21-25	251	41.3
	26-30	169	27.8
	31 - 35	17	2.8
	36 - 40	5	0.8
Weekly VLE class room instruction (periods)	0 - 5	574	94.4
	6 - 10	22	3.6
	11 - 15	8	1.3
	16 - 20	3	0.5
	21 - 25	1	0.2
Weekly VLE usage besides class room instruction (hours)	0 - 5	579	95.2
	6 - 10	19	3.1
	11 - 15	6	1.0
	>= 16	4	0.7

5.5 Descriptive statistics

In terms of weekly periods of VLE classroom instruction, the mean is 1.30 with standard deviation of 2.695. This indicates that on average the respondents of this study spent 1.3 periods or about 52 minutes each week in using VLE for classroom teaching. Besides the classroom VLE instruction, the respondents also spent on average 1.86 hours or 111.6 minutes with standard deviation 9.425 each week using the VLE beyond the classroom boundary. In terms of age, the average age of the respondents is 38.18 years with standard deviation of 8.362 while the average teaching experience of the respondents is 12.69 years with standard deviation of 8.651. From the perspective of training, on average the respondents have attended 2.66 times of trainings with standard deviation of 2.193. In terms of experience in using the VLE, on average the respondents have 16.16 months of experience with standard deviation of 11.819. Finally, the average weekly teaching periods of the respondents is 22.22 periods with standard deviation of 7.312. The detail of the descriptive statistics is shown in Table 5.4.

Table 5.4: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Weekly VLE classroom instruction (periods)	608	0	21	1.30	2.695
Weekly VLE usage besides class room instruction (hours)	608	0	160	1.86	9.425
Age (years)	608	22	60	38.18	8.362
Teaching experience (years)	608	1	38	12.69	8.651
Frequency of training (times)	608	0	10	2.66	2.193
Experience in using VLE (months)	608	0	60	16.16	11.819
Weekly teaching periods	608	0	37	22.22	7.312

5.6 Common Method Bias (CMB)

Even though the data gathering was conducted in two waves of survey (T1 & T2) to reduce the CMB however there still will be some possibility of CMB issue that may arise. Procedural and statistical measures were taken to reduce and examine the CMB issue. In terms of procedural measure, respondents were assured of anonymity of their identities. Besides that they were also told that there are no correct or wrong answers. Besides that difference response formats were used in the survey. For example, the measure for teaching experience was ratio scale and for other constructs, 7-point Likert scales were used. Finally, well established items with clear meanings were used in the surveys. Besides that, CMB was also assessed statistically by using Harman's Single Factor. Harman's Single Factor was performed using Exploratory Factor Analysis (EFA) with no rotation. The result showed that the single factor explains 39.015% of the variance. Since this is less than 50.0% the issue of CMB does not arise.

Finally, as recommended by Liang, Saraf, Hu and Xue (2007), Podsakoff et al. (2003) and Williams, Le´vesque, Zeldman, Wright and Deci (2003), method factor analysis was used to further confirm the CMB issue. In order to perform this analysis, a method factor was constructed by using all the indicators of the major constructs as its indicators. Besides that all indicators have been transformed to single-indicator

constructs therefore making all constructs become second order constructs (Figure 5.1). Using bootstrapping with 5000 samples and no sign changes, the model was run to obtain the substantive factor loadings and method factor loadings. Based on these factor loadings, the substantive variance and method variance were calculated by squaring the factor loadings of the substantive and method constructs. Table 5.5 shows that all substantive variances are substantially larger than the method variances. Besides that majority of the method factor loadings have negative or small values and are non-significant. The ratio of substantive variance to method variance is 135:1 and 68.8% of the method factor loadings are non-significant. Hence, it is confirmed that there is no issue of CMB in this study.

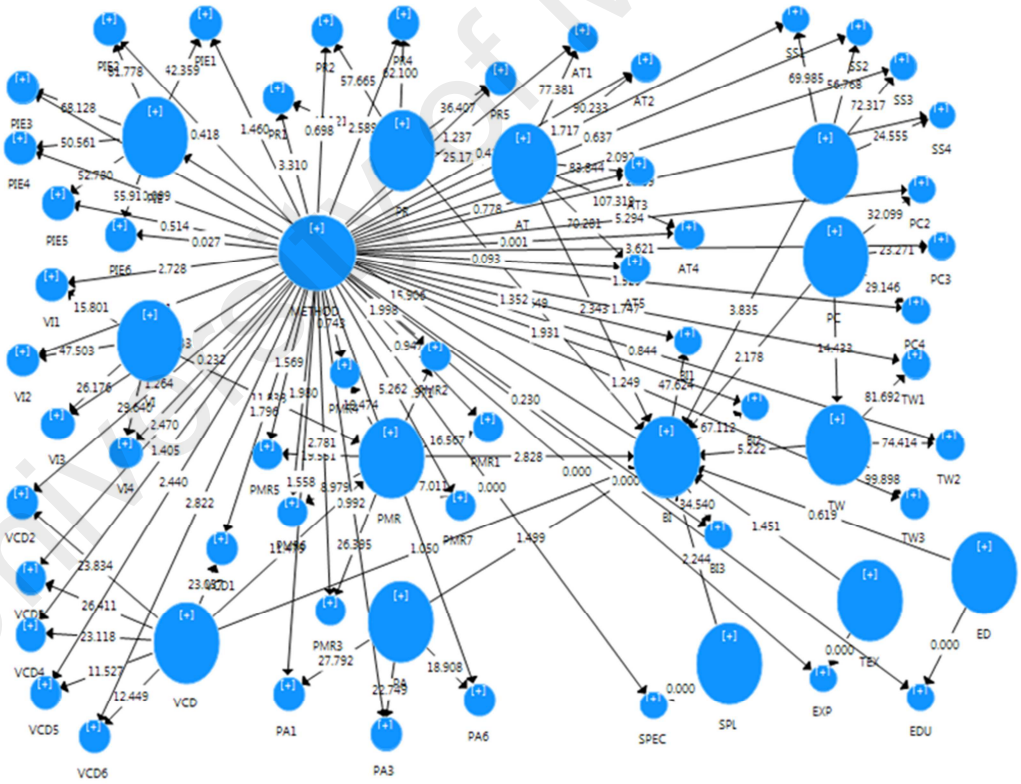


Figure 5.1 : Substantive and method factor loadings

Table 5.5 : Substantive and method factor loadings and variance

Construct	Indicator	Substantive factor loading (R1)	R1 square	Method factor loading (R2)	R2 square
Attitude (AT)	AT1	0.965***	0.931	-0.018	0.000
	AT2	0.966***	0.933	0.006	0.000
	AT3	0.956***	0.914	0.011	0.000
	AT4	0.975***	0.950	0.000	0.000
	AT5	0.954***	0.910	0.001	0.000
Behavioral Intention (BI)	BI1	0.927***	0.858	0.031	0.001
	BI2	1.008***	1.015	-0.037	0.001
	BI3	0.966***	0.934	0.006	0.000
Perceived Autonomy (PA)	PA1	0.922***	0.850	-0.063	0.004
	PA3	0.893***	0.797	-0.042	0.002
	PA6	0.768***	0.589	0.105*	0.011
Perceived Competence (PC)	PC2	0.981***	0.962	-0.204***	0.042
	PC3	0.768***	0.590	0.132***	0.017
	PC4	0.858***	0.737	0.051	0.003
Perceived Instructional Effectiveness (PIE)	PIE1	0.884***	0.781	0.036	0.001
	PIE2	0.945***	0.894	-0.007	0.000
	PIE3	0.942***	0.888	-0.018	0.000
	PIE4	0.915***	0.837	0.002	0.000
	PIE5	0.915***	0.838	-0.013	0.000
	PIE6	0.920***	0.847	0.001	0.000
Perceived Media Richness (PMR)	PMR1	0.824***	0.680	0.048	0.002
	PMR2	0.822***	0.676	0.081*	0.007
	PMR3	0.990***	0.979	-0.120**	0.014
	PMR4	0.862***	0.742	0.033	0.001
	PMR5	0.832***	0.692	0.066	0.004
	PMR6	0.815***	0.664	0.089*	0.008
	PMR7	1.038***	1.078	-0.209***	0.044
Perceived Relatedness (PR)	PR1	0.839***	0.704	0.087**	0.008
	PR2	0.911***	0.830	0.016	0.000
	PR4	0.956***	0.914	-0.059*	0.003
	PR5	0.857***	0.734	0.024	0.001
School Support (SS)	SS1	0.966***	0.934	-0.034	0.001
	SS2	0.959***	0.920	-0.012	0.000
	SS3	0.977***	0.955	-0.037*	0.001
	SS4	0.813***	0.660	0.090*	0.008
Trust in Website (TW)	TW1	0.978***	0.957	-0.028	0.001
	TW2	0.960***	0.922	0.012	0.000
	TW3	0.967***	0.934	0.015	0.000

Table 5.5 continued

Construct	Indicator	Substantive factor loading (R1)	R1 square	Method factor loading (R2)	R2 square
VLE Content Design (VCD)	VCD1	0.955***	0.911	-0.087	0.008
	VCD2	0.950***	0.902	-0.054	0.003
	VCD3	1.008***	1.016	-0.105*	0.011
	VCD4	0.957***	0.917	-0.066	0.004
	VCD5	0.743***	0.552	0.152*	0.023
	VCD6	0.741***	0.550	0.164**	0.027
VLE Interactivity (VI)	VI1	0.753***	0.566	0.140**	0.020
	VI2	1.004***	1.007	-0.119**	0.014
	VI3	0.931***	0.866	-0.008	0.000
	VI4	0.874***	0.765	-0.008	0.000
Average variance			0.835		0.006

5.7 Non-response bias

Similar to Armstrong and Overton (1977), non-response bias was examined by comparing the responses from the early and late respondents. More specifically, the first and the last quartiles of the respondents were tested for significant differences across the means of the theoretical constructs under-studied using independent samples t-test (Ranganathan, Teo & Dhaliwal, 2011; Dong & Wang, 2011). The results showed that there are no significant differences between the early and late respondents on perceived media richness (t=-1.636, p=0.103), VLE content design (t=0.857, p=0.392), VLE interactivity (t=-0.215, p=0.830), school support (t=-0.539, p=0.590), attitude towards knowledge sharing (t=0.632, p=0.528), trust in website (t=-0.493, p=0.623), behavioral intention (t=0.696, p=0.487), perceived autonomy (t=-0.175, p=0.861) and perceived competence (t=0.214, p=0.831). Although the t-tests for perceived relatedness and perceived instructional effectiveness were found to be slightly significant, the researcher further validated these differences by using chi-square test of independence and found that the Pearson's chi-squares for perceived relatedness (χ^2=31.705, p=0.333) and perceived instructional effectiveness (χ^2=39.953, p=0.158)

were insignificant. Therefore, it is concluded that there is no non-response bias in the study.

5.8 SmartPLS Partial Least Squares Structural Equation Modeling

Based on the justification that the distribution of the data is not normally distributed, one of the multivariate assumptions has been violated. Therefore, CBSEM is not suitable to be used in this study. Besides that the study is exploratory in its nature as the purpose of the study is to maximize the percentage of variance explained in forecasting behavioral intention and instruction effectiveness of the Frog VLE system. Since there are strong theoretical foundations and underlying hypotheses, ANN is not suitable to be used in this study. The study is more on theory building rather than prediction of behavior. Furthermore the research model is very complicated with many constructs and indicators which make PLS-SEM a better option. If applied correctly, PLS-SEM would be the silver bullet in various researches (Hair et al, 2013).

As stated early, there are several statistical packages to be used for VBSEM. Due to its statistical power and user friendliness, SmartPLS 3.0 was chosen as the statistical package for PLS-SEM analyses. With over 2500 citations in academic publications, SmartPLS is one of the leading statistical packages for PLS analyses (Hair et al., 2013). SmartPLS is robust against outliers, non-normality and small sample size. It is capable of analyzing highly complicated model that involves both reflective and formative constructs. Besides PLS with path modeling algorithm, it is also able to perform ordinary least squares regression based on sum scores, advanced bootstrapping, blindfolding, importance-performance matrix analysis (IPMA), multi-group analysis (MGA), hierarchical component models (second order models), confirmatory tetrad

analysis (CTA), finite mixture (FIMIX) segmentation, prediction-oriented segmentation (POS) and etc.

5.9 Mean and Standard Deviation (SD) of items under each construct

The mean and SD of the items for each construct is shown in Table 5.6.

Table 5.6 : Mean and SD

Construct	Item	Mean	SD
Attitude toward knowledge sharing (**AT**)	AT1	5.28	1.140
	AT2	5.29	1.156
	AT3	5.28	1.171
	AT4	5.29	1.142
	AT5	5.27	1.167
Behavioural Intention (**BI**)	BI1	4.44	1.336
	BI2	4.54	1.313
	BI3	4.57	1.331
Perceived Autonomy (**PA**)	PA1	4.34	1.169
	PA2_R	4.33	1.373
	PA3	4.16	1.177
	PA4_R	4.11	1.218
	PA5	3.92	1.148
	PA6	4.06	1.126
	PA7_R	4.35	1.144
Perceived Competence (**PC**)	PC1_R	4.00	1.291
	PC2	3.75	1.228
	PC3	4.52	1.156
	PC4	4.06	1.124
	PC5_R	4.35	1.183
	PC6_R	4.36	1.287
Perceived Instructional Effectiveness (**PIE**)	PIE1	4.83	1.214
	PIE2	4.80	1.174
	PIE3	4.65	1.193
	PIE4	4.53	1.237
	PIE5	4.51	1.259
	PIE6	4.66	1.238
Perceived Media Richness (**PMR**)	PMR1	4.19	1.182
	PMR2	4.23	1.151
	PMR3	4.03	1.147
	PMR4	4.16	1.154
	PMR5	4.09	1.216
	PMR6	4.22	1.222
	PMR7	3.89	1.213
Perceived Relatedness (**PR**)	PR1	5.11	1.133
	PR2	5.23	1.169
	PR3_R	4.96	1.527
	PR4	5.50	1.186
	PR5	5.16	1.143
	PR6_R	5.26	1.455
	PR7_R	5.67	1.348
	PR8	5.37	1.233
School Support (**SS**)	SS1	4.96	1.370
	SS2	4.91	1.320
	SS3	5.11	1.369
	SS4	4.72	1.381

Table 5.6 continued

Construct	Item	Mean	SD
Trust in Website (**TW**)	TW1	4.66	1.272
	TW2	4.60	1.225
	TW3	4.63	1.255
VLE Content Design (**VCD**)	VCD1	4.15	1.067
	VCD2	4.23	1.114
	VCD3	4.22	1.072
	VCD4	4.23	1.110
	VCD5	4.50	1.161
	VCD6	4.51	1.164
VLE Interactivity (**VI**)	VI1	4.11	1.143
	VI2	3.69	1.188
	VI3	3.90	1.155
	VI4	3.59	1.291

5.10 Treatment of initial measurement model

The initial measurement model (Figure 5.2) consists of 14 reflective first order constructs and 62 indicators. However, before the measurement model was used for final statistical analyses, the measurement model was treated first in order to ensure that there are no indicators with outer loadings less than 0.708. Hair and Hult (2016) recommended that indicator reliability (i.e. square of outer loadings) should be at least 0.50 which means that the minimum outer loading should be not less than square root of 0.50 equivalent to 0.708. According to Hair and Hult (2016), for most instances, an outer loading of 0.70 is considered to be acceptable to be close enough to 0.708. Hence, in treatment of the initial measurement model, the cutoff point of 0.70 was used as a criterion for removing indicators with poor loadings if the removal is able to increase measurement quality (i.e. internal consistency reliability, composite reliability and AVE). The treatment of the initial measure model involved several iterations.

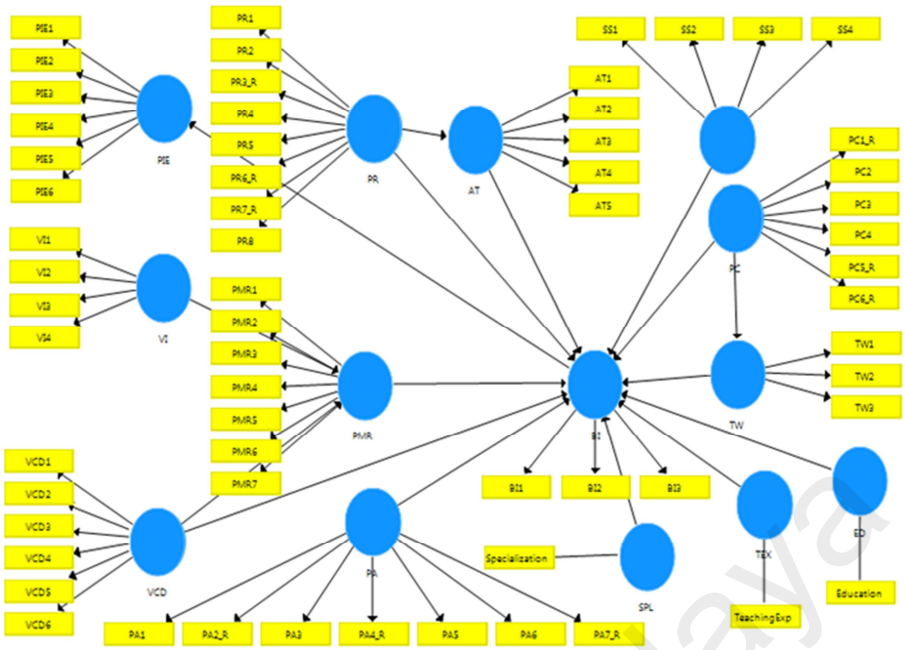


Figure 5.2: Initial measurement model

First iteration:

To perform the treatment on measurement model, PLS Algorithm in SmartPLS with 300 as the maximum number of iterations with 7 as the stopping criterion was engaged. Based on the PLS Algorithm result, outer loadings were examined one by one. Table 5.7 shows that there are 10 indicators with outer loadings less than 0.70, namely PA7_R (-0.150), PC5_R (-0.140), PA4_R (-0.089), PC1_R (- 0.001), PA2_R (0.020), PC6_R (0.045), PR3_R (0.149), PR6_R (0.261), PR7_R (0.373) and PA5 (0.652). The outers loadings of the indicators in the initial measurement model are shown in Figure 5.3. Hence, the indicator with the smallest outer loading (i.e. PA7_R) was first removed from the initial measurement model. The overview quality of the initial measurement model is shown in Table 5.8 and it indicates that PA and PC have Cronbach's alpha and composite reliability less than the recommended threshold of at least 0.70. Furthermore, the AVE for PA and PC are also less than the suggested threshold of 0.50. These show that further treatment is indeed required. Thus, with the removal of PA7_R from the initial measurement model, PLS Algorithm was performed in the second iteration.

Table 5.7 : Outer loadings of initial measurement model

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
AT1	0.952										
AT2	0.969										
AT3	0.963										
AT4	0.975										
AT5	0.955										
BI1		0.953									
BI2		0.977									
BI3		0.971									
PA1			0.828								
PA2_R			0.020								
PA3			0.842								
PA4_R			-0.089								
PA5			0.652								
PA6			0.860								
PA7_R			-0.150								
PC1_R				-0.001							
PC2				0.798							
PC3				0.878							
PC4				0.907							
PC5_R				-0.140							
PC6_R				0.045							
PIE1					0.911						
PIE2					0.943						
PIE3					0.931						
PIE4					0.915						
PIE5					0.904						
PIE6					0.919						
PMR1						0.868					
PMR2						0.894					
PMR3						0.883					
PMR4						0.889					
PMR5						0.890					
PMR6						0.894					
PMR7						0.854					
PR1							0.889				
PR2							0.916				
PR3_R							0.149				
PR4							0.916				
PR5							0.871				
PR6_R							0.261				
PR7_R							0.373				
PR8							0.848				
SS1								0.941			
SS2								0.950			
SS3								0.950			
SS4								0.879			
TW1									0.957		
TW2									0.970		
TW3									0.978		
VCD1										0.877	
VCD2										0.901	
VCD3										0.915	
VCD4										0.900	
VCD5										0.878	
VCD6										0.887	
VI1											0.866
VI2											0.904
VI3											0.924
VI4											0.871

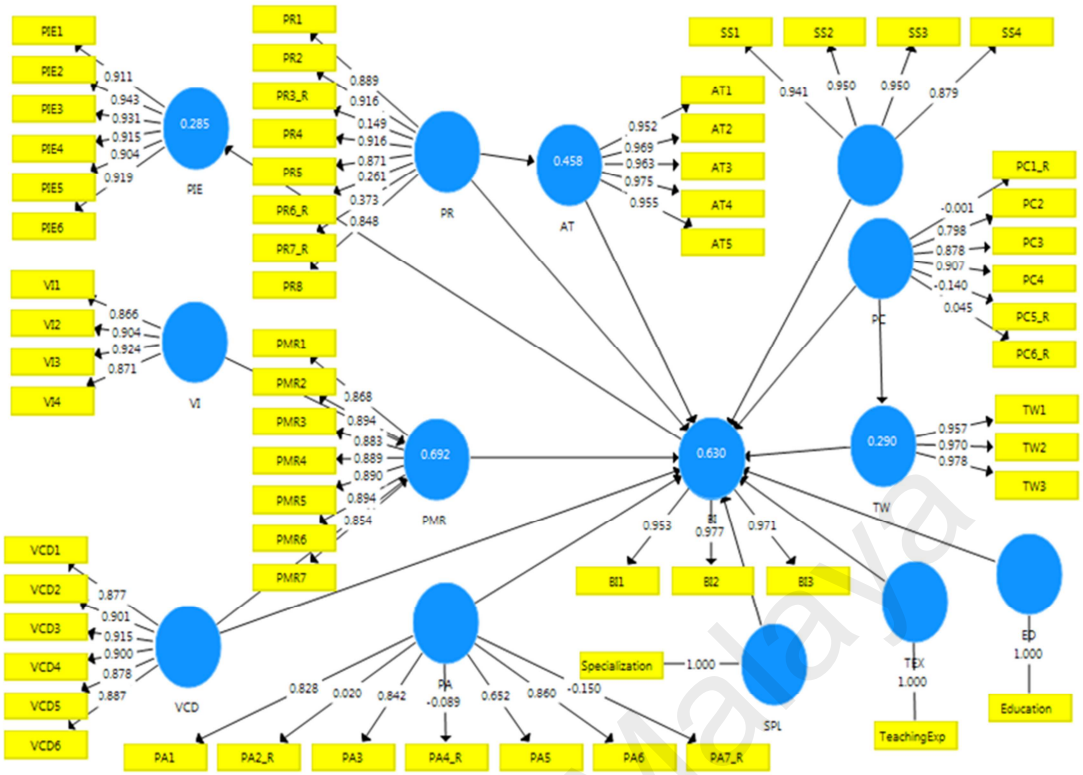


Figure 5.3: Outer loadings of initial measurement model

Table 5.8: Overview quality of initial measurement model

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
AT	0.980	0.985	0.927
BI	0.965	0.977	0.935
PA	0.570	0.666	0.370
PC	0.631	0.623	0.375
PIE	0.964	0.971	0.847
PMR	0.952	0.961	0.778
PR	0.856	0.877	0.522
SS	0.948	0.963	0.866
TW	0.967	0.978	0.938
VCD	0.949	0.959	0.797
VI	0.914	0.939	0.795

Note: AT = Attitude toward Knowledge Sharing, BI = Behavioral Intention, PA = Perceived Autonomy, PC = Perceived Competence, PIE = Perceived Instructional Effectiveness, PMR = Perceived Media Richness, PR = Perceived Relatedness, SS = School Support, TW = Trust in Website, VCD = VLE Content Design, VI = VLE Interactivity.

Second iteration:

After the removal of PA7_R, the composite reliability for PA has improved from 0.660 to 0.743. Besides that its Cronbach's alpha has also increased from 0.570 to 0.600 while the AVE also improved from 0.370 to 0.427. For the second iteration, Table 5.9 and Figure 5.4 show that the indicator PC5_R has the least outer loading of -0.140. Hence, PC5_R was removed from the measurement model.

Table 5.9: Outer loadings of second iteration

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
AT1	0.952										
AT2	0.969										
AT3	0.963										
AT4	0.975										
AT5	0.955										
BI1		0.953									
BI2		0.977									
BI3		0.971									
PA1			0.831								
PA2_R			0.039								
PA3			0.846								
PA4_R			-0.068								
PA5			0.645								
PA6			0.856								
PC1_R				-0.001							
PC2				0.798							
PC3				0.878							
PC4				0.907							
PC5_R				-0.140							
PC6_R				0.045							
PIE1					0.911						
PIE2					0.943						
PIE3					0.931						
PIE4					0.915						
PIE5					0.904						
PIE6					0.919						
PMR1						0.868					
PMR2						0.894					
PMR3						0.883					
PMR4						0.889					
PMR5						0.890					
PMR6						0.894					
PMR7						0.854					
PR1							0.889				
PR2							0.916				
PR3_R							0.149				
PR4							0.916				
PR5							0.871				
PR6_R							0.261				
PR7_R							0.373				
PR8							0.848				

Table 5.9 continued

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
SS1								0.941			
SS2								0.950			
SS3								0.950			
SS4								0.879			
TW1									0.957		
TW2									0.970		
TW3									0.978		
VCD1										0.877	
VCD2										0.901	
VCD3										0.915	
VCD4										0.900	
VCD5										0.878	
VCD6										0.887	
VI1											0.866
VI2											0.904
VI3											0.924
VI4											0.871

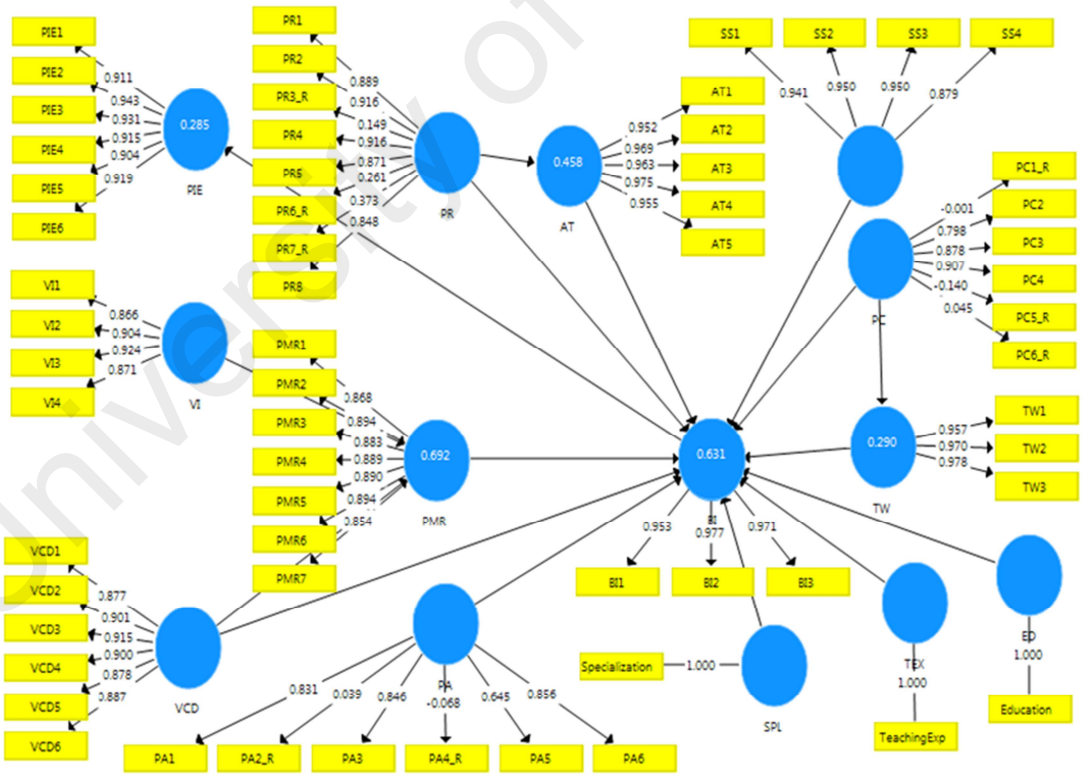


Figure 5.4: Outer loadings of second iteration

Table 5.10: Overview quality of second iteration

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
AT	0.980	0.985	0.927
BI	0.965	0.977	0.935
PA	0.600	0.743	0.427
PC	0.631	0.623	0.375
PIE	0.964	0.971	0.847
PMR	0.952	0.961	0.778
PR	0.856	0.877	0.522
SS	0.948	0.963	0.866
TW	0.967	0.978	0.938
VCD	0.949	0.959	0.797
VI	0.914	0.939	0.795

Note: AT = Attitude toward Knowledge Sharing, BI = Behavioral Intention, PA = Perceived Autonomy, PC = Perceived Competence, PIE = Perceived Instructional Effectiveness, PMR = Perceived Media Richness, PR = Perceived Relatedness, SS = School Support, TW = Trust in Website, VCD = VLE Content Design, VI = VLE Interactivity.

Third iteration:

Once indicator PC5_R was removed, Table 5.11 and Figure 5.5 indicate that the indicator PA4_R has the least outer loading and thus it was removed in the next iteration. Furthermore, table 5.12 also shows that after indicator PC5_R was removed, its composite reliability has improved from 0.623 to 0.723 whereas the Cronbach's alpha also increased from 0.631 to 0.637. Finally, the AVE has also improved from 0.375 to 0.448.

Table 5.11 : Outer loadings of third iteration

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
AT1	0.952										
AT2	0.969										
AT3	0.963										
AT4	0.975										
AT5	0.955										
BI1		0.953									
BI2		0.977									
BI3		0.971									
PA1			0.831								
PA2_R			0.039								
PA3			0.846								
PA4_R			-0.068								
PA5			0.645								
PA6			0.856								

Table 5.11 continued

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
PC1_R				0.024							
PC2				0.801							
PC3				0.878							
PC4				0.906							
PC6_R				0.074							
PIE1					0.911						
PIE2					0.943						
PIE3					0.931						
PIE4					0.915						
PIE5					0.904						
PIE6					0.919						
PMR1						0.868					
PMR2						0.894					
PMR3						0.883					
PMR4						0.889					
PMR5						0.890					
PMR6						0.894					
PMR7						0.854					
PR1							0.889				
PR2							0.916				
PR3_R							0.149				
PR4							0.916				
PR5							0.871				
PR6_R							0.261				
PR7_R							0.373				
PR8							0.848				
SS1								0.941			
SS2								0.950			
SS3								0.950			
SS4								0.879			
TW1									0.957		
TW2									0.970		
TW3									0.978		
VCD1										0.877	
VCD2										0.901	
VCD3										0.915	
VCD4										0.900	
VCD5										0.878	
VCD6										0.887	
VI1											0.866
VI2											0.904
VI3											0.924
VI4											0.871

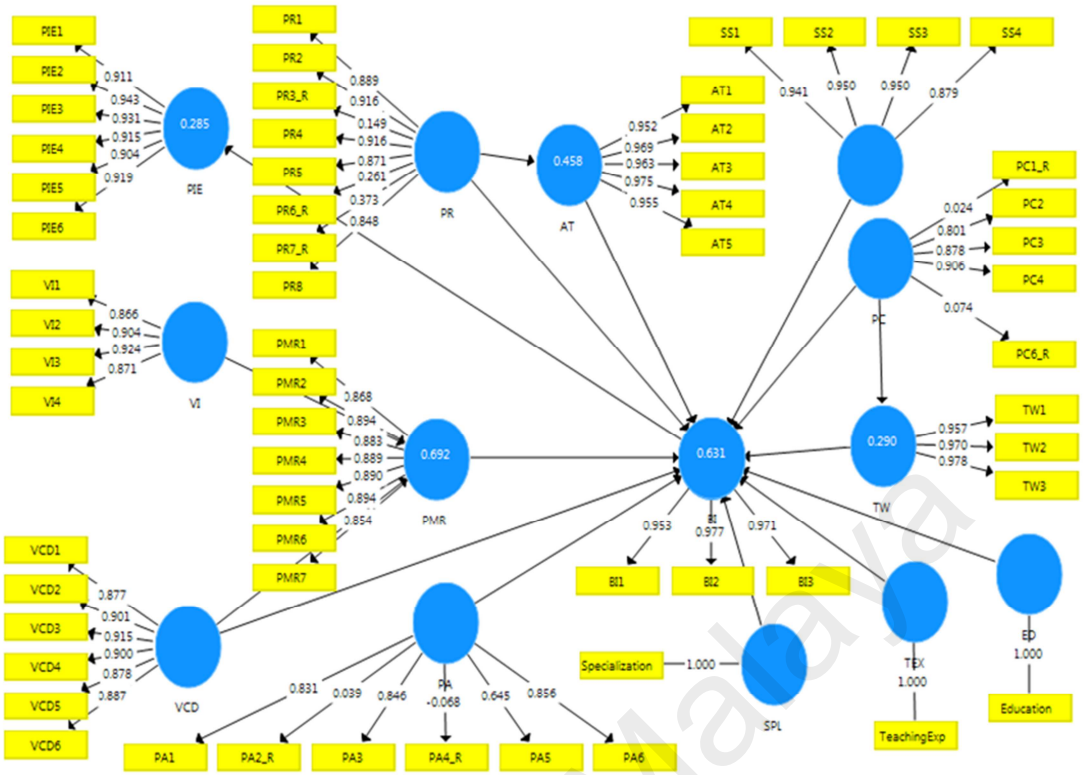


Figure 5.5 : Outer loadings of third iteration

Table 5.12: Overview quality of third iteration

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
AT	0.980	0.985	0.927
BI	0.965	0.977	0.935
PA	0.600	0.743	0.427
PC	0.637	0.723	0.448
PIE	0.964	0.971	0.847
PMR	0.952	0.961	0.778
PR	0.856	0.877	0.522
SS	0.948	0.963	0.866
TW	0.967	0.978	0.938
VCD	0.949	0.959	0.797
VI	0.914	0.939	0.795

Note: AT = Attitude toward Knowledge Sharing, BI = Behavioral Intention, PA = Perceived Autonomy, PC = Perceived Competence, PIE = Perceived Instructional Effectiveness, PMR = Perceived Media Richness, PR = Perceived Relatedness, SS = School Support, TW = Trust in Website, VCD = VLE Content Design, VI = VLE Interactivity.

Fourth iteration:

Table 5.13 and Figure 5.6 indicate that PC1_R has the least outer loading and therefore was removed in the next iteration. After indicator PA4_R was removed, Table 5.14 shows that its composite reliability improved from 0.743 to 0.809 while the Cronbach's alpha increased from 0.600 to 0.674. Finally, the AVE also improved from 0.427 to 0.512.

Table 5.13 : Outer loadings of fourth iteration

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
AT1	0.952										
AT2	0.969										
AT3	0.963										
AT4	0.975										
AT5	0.955										
BI1		0.953									
BI2		0.977									
BI3		0.971									
PA1			0.831								
PA2_R			0.028								
PA3			0.847								
PA5			0.648								
PA6			0.856								
PC1_R				0.024							
PC2				0.801							
PC3				0.878							
PC4				0.906							
PC6_R				0.074							
PIE1					0.911						
PIE2					0.943						
PIE3					0.931						
PIE4					0.915						
PIE5					0.904						
PIE6					0.919						
PMR1						0.868					
PMR2						0.894					
PMR3						0.883					
PMR4						0.889					
PMR5						0.890					
PMR6						0.894					
PMR7						0.854					
PR1							0.889				
PR2							0.916				
PR3_R							0.149				
PR4							0.916				
PR5							0.871				
PR6_R							0.261				
PR7_R							0.373				
PR8							0.848				

Table 5.13 continued

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
SS1								0.941			
SS2								0.950			
SS3								0.950			
SS4								0.879			
TW1									0.957		
TW2									0.970		
TW3									0.978		
VCD1										0.877	
VCD2										0.901	
VCD3										0.915	
VCD4										0.900	
VCD5										0.878	
VCD6										0.887	
VI1											0.866
VI2											0.904
VI3											0.924
VI4											0.871

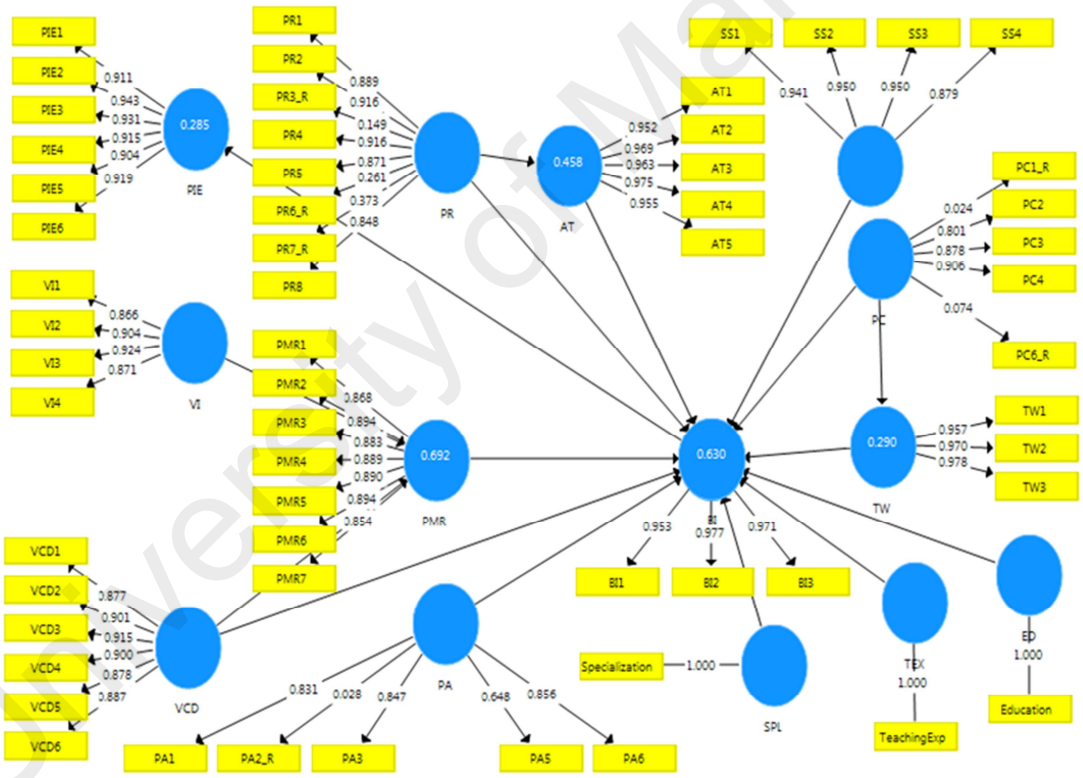


Figure 5.6 : Outer loadings of fourth iteration

Table 5.14 : Overview quality of fourth iteration

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
AT	0.980	0.985	0.927
BI	0.965	0.977	0.935
PA	0.674	0.809	0.512
PC	0.637	0.723	0.448
PIE	0.964	0.971	0.847
PMR	0.952	0.961	0.778
PR	0.856	0.877	0.522
SS	0.948	0.963	0.866
TW	0.967	0.978	0.938
VCD	0.949	0.959	0.797
VI	0.914	0.939	0.795

Note: AT = Attitude toward Knowledge Sharing, BI = Behavioral Intention, PA = Perceived Autonomy, PC = Perceived Competence, PIE = Perceived Instructional Effectiveness, PMR = Perceived Media Richness, PR = Perceived Relatedness, SS = School Support, TW = Trust in Website, VCD = VLE Content Design, VI = VLE Interactivity.

Fifth iteration:

Table 5.15 and Figure 5.7 show that indicator PA2_R has the smallest outer loading and thus was removed in the next iteration. Besides that, it was found that after the deletion of indicator PC1_R, the composite reliability of PC has improved from 0.723 to 0.800 while its Cronbach's alpha increased from 0.637 to 0.665. Furthermore, the AVE has also improved from 0.448 to 0.560.

Table 5.15 : Outer loadings of fifth iteration

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
AT1	0.952										
AT2	0.969										
AT3	0.963										
AT4	0.975										
AT5	0.955										
BI1		0.953									
BI2		0.977									
BI3		0.971									
PA1			0.831								
PA2_R			0.028								
PA3			0.847								
PA5			0.648								
PA6			0.856								
PC2				0.800							
PC3				0.879							
PC4				0.906							
PC6_R				0.070							

Table 5.15 continued

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
PIE1					0.911						
PIE2					0.943						
PIE3					0.931						
PIE4					0.915						
PIE5					0.904						
PIE6					0.919						
PMR1						0.868					
PMR2						0.894					
PMR3						0.883					
PMR4						0.889					
PMR5						0.890					
PMR6						0.894					
PMR7						0.854					
PR1							0.889				
PR2							0.916				
PR3_R							0.149				
PR4							0.916				
PR5							0.871				
PR6_R							0.261				
PR7_R							0.373				
PR8							0.848				
SS1								0.941			
SS2								0.950			
SS3								0.950			
SS4								0.879			
TW1									0.957		
TW2									0.970		
TW3									0.978		
VCD1										0.877	
VCD2										0.901	
VCD3										0.915	
VCD4										0.900	
VCD5										0.878	
VCD6										0.887	
VI1											0.866
VI2											0.904
VI3											0.924
VI4											0.871

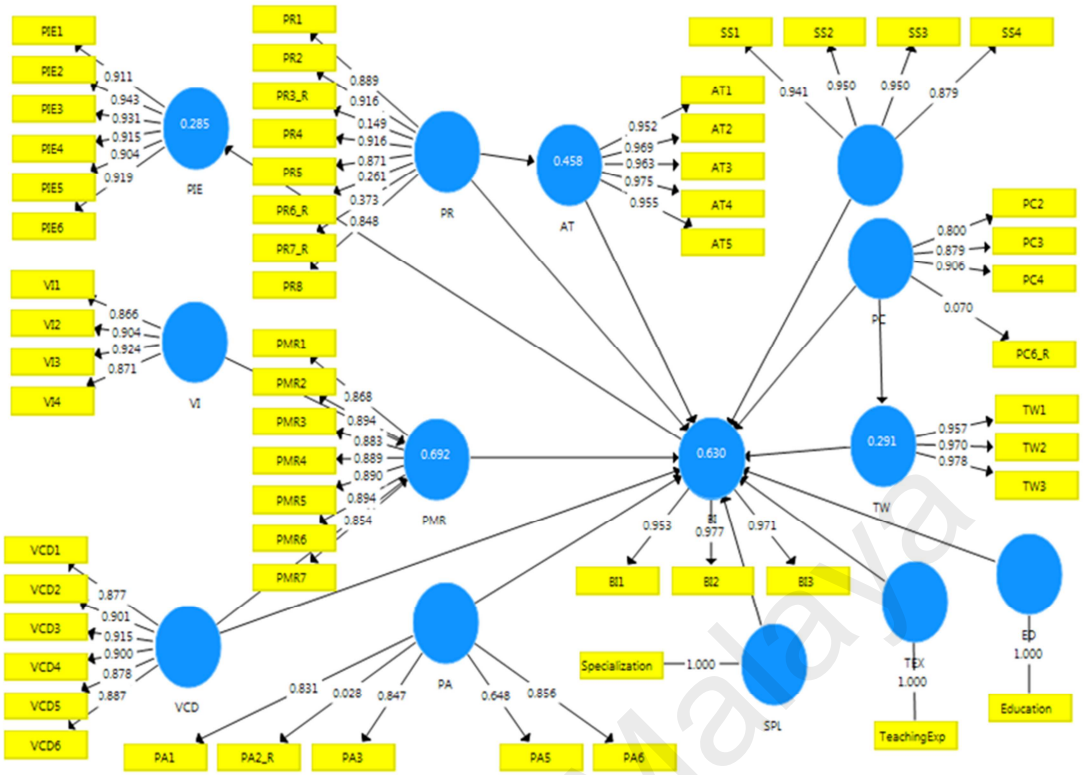


Figure 5.7 : Outer loadings of fifth iteration

Table 5.16 : Overview quality of fifth iteration

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
AT	0.980	0.985	0.927
BI	0.965	0.977	0.935
PA	0.674	0.809	0.512
PC	0.665	0.800	0.560
PIE	0.964	0.971	0.847
PMR	0.952	0.961	0.778
PR	0.856	0.877	0.522
SS	0.948	0.963	0.866
TW	0.967	0.978	0.938
VCD	0.949	0.959	0.797
VI	0.914	0.939	0.795

Note: AT = Attitude toward Knowledge Sharing, BI = Behavioral Intention, PA = Perceived Autonomy, PC = Perceived Competence, PIE = Perceived Instructional Effectiveness, PMR = Perceived Media Richness, PR = Perceived Relatedness, SS = School Support, TW = Trust in Website, VCD = VLE Content Design, VI = VLE Interactivity.

Sixth iteration:

Table 5.17 and Figure 5.8 indicate that indicator PC6_R has the smallest outer loading and thus it was removed for the next iteration. After the removal of indicator PA2_R, Table 5.18 shows that after the removal of indicator PA2_R, the composite reliability for PA has improved from 0.809 to 0.878 while its Cronbach's alpha has improved from 0.674 to 0.815. Finally, the AVE also improved from 0.512 to 0.645.

Table 5.17 : Outer loadings of sixth iteration

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
AT1	0.952										
AT2	0.969										
AT3	0.963										
AT4	0.975										
AT5	0.955										
BI1		0.953									
BI2		0.977									
BI3		0.971									
PA1			0.831								
PA3			0.849								
PA5			0.662								
PA6			0.855								
PC2				0.800							
PC3				0.879							
PC4				0.906							
PC6_R				0.070							
PIE1					0.911						
PIE2					0.943						
PIE3					0.931						
PIE4					0.915						
PIE5					0.904						
PIE6					0.919						
PMR1						0.868					
PMR2						0.894					
PMR3						0.883					
PMR4						0.889					
PMR5						0.890					
PMR6						0.894					
PMR7						0.854					
PR1							0.889				
PR2							0.916				
PR3_R							0.149				
PR4							0.916				
PR5							0.871				
PR6_R							0.261				
PR7_R							0.373				
PR8							0.848				

Table 5.17 continued

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
SS1								0.941			
SS2								0.950			
SS3								0.950			
SS4								0.879			
TW1									0.957		
TW2									0.970		
TW3									0.978		
VCD1										0.877	
VCD2										0.901	
VCD3										0.915	
VCD4										0.900	
VCD5										0.878	
VCD6										0.887	
VI1											0.866
VI2											0.904
VI3											0.924
VI4											0.871

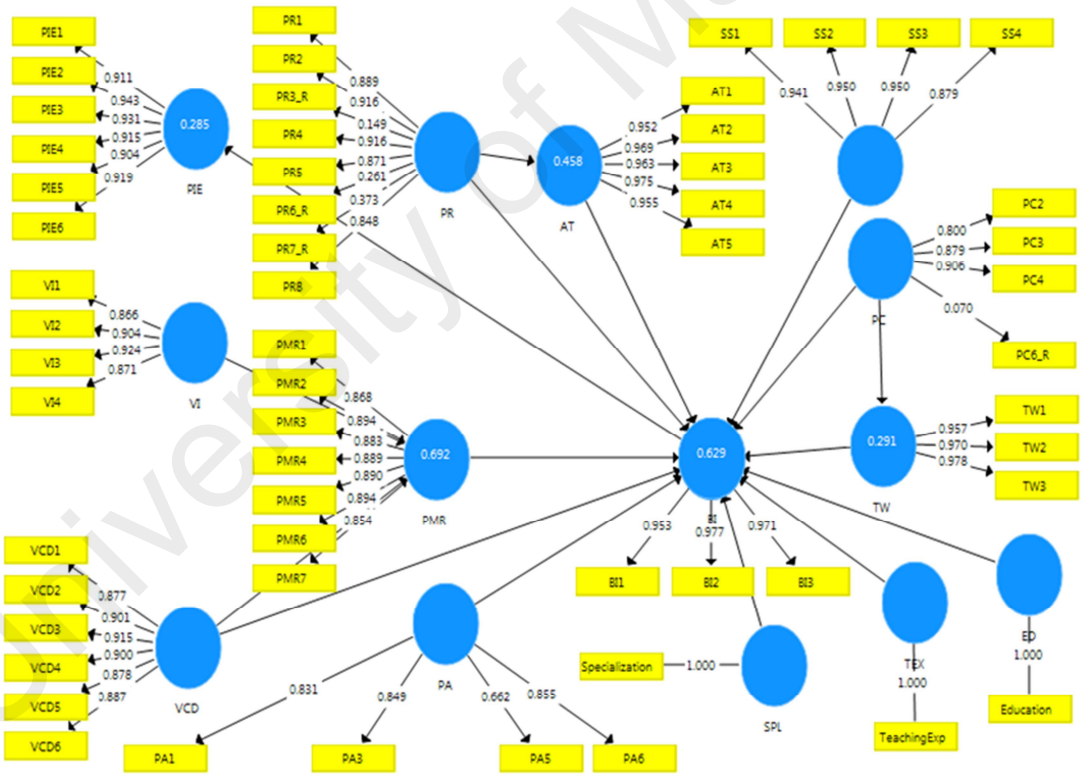


Figure 5.8 : Outer loadings of indicators for sixth iteration

Table 5.18: Overview quality of sixth iteration

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
AT	0.980	0.985	0.927
BI	0.965	0.977	0.935
PA	0.815	0.878	0.645
PC	0.665	0.800	0.560
PIE	0.964	0.971	0.847
PMR	0.952	0.961	0.778
PR	0.856	0.877	0.522
SS	0.948	0.963	0.866
TW	0.967	0.978	0.938
VCD	0.949	0.959	0.797
VI	0.914	0.939	0.795

Note: AT = Attitude toward Knowledge Sharing, BI = Behavioral Intention, PA = Perceived Autonomy, PC = Perceived Competence, PIE = Perceived Instructional Effectiveness, PMR = Perceived Media Richness, PR = Perceived Relatedness, SS = School Support, TW = Trust in Website, VCD = VLE Content Design, VI = VLE Interactivity.

Seventh iteration:

Table 5.19 and Figure 5.9 show that indicator PR3_R has the smallest outer loading and therefore was removed for the next iteration. Table 5.20 shows that after the deletion of PC6_R, the composite reliability for PC has improved from 0.800 to 0.897 whereas its Cronbach's alpha has improved from 0.665 to 0.830. Lastly, the AVE has also improved from 0.560 to 0.745.

Table 5.19 : Outer loadings of seventh iteration

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
AT1	0.952										
AT2	0.969										
AT3	0.963										
AT4	0.975										
AT5	0.955										
BI1		0.953									
BI2		0.977									
BI3		0.971									
PA1			0.831								
PA3			0.849								
PA5			0.662								
PA6			0.855								
PC2				0.799							
PC3				0.880							
PC4				0.907							

Table 5.19 continued

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
PIE1					0.911						
PIE2					0.943						
PIE3					0.931						
PIE4					0.915						
PIE5					0.904						
PIE6					0.919						
PMR1						0.868					
PMR2						0.894					
PMR3						0.883					
PMR4						0.889					
PMR5						0.890					
PMR6						0.894					
PMR7						0.854					
PR1							0.889				
PR2							0.916				
PR3_R							0.149				
PR4							0.916				
PR5							0.871				
PR6_R							0.261				
PR7_R							0.373				
PR8							0.848				
SS1								0.941			
SS2								0.950			
SS3								0.950			
SS4								0.879			
TW1									0.957		
TW2									0.970		
TW3									0.978		
VCD1										0.877	
VCD2										0.901	
VCD3										0.915	
VCD4										0.900	
VCD5										0.878	
VCD6										0.887	
VI1											0.866
VI2											0.904
VI3											0.924
VI4											0.871

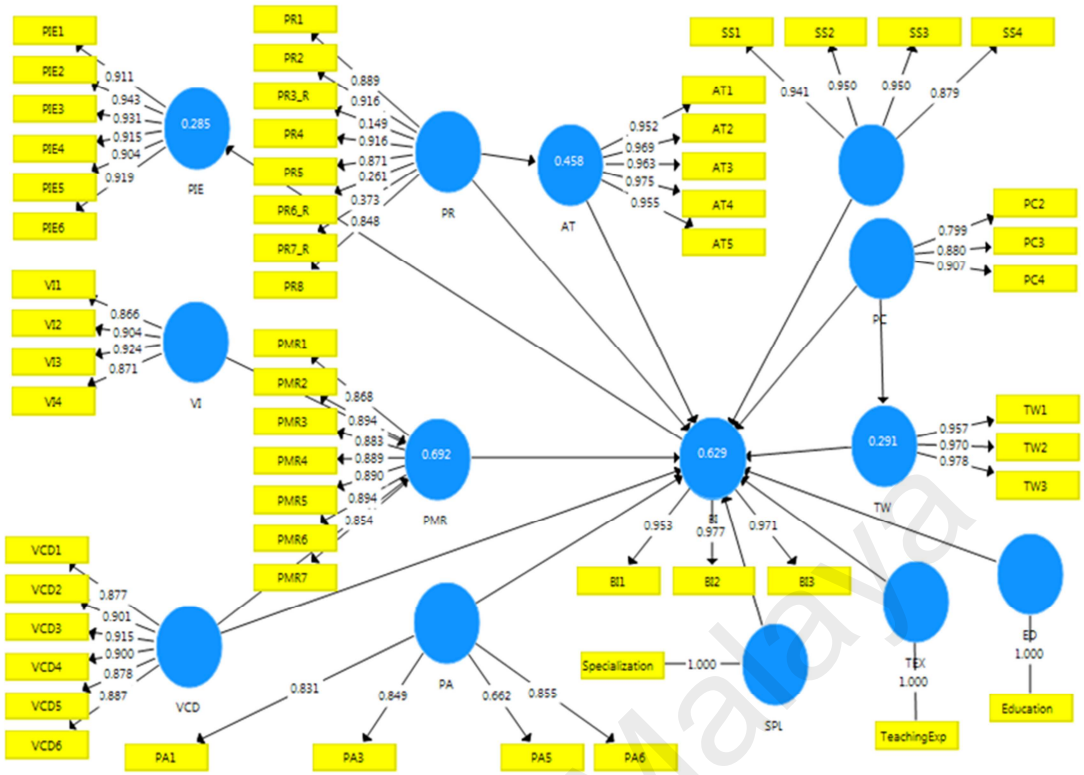


Figure 5.9 : Outer loadings of seventh iteration

Table 5.20 : Overview quality of seventh iteration

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
AT	0.980	0.985	0.927
BI	0.965	0.977	0.935
PA	0.815	0.878	0.645
PC	0.830	0.897	0.745
PIE	0.964	0.971	0.847
PMR	0.952	0.961	0.778
PR	0.856	0.877	0.522
SS	0.948	0.963	0.866
TW	0.967	0.978	0.938
VCD	0.949	0.959	0.797
VI	0.914	0.939	0.795

Note: AT = Attitude toward Knowledge Sharing, BI = Behavioral Intention, PA = Perceived Autonomy, PC = Perceived Competence, PIE = Perceived Instructional Effectiveness, PMR = Perceived Media Richness, PR = Perceived Relatedness, SS = School Support, TW = Trust in Website, VCD = VLE Content Design, VI = VLE Interactivity.

Eight iteration:

Table 5.21 and Figure 5.10 indicate that indicator PR6_R has the least outer loading and thus it was removed for the next iteration. Table 5.22 shows that after the removal of indicator PR3_R, the composite reliability for PR has improved from 0.877 to 0.901 while its Cronbach's alpha improved from 0.856 to 0.872. The AVE has also improved from 0.522 to 0.593.

Table 5.21 : Outer loadings of eighth iteration

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
AT1	0.952										
AT2	0.969										
AT3	0.963										
AT4	0.975										
AT5	0.955										
BI1		0.953									
BI2		0.977									
BI3		0.971									
PA1			0.831								
PA3			0.849								
PA5			0.662								
PA6			0.855								
PC2				0.799							
PC3				0.880							
PC4				0.907							
PIE1					0.911						
PIE2					0.943						
PIE3					0.931						
PIE4					0.915						
PIE5					0.904						
PIE6					0.919						
PMR1						0.868					
PMR2						0.894					
PMR3						0.883					
PMR4						0.889					
PMR5						0.890					
PMR6						0.894					
PMR7						0.854					
PR1							0.888				
PR2							0.916				
PR4							0.916				
PR5							0.870				
PR6_R							0.265				
PR7_R							0.377				
PR8							0.848				
SS1								0.941			
SS2								0.950			
SS3								0.950			
SS4								0.879			

Table 5.21 continued

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
TW1									0.957		
TW2									0.970		
TW3									0.978		
VCD1										0.877	
VCD2										0.901	
VCD3										0.915	
VCD4										0.900	
VCD5										0.878	
VCD6										0.887	
VI1											0.866
VI2											0.904
VI3											0.924
VI4											0.871

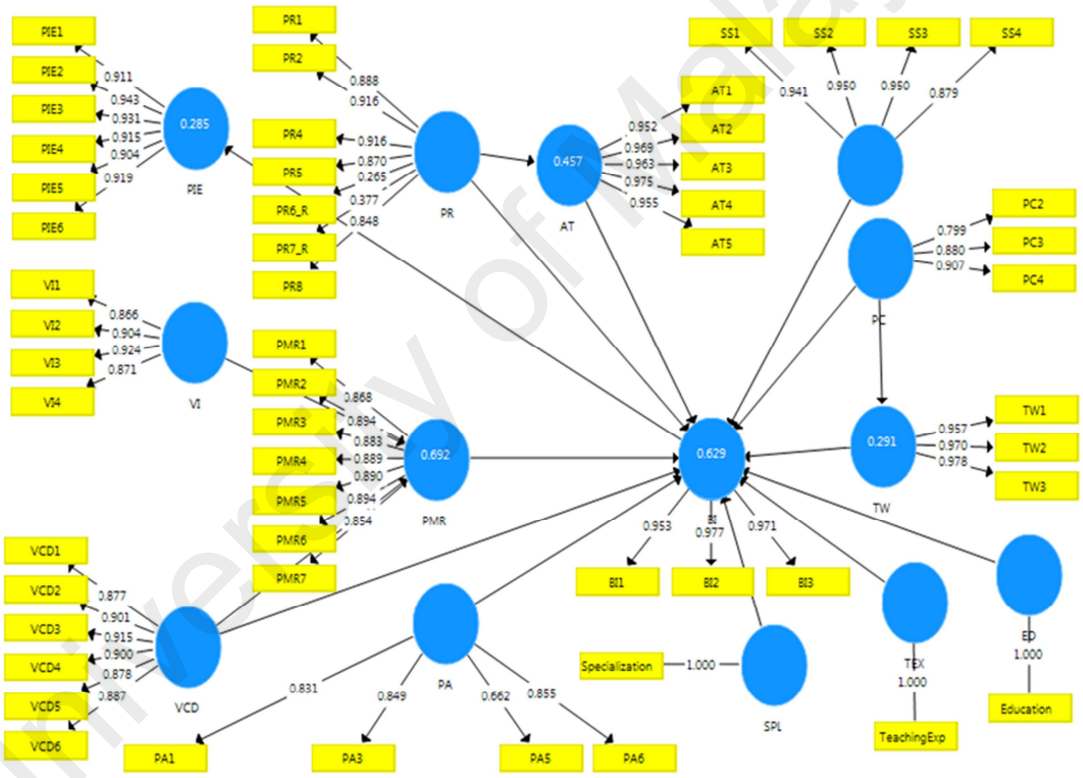


Figure 5.10 : Outer loadings of eighth iteration

Table 5.22 : Overview quality of eighth iteration

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
AT	0.980	0.985	0.927
BI	0.965	0.977	0.935
PA	0.815	0.878	0.645
PC	0.830	0.897	0.745
PIE	0.964	0.971	0.847
PMR	0.952	0.961	0.778
PR	0.872	0.901	0.593
SS	0.948	0.963	0.866
TW	0.967	0.978	0.938
VCD	0.949	0.959	0.797
VI	0.914	0.939	0.795

Note: AT = Attitude toward Knowledge Sharing, BI = Behavioral Intention, PA = Perceived Autonomy, PC = Perceived Competence, PIE = Perceived Instructional Effectiveness, PMR = Perceived Media Richness, PR = Perceived Relatedness, SS = School Support, TW = Trust in Website, VCD = VLE Content Design, VI = VLE Interactivity.

Ninth iteration:

Table 5.23 and Figure 5.11 show that indicator PR7_R has the least outer loading and therefore this indicator was removed for the next iteration. Table 5.24 also indicates that after the deletion of indicator PR6_R, the composite reliability for PR has improved from 0.901 to 0.923 while its Cronbach's alpha improved from 0.872 to 0.895. Besides that, the AVE has also improved from 0.593 to 0.680.

Table 5.23 : Outer loadings of ninth iteration

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
AT1	0.952										
AT2	0.969										
AT3	0.963										
AT4	0.975										
AT5	0.955										
BI1		0.953									
BI2		0.977									
BI3		0.971									
PA1			0.831								
PA3			0.849								
PA5			0.662								
PA6			0.855								
PC2				0.799							
PC3				0.880							
PC4				0.907							

Table 5.23 continued

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
PIE1					0.911						
PIE2					0.943						
PIE3					0.931						
PIE4					0.915						
PIE5					0.904						
PIE6					0.919						
PMR1						0.868					
PMR2						0.894					
PMR3						0.883					
PMR4						0.889					
PMR5						0.890					
PMR6						0.894					
PMR7						0.854					
PR1							0.891				
PR2							0.917				
PR4							0.918				
PR5							0.871				
PR7_R							0.359				
PR8							0.846				
SS1								0.941			
SS2								0.950			
SS3								0.950			
SS4								0.879			
TW1									0.957		
TW2									0.970		
TW3									0.978		
VCD1										0.877	
VCD2										0.901	
VCD3										0.915	
VCD4										0.900	
VCD5										0.878	
VCD6										0.887	
VI1											0.866
VI2											0.904
VI3											0.924
VI4											0.871

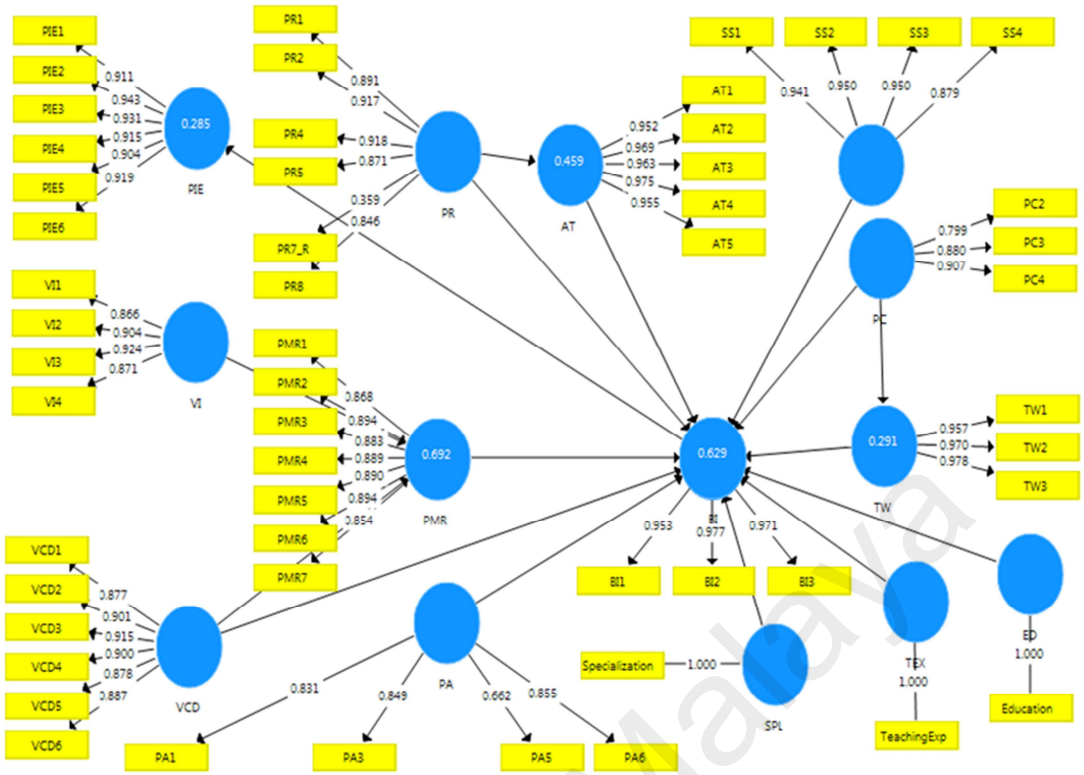


Figure 5.11 : Outer loadings of ninth iteration

Table 5.24 : Overview quality of ninth iteration

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
AT	0.980	0.985	0.927
BI	0.965	0.977	0.935
PA	0.815	0.878	0.645
PC	0.830	0.897	0.745
PIE	0.964	0.971	0.847
PMR	0.952	0.961	0.778
PR	0.895	0.923	0.680
SS	0.948	0.963	0.866
TW	0.967	0.978	0.938
VCD	0.949	0.959	0.797
VI	0.914	0.939	0.795

Note: AT = Attitude toward Knowledge Sharing, BI = Behavioral Intention, PA = Perceived Autonomy, PC = Perceived Competence, PIE = Perceived Instructional Effectiveness, PMR = Perceived Media Richness, PR = Perceived Relatedness, SS = School Support, TW = Trust in Website, VCD = VLE Content Design, VI = VLE Interactivity.

Tenth iteration:

Table 5.25 and Figure 5.12 indicate that indicator PA5 has an outer loading less than 0.70 and thus it was removed for the next iteration. In addition, Table 5.26 shows that after the removal of indicator PR7_R, the composite reliability for PR has improved from 0.923 to 0.950 while the Cronbach's alpha also improved from 0.895 to 0.934. Lastly, the AVE also improved from 0.680 to 0.792.

Table 5.25: Outer loadings of tenth iteration

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
AT1	0.952										
AT2	0.969										
AT3	0.963										
AT4	0.975										
AT5	0.955										
BI1		0.953									
BI2		0.977									
BI3		0.971									
PA1			0.831								
PA3			0.849								
PA5			0.662								
PA6			0.855								
PC2				0.799							
PC3				0.880							
PC4				0.907							
PIE1					0.911						
PIE2					0.943						
PIE3					0.931						
PIE4					0.915						
PIE5					0.904						
PIE6					0.919						
PMR1						0.868					
PMR2						0.894					
PMR3						0.883					
PMR4						0.889					
PMR5						0.890					
PMR6						0.894					
PMR7						0.854					
PR1							0.896				
PR2							0.921				
PR4							0.917				
PR5							0.872				
PR8							0.842				
SS1								0.941			
SS2								0.950			
SS3								0.950			
SS4								0.879			
TW1									0.957		
TW2									0.970		
TW3									0.978		

Table 5.25 continued

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
VCD1										0.877	
VCD2										0.901	
VCD3										0.915	
VCD4										0.900	
VCD5										0.878	
VCD6										0.887	
VI1											0.866
VI2											0.904
VI3											0.924
VI4											0.871

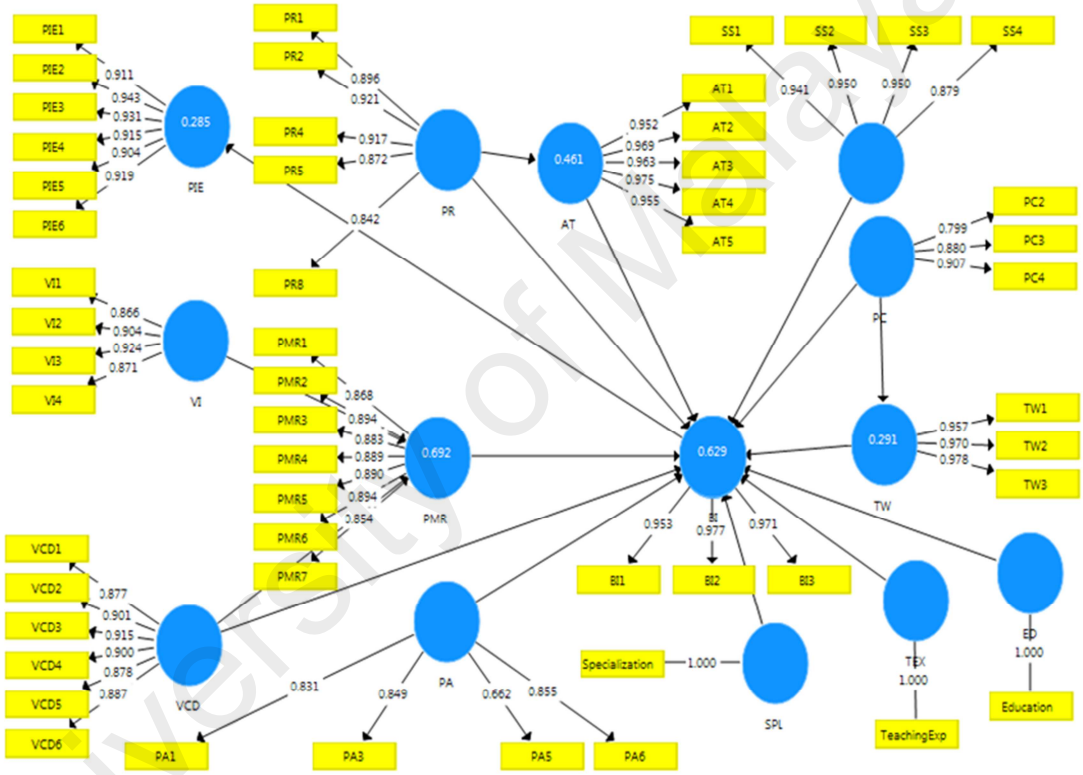


Figure 5.12 : Outer loadings of tenth iteration

Table 5.26 : Overview quality of tenth iteration

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
AT	0.980	0.985	0.927
BI	0.965	0.977	0.935
PA	0.815	0.878	0.645
PC	0.830	0.897	0.745
PIE	0.964	0.971	0.847
PMR	0.952	0.961	0.778
PR	0.934	0.950	0.792
SS	0.948	0.963	0.866
TW	0.967	0.978	0.938
VCD	0.949	0.959	0.797
VI	0.914	0.939	0.795

Note: AT = Attitude toward Knowledge Sharing, BI = Behavioral Intention, PA = Perceived Autonomy, PC = Perceived Competence, PIE = Perceived Instructional Effectiveness, PMR = Perceived Media Richness, PR = Perceived Relatedness, SS = School Support, TW = Trust in Website, VCD = VLE Content Design, VI = VLE Interactivity.

Eleventh iteration:

Table 5.27 and Figure 5.13 show that there are no indicators having outer loadings less than the recommended threshold of 0.70 (Hair & Hult, 2016), hence no more indicators are removed and this measurement model was taken as the final measurement model for further analyses. Table 5.28 shows that after the removal of indicator PA5, the composite reliability for PA has improved from 0.878 to 0.895 while its Cronbach's alpha has also improved from 0.815 to 0.824. Finally, the AVE has also improved from 0.645 to 0.740.

Table 5.27 : Outer loadings of final measurement model

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
AT1	0.952										
AT2	0.969										
AT3	0.963										
AT4	0.975										
AT5	0.955										
BI1		0.953									
BI2		0.977									
BI3		0.971									
PA1			0.866								
PA3			0.851								
PA6			0.864								
PC2				0.799							
PC3				0.880							
PC4				0.907							

Table 5.27 continued

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI
PIE1					0.911						
PIE2					0.943						
PIE3					0.931						
PIE4					0.915						
PIE5					0.904						
PIE6					0.919						
PMR1						0.868					
PMR2						0.894					
PMR3						0.883					
PMR4						0.889					
PMR5						0.890					
PMR6						0.894					
PMR7						0.854					
PR1							0.896				
PR2							0.921				
PR4							0.917				
PR5							0.872				
PR8							0.842				
SS1								0.941			
SS2								0.950			
SS3								0.950			
SS4								0.879			
TW1									0.957		
TW2									0.970		
TW3									0.978		
VCD1										0.877	
VCD2										0.901	
VCD3										0.915	
VCD4										0.900	
VCD5										0.878	
VCD6										0.887	
VI1											0.866
VI2											0.904
VI3											0.924
VI4											0.871

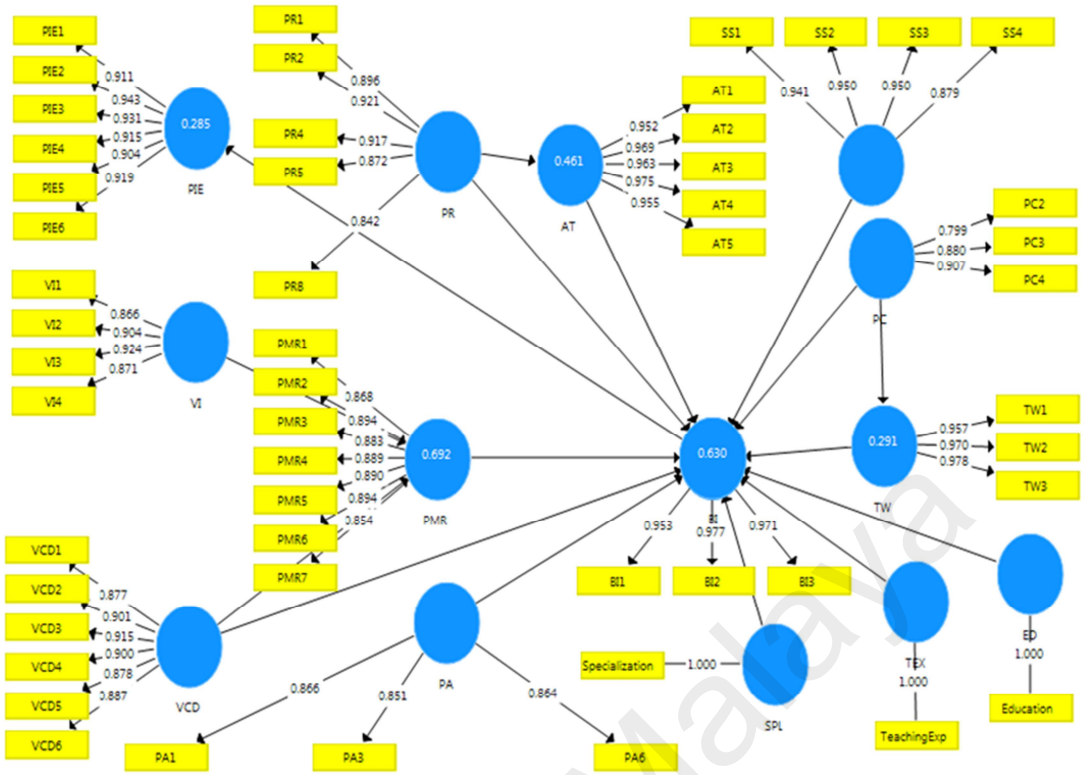


Figure 5.13 : Outer loadings of the final measurement model

Table 5.28 : Overview quality of final measurement model

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
AT	0.980	0.985	0.927
BI	0.965	0.977	0.935
PA	0.825	0.895	0.740
PC	0.830	0.897	0.745
PIE	0.964	0.971	0.847
PMR	0.952	0.961	0.778
PR	0.934	0.950	0.792
SS	0.948	0.963	0.866
TW	0.967	0.978	0.938
VCD	0.949	0.959	0.797
VI	0.914	0.939	0.795

Note: AT = Attitude toward Knowledge Sharing, BI = Behavioral Intention, PA = Perceived Autonomy, PC = Perceived Competence, PIE = Perceived Instructional Effectiveness, PMR = Perceived Media Richness, PR = Perceived Relatedness, SS = School Support, TW = Trust in Website, VCD = VLE Content Design, VI = VLE Interactivity.

5.11 Evaluation of final measurement model

Following Anderson and Gerbing (1988), a two-staged analysis was engaged for the PLS-SEM approach. Stage one saw the testing of the measurement model while second stage was the analysis of the causal relationships in the structural model. The aim of the measurement model testing is to evaluate unidimensionality, convergent validity, discriminant validity and construct reliability.

5.11.1 Unidimensionality

Unidimensionality ensures that the relevant items only measure a single theoretical construct. To assess unidimensionality, all relevant factor loadings must be significant and greater than 0.50 (Hair et al., 2013). Appendix X shows that all relevant items loadings are significant and more than 0.50.

5.11.2 Convergent validity

Convergent validity ensures that the relevant items converge to its relevant construct and thus measuring what it is supposed to measure. To assess convergent validity, Average Variance Extracted (AVE) was examined. If the AVE is greater than 0.50 then convergent validity is verified. Table 5.29 shows that all AVEs are significant and exceed 0.50. In addition, as recommended by Hair et al. (2014), convergent validity was also verified based on the values of outer loadings (Table 5.27) and composite reliability (Table 5.28). Thus, it is concluded that convergent validity has been validated.

Table 5.29: Average variance extracted

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
AT	0.927	0.927	0.009	101.830	0.000
BI	0.935	0.935	0.011	87.110	0.000
PA	0.740	0.740	0.019	38.220	0.000
PC	0.745	0.744	0.018	42.389	0.000
PIE	0.847	0.847	0.011	79.542	0.000
PMR	0.778	0.778	0.014	54.276	0.000
PR	0.804	0.804	0.015	52.972	0.000
SS	0.866	0.865	0.012	74.826	0.000
TW	0.938	0.938	0.008	118.655	0.000
VCD	0.797	0.797	0.015	54.060	0.000
VI	0.795	0.795	0.015	51.794	0.000

Note: AT=Attitude, BI=Behavioral Intention, PA=Perceived Autonomy, PC=Perceived Competence, PIE=Perceived Instructional Effectiveness, PMR=Perceived Media Richness, PR=Perceived Relatedness, SS=School Support, TW=Trust in Website, VCD=VLE Content Design, VI=VLE Interactivity

5.11.3 Discriminant validity

Discriminant validity ensures that the relevant items load strongly to its construct and poorly on other unrelated constructs. Therefore, these items are significantly differentiable from other items of other constructs. Discriminant validity was assessed by using several criteria including the Fornell-Larcker's (1981) criterion.

Fornell-Larcker's criterion states that for discriminant validity to be observed, the square roots of AVE must be greater than the respective correlation coefficients. Alternatively the Fornell-Larcker's ratio (FLR) is also computed and if FLR is less than 1 then discriminant validity is verified. FLR is the ratio of the maximum shared variance over AVE. Table 5.30 shows that all square roots of AVEs are higher than their correlation coefficients and all FLRs are less than 1. Thus, discriminant validity is verified.

Table 5.30: Fornell-Larcker's criterion

	AT	BI	PA	PC	PIE	PMR	PR	SS	TW	VCD	VI	FLR
AT	0.963											0.487
BI	0.545	0.967										0.470
PA	0.449	0.632	0.860									0.750
PC	0.469	0.638	0.745	0.863								0.746
PIE	0.345	0.534	0.458	0.464	0.920							0.336
PMR	0.448	0.663	0.711	0.690	0.533	0.882						0.778
PR	0.672	0.482	0.431	0.440	0.288	0.413	0.897					0.562
SS	0.535	0.589	0.488	0.465	0.381	0.514	0.491	0.930				0.400
TW	0.513	0.651	0.554	0.540	0.421	0.587	0.461	0.493	0.968			0.452
VCD	0.477	0.644	0.720	0.673	0.514	0.778	0.448	0.536	0.573	0.893		0.759
VI	0.367	0.631	0.658	0.643	0.515	0.778	0.362	0.460	0.562	0.749	0.892	0.761

Note: Diagonal elements are square roots of AVEs; FLR=Fornell-Larcker's ratio, AT=Attitude, BI=Behavioral Intention, PA=Perceived Autonomy, PC=Perceived Competence, PIE=Perceived Instructional Effectiveness, PMR=Perceived Media Richness, PR=Perceived Relatedness, SS=School Support, TW=Trust in Website, VCD=VLE Content Design, VI=VLE Interactivity

5.11.4 Construct reliability

Construct reliability measures the internal consistency of the measures. Generally, there are three approaches in assessing construct reliability namely by examining the Cronbach's alpha coefficients, the composite reliability and AVEs of the constructs.

The most commonly used measure of construct reliability is the Cronbach's alpha coefficients. A recommended threshold for a construct to be reliable is when the Cronbach's alpha coefficients exceed 0.70 (Hair et al., 2013). Table 5.31 shows that all Cronbach's alpha coefficients have exceeded the minimum threshold of 0.70. Thus, construct reliability has been verified.

Unlike Cronbach's alpha which uses equal weights for its computation, CR uses the actual loadings of the construct as its weights. A standard criterion for CR is a minimum value of 0.70 (Hair et al., 2013). Table 5.31 shows that all CRs are above the minimum requirement and hence it is concluded that all constructs have very high level of reliability.

Last but not the least, construct reliability was assessed by examining the composite reliability of the construct. A minimum value of 0.50 indicates adequate construct reliability. Table 5.31 shows that all CRs are greater than 0.50. It is therefore concluded that all constructs have very good degree of reliability.

Table 5.31: Cronbach's alpha, composite reliability and AVE

	Cronbach's alpha	Composite reliability (CR)	Average Variance Extracted (AVE)
AT	0.980	0.985	0.927
BI	0.965	0.977	0.935
PA	0.825	0.895	0.740
PC	0.830	0.897	0.745
PIE	0.964	0.971	0.847
PMR	0.952	0.960	0.778
PR	0.919	0.942	0.804
SS	0.948	0.961	0.866
TW	0.967	0.979	0.938
VCD	0.949	0.959	0.797
VI	0.914	0.939	0.795

Note: AT=Attitude, BI=Behavioral Intention, PA=Perceived Autonomy, PC=Perceived Competence, PIE=Perceived Instructional Effectiveness, PMR=Perceived Media Richness, PR=Perceived Relatedness, SS=School Support, TW=Trust in Website, VCD=VLE Content Design, VI=VLE Interactivity

Standardized Root Mean Square Residual (SRMR) is the difference between the observed and the predicted correlation. It is used to assess the average magnitude of the discrepancies between observed and expected correlations as an absolute measure of model fit criterion. A recommended value of 0.08 is assumed to be a good model fit (Henseler, Dijkstra, Sarstedt, Ringle, Diamantopoulos, Straub & Calantone, 2014). In this study, the SRMR for composite model is 0.033 (t=14.569). Since this value is less than 0.08, it is therefore concluded that the model possess good model fit.

5.12 Structural model

The structural model is analyzed by using bootstrapping procedure with 5000 samples and no sign changes. A two-tailed significant level of 0.05 was set. The R^2 for the endogenous constructs are shown in Table 5.32. Since all R^2 are greater than 0.10, it is therefore concluded that the model possesses adequate predictive power (Hair et al., 2014).

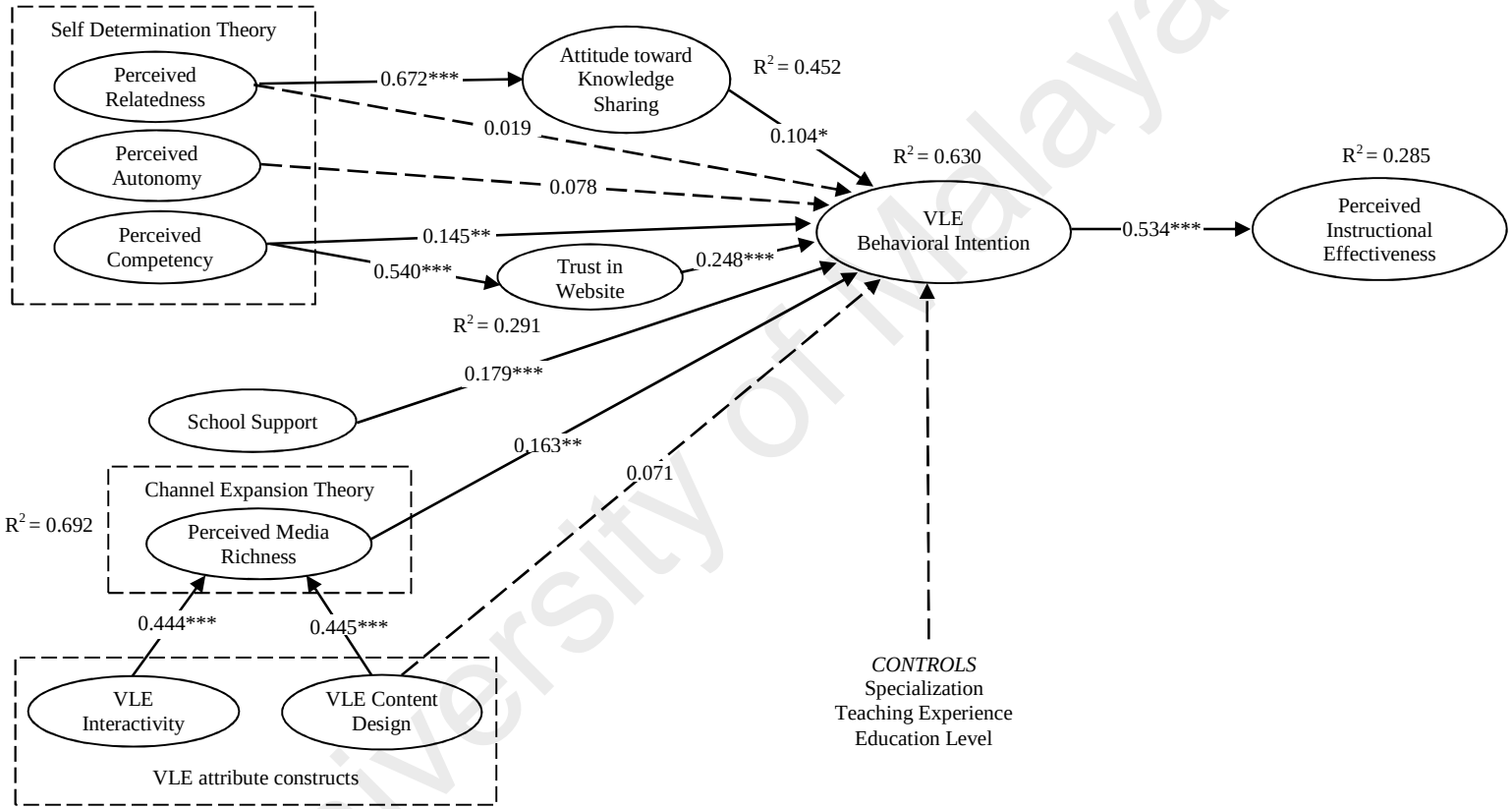
Table 5.32: R-squares (R^2)

Construct	R Square	T Statistics (|O/STDEV|)	P Values
AT	0.452	12.327	0.000
BI	0.630	22.627	0.000
PIE	0.285	7.482	0.000
PMR	0.692	24.858	0.000
TW	0.291	6.963	0.000

Note: AT=Attitude, BI=Behavioral Intention, PA=Perceived Autonomy, PC=Perceived Competence, PIE=Perceived Instructional Effectiveness, PMR=Perceived Media Richness, PR=Perceived Relatedness, SS=School Support, TW=Trust in Website, VCD=VLE Content Design, VI=VLE Interactivity

5.13 Hypothesis validation

In testing the hypothesis, the significance of a path is determined according to its p-value. A p-value of less than 0.05 is considered as significant. Based on the PLS-SEM path analysis, it was found that attitude towards knowledge sharing (β =0.104, p=0.015), perceived competence (β =0.145, p=0.010), perceived media richness (β =0.163, p=0.005), Specialization (β =-0.058, p=0.022), school support (β =0.179, p=0.000) and trust in website (β =0.248, p<0.001) have significant influence on behavioral intention. Perceived competence (β =0.540, p<0.001) significantly affects trust in website. VLE interactivity (β =0.444, p<0.001) has significant effect on perceived media richness. Perceived relatedness (β =0.672, p<0.001) has significant influence on attitude towards knowledge sharing and VLE content design (β =0.445, p<0.001) significantly influences perceived media richness. Behavioral intention (β =0.534, p<0.001) has significant impact on perceived instructional effectiveness. However there are no significant effects of educational level (β =0.016, p=0.552), perceived autonomy (β =0.078, p=0.126), perceived relatedness (β =0.019, p=0.611), teaching experience (β =-0.041, p=0.115) and VLE content design (β =0.071, p=0.245) on behavioral intention. The PLS-SEM path diagram is shown in Figure 5.14 and Table 5.33 lists the results of the PLS-SEM path analysis.



Note: *p<0.05; **p<0.01; ***p<0.001

Figure 5.14: PLS-SEM path analysis

Table 5.33: PLS-SEM path analysis

Hypothesis	Path	Beta coefficient	Standard deviation	t-value
H1a	PR → AT	0.672	0.027	24.552***
H1b	PR → BI	0.019	0.037	0.509
H1c	AT → BI	0.104	0.043	2.434*
H2	PA → BI	0.078	0.051	1.532
H3a	PC → BI	0.145	0.056	2.592**
H3b	PC → TW	0.540	0.039	13.875***
H3c	TW → BI	0.248	0.052	4.802***
H4	SS → BI	0.179	0.042	4.292***
H5a	VCD → PMR	0.445	0.039	11.438***
H5b	VCD → BI	0.071	0.061	1.163
H5c	PMR → BI	0.163	0.057	2.840**
H6	VI → PMR	0.444	0.039	11.522***
H7	BI → PIE	0.534	0.036	14.909***
Controls	SPL → BI	-0.058	0.025	2.298*
	TEX → BI	-0.041	0.026	1.576
	ED → BI	0.016	0.027	0.595

Note: *p<0.05; **p<0.01; ***p<0.001; PR=Perceived Relatedness, PA=Perceived Autonomy, PC=Perceived Competence, PMR=Perceived Media Richness, VCD=VLE Content Design, VI=VLE Interactivity, SS=School Support, AT=Attitude toward knowledge sharing, TW=Trust in Website, ED=Educational Level, SPL=Specialization, TEX=Teaching experience, BI=Behavioral Intention, PIE=Perceived Instructional Effectiveness.

5.14 Mediating effects and Variance Accounted For (VAF)

The mediating effects of the mediator variables (MV) were assessed using Baron-Kenny's (1985) approach. The degree of mediation effects depends on the significance of the direct relationship between independent variable (IV) and the dependent variable (DV) for the non-mediated and mediated models. For mediation to occur the following criteria are used (Vonkeman, Verhagen & van Dolen, 2017):

a) The paths of IV→MV and IV→DV should be significant
b) If there is a drop in the strength of the IV→DV path but remains significant then partial mediation exists
c) If the path IV→DV becomes insignificant when the mediator is introduced then a full mediation exists.

Besides examining the degree of the mediation effects, the significance of these effects were also examined using Sobel's test for significance of mediation effects (Zhang, Zhang, Yang & Yang, 2016) through the online website at http://www.danielsoper.com/statcalc3/ calc.aspx?id=31. To measure the size of the mediation effects, Variance Accounted For (VAF) was computed. VAF is the percentage of indirect effect over the total effect. A VAF above 80% is considered as full mediation, 20% to 80% is considered as partial mediation and less than 20% is considered as no mediation effect (Hair et al., 2014).

Table 5.34 and 5.35 shows that there are significant partial mediation effects of TW on the path PC-TW-BI, AT on the path PR-AT-BI and PMR on the path VCD-PMR-BI. The findings show that when trust-in-website is introduced into the research model, the direct effect of perceived competent on behavioral intention will be lessen. Similarly, when attitude towards knowledge sharing is introduced into the research model, the

direct effect of perceived relatedness on behavioral intention is also reduced. Finally, when perceived media richness is introduced into the research model, the direct effect of VLE content design on behavioral intention is also lightened. Of the three mediators, VCD has the strongest mediation effects with 38.3% VAF followed by TW with 36.5% and AT with 26.2%.

Table 5.34: Baron-Kenny's mediation,

Variable			**Non Mediated**			**Mediated (IV+M→DV)**		
IV	**MV**	**DV**	**IV→MV**		**IV→DV**	**IV**	**MV**	
			beta	**S.E.**	**beta**	**beta**	**beta**	**S.E.**
PC	TW	BI	0.539*	0.039	0.639*	0.405*	0.432*	0.047
PR	AT	BI	0.672*	0.027	0.483*	0.213*	0.403*	0.047
VCD	PMR	BI	0.779*	0.021	0.645*	0.327*	0.409*	0.057

Note: *p<0.001 (two-tailed); IV=Independent variable, MV=Mediator variable, DV=Dependent variable, S.E.=Standard error; VAF=Variance Account For, PC=Perceived Competency, PR=Perceived Relatedness, VCD=VLE content design, TW=Trust in website, AT=Attitude toward knowledge sharing, PMR=Perceived media richness, BI=Behavioral intention.

Table 5.35: Sobel's test and VAF

Effect	**Sobel's test for significance of mediation**			**VAF**
	t-value	**p-value**	**Sig.**	
Partial	7.653	0.000*	Yes	36.5%
Partial	8.107	0.000*	Yes	26.2%
Partial	7.045	0.000*	Yes	38.3%

Note: VAF = Variance Accounted For

5.15 Indirect effects

As a complement to the Baron-Kenny's mediation test, mediating effects can also be examined based on the indirect effects of the mediators. Direct effects are relationships between two variables that are connected by a single line whereas the indirect effects are relationships between variables that pass through one or more other variables. Total effect is the sum of direct and indirect effects. Based the PLS analysis, it was found that

perceived competence (0.149, t=4.468) has the strongest indirect effect on perceived instructional effectiveness which is followed by trust-in-website (0.133, t=4.486), school support (0.095, t=4.097), perceived media richness (0.087, t=2.784), VLE content design (0.076, t=2.932), attitude towards knowledge sharing (0.056, t=2.408), perceived relatedness (0.047, t=2.341) and specialization (-0.031, t=2.323). However, there are no significant indirect effects of education (0.009, t=0.588), perceived autonomy (0.042, t=1.538) and teaching experience (-0.022, t=1.588) on perceived instructional effectiveness.

Besides that, perceived competence (0.134, t=4.502) has the strongest indirect effect on behavioral intention and this is followed by VLE content design (0.127, t=2.831) and perceived relatedness (0.070, t=2.363). Table 5.36 shows the significant and insignificant indirect effects of the independent variables on dependent variables.

Table 5.36: Indirect effects

	Original Sample (O)	T Statistics (|O/STDEV|)	P Values
AT → PIE	0.056	2.408	0.016
ED → PIE	0.009	0.588	0.556
PA → PIE	0.042	1.538	0.124
PC → BI	0.134	4.503	0.000
PC → PIE	0.149	4.468	0.000
PMR → PIE	0.087	2.784	0.005
PR → BI	0.070	2.394	0.017
PR → PIE	0.047	2.341	0.019
SPL → PIE	-0.031	2.323	0.020
SS → PIE	0.095	4.097	0.000
TEX → PIE	-0.022	1.588	0.112
TW → PIE	0.133	4.486	0.000
VCD → BI	0.072	2.751	0.006
VCD → PIE	0.076	2.932	0.003
VI → BI	0.072	2.679	0.007
VI → PIE	0.039	2.638	0.008

Note: AT=Attitude, BI=Behavioral Intention, PA=Perceived Autonomy, PC=Perceived Competence, PIE=Perceived Instructional Effectiveness, PMR=Perceived Media Richness, PR=Perceived Relatedness, SS=School Support, TW=Trust in Website, VCD=VLE Content Design, VI=VLE Interactivity, ED=Education, SPL=Specialization, TEX=Teaching Experience

5.16 Predictive relevance and effect size

Predictive relevance and effect size were examined using blindfolding with omission distance 7. Predictive relevance measures the relative relevance of an independent variable (IV) based on the values of R^2. The R^2 for perceived media richness is 0.692 indicating that the predictors are able to explain 69.2% of the total variance. Behavioral intention has a R^2 of 0.630 meaning that the predictors are capable of explaining 63.0% of the total variance. Attitude towards knowledge sharing has a R^2 of 0.452 indicating that the predictors are able to explain 45.2% of the total variance. Similarly, trust with website has a R^2 value of 0.291 implying that the predictors are capable of explaining 29.1% of the total variance. Finally, the R^2 for perceived instructional effectiveness is 0.285 indicating that the predictors are able to explain 28.5% of the total variance. Table 5.37 shows that all IVs possess adequate predictive power towards the respective DV as all R^2 values are greater than the minimum threshold of 0.10 or 10% (Hair et al., 2014).

Table 5.37: Predictive relevance of endogenous variables.

Endogenous variable	R^2
AT	0.452
BI	0.630
PIE	0.285
PMR	0.692
TW	0.291

Note: AT = attitude toward knowledge sharing, TW = trust in website, PMR = perceived media richness, BI = behavioral intention, PIE = perceived instructional effectiveness.

Effect size measures the relative importance or effects of an IV on the dependent variable (DV). The common measure for effect size is Cohen's f-square (f^2). Cohen (2013) recommended that an f^2 of 0.02, 0.15 and 0.35 are considered as small, medium and large effect size. Table 5.38 shows that there is large effect size of behavioral intention (f^2=0.399) on perceived instructional effectiveness, perceived competence

(f^2=0.411) on trust in website, perceived relatedness (f^2=0.824) on attitude towards knowledge sharing, VLE content design (f^2=0.281) on perceived media richness and VLE interactivity (f^2=0.281) on perceived media richness. There is also small effect size of school support (f^2=0.049) on behavioral intention and trust in website (f^2=0.089) on behavioral intention. The other effect sizes are all not significant.

Table 5.38: Effect size (f^2)

	Original Sample (O)	**T Statistics (|O/STDEV|)**	**P Values**
AT → BI	0.013	1.164	0.245
BI → PIE	0.399	5.253	0.000
ED → BI	0.001	0.183	0.855
PA → BI	0.006	0.681	0.496
PC → BI	0.021	1.240	0.215
PC → TW	0.411	4.815	0.000
PMR → BI	0.023	1.394	0.163
PR → AT	0.824	6.663	0.000
PR → BI	0.000	0.142	0.887
SPL → BI	0.009	1.089	0.276
SS → BI	0.049	2.010	0.044
TEX → BI	0.004	0.743	0.458
TW → BI	0.089	2.296	0.022
VCD → BI	0.004	0.486	0.627
VCD → PMR	0.281	4.598	0.000
VI → PMR	0.281	4.449	0.000

Note: AT=Attitude, BI=Behavioral Intention, PA=Perceived Autonomy, PC=Perceived Competence, PIE=Perceived Instructional Effectiveness, PMR=Perceived Media Richness, PR=Perceived Relatedness, SS=School Support, TW=Trust in Website, VCD=VLE Content Design, VI=VLE Interactivity, ED=Education, SPL=Specialization, TEX=Teaching Experience

5.17 Chapter summary

This chapter has presented the details of the statistical analyses performed in validating the multivariate assumptions, assessing the quality of the measurement model and examining the strengths and significance of the path coefficients. Besides that Baron-Kenny's approach and Sobel's test were engaged to examine the mediating effects of the mediators in the research model. Finally, the relative importance or effect

size of the predictors was evaluated based on Cohen's f^2. The next chapter will discuss about the findings drawn from these statistical analyses.

CHAPTER 6: DISCUSSION

6.1 Introduction

This chapter will discuss about the key findings of the research as well as the comparison and contrast with previous studies. It will also present the answers to the research question and objectives of this research.

6.2 Revisit of the research question and objectives

This study has only one research question which is:

- ***RQ***: What are the factors that may impact the intention to use the VLE for instructional effectiveness among teachers?

Based on this research question, two research objectives were set. The research objectives are as follows:

- ***RO1***: To examine the possible factors that may affect teachers' intention to use VLE.
- ***RO2***: To investigate the effects of behavioral intention to use VLE on perceived instructional effectiveness.

With regards to the research question and research objectives, an instrument has been rigorously developed and validated to measure the factors that may affect teachers' intention to use VLE through pre-test followed by pilot test and finally fieldwork study. During the pre-test stage, the face validity and content validity were validated based on the comments and feedbacks from a panel of experts consisting of three academicians and three practitioners. Content validity index (I-CVI and S-CVI) was used to evaluate the content validity of a scale. Minor amendments were done based on the

recommendations from the expert panel. The instrument then underwent English-Malay back translation by several translators. The first round translated the original English version into Malay version. The second round translated back from Malay to English and the third round compared the translation consistency of the two versions. All translators agreed that both versions have the same content and meanings and were satisfied with the translation quality.

To assess construct validity, two rounds of Q-sort procedure were engaged. Each round consists of two pairs of practitioners who are tasked to sort the items based on the respective definitions of the constructs. The inter-rater reliability or Cohen's Kappa is calculated together with the hit ratio. Items that are too ambiguous were discarded and those that are less ambiguous items will be refined. Following this, a pilot test was conducted to test the instrument's clarity and reliability. The Cronbach's alpha of the final instrument met the minimum threshold of 0.70 and minor amendments were done based on the comments and feedback from the respondents. The instrument was then tested in the fieldwork study. A gestation period of four months was imposed for two waves of survey in order to reduce common method bias. Phase one (T1) was conducted to gather data of the IVs and phase two (T2) for DVs. From the results of the SEM analysis, the instrument's goodness-of-fit index, convergent validity, discriminant validity and construct reliability were validated.

To identify what factors constituted to the teachers' intention to use VLE, a full study was conducted whereby fifty champion schools were random selected nationwide. The data was then analysed using PLS-SEM approach with SmartPLS 3.0. Based on the results of the analyses, several factors that affect teachers' behavioural intention to use VLE have been successfully identified. Besides that the influence of BI on PIE was

also statistically validated. Hence, the research has successfully answered the research question and the research objectives. The next subsection will elaborate the details of the key findings derived from the full study.

6.3 Overview of key findings

In answering the research question and objectives, Table 6.1 provides the summary of the key findings derived from the statistical analyses. All together sixteen hypotheses were tested for their statistical significances. The findings showed that five of these hypotheses were insignificant namely the effects of educational level, teaching experience, perceived autonomy, perceived relatedness and VLE content design on behavioral intention. Besides that the mediating effects of the mediator variables were also tested using Baron-Kenny's approach with Sobel's test for significance of mediation effect. The findings showed that there are significant mediation effects of trust in website on the relation between perceived competence and behavioral intention, attitude towards knowledge sharing on the link between perceived relatedness and behavioral intention and perceived media richness on the association between VLE content design and behavioral intention. The strongest mediation based on the VAF is attitude towards knowledge sharing followed by perceived media richness and trust in website.

The significance of the findings can be seen from the following new aspects which are different from the findings of previous studies. First, a new instrument for the cloud-based Frog VLE context was scientifically developed and rigorously validated. Secondly, unlike previous studies, this study has successfully integrated SDT and CET together with VLE-related constructs (i.e. content design, interactivity, school support, trust in website, attitude toward knowledge sharing). Third, different from previous

studies which focused on undergraduates or university instructors' perspectives, this study focused on the perspective of school teachers. Another new aspect is that previous findings have been based on the grid-based e-learning contexts; however the present study is based on the newly emerged cloud-based VLE context. More importantly, the findings from this study have successfully and empirically validated several new relationships (e.g. TW, AT, SS, PMR, VCD and ED on BI, PR-AT and PC-TW). Finally, the findings also provided useful and practical suggestions to MoE, FrogAsia and all relevant stakeholders which will be explained in detail in the practical implication section.

Table 6.1: Summary of key findings

Hypothesis/Mediation	**Key findings**
H1a: Perceived relatedness has influence on attitude toward knowledge sharing.	Supported
H1b: Perceived relatedness influences behavioral intention to use VLE.	Not supported
H1c: Attitude towards knowledge sharing influences behavioral intention to use VLE.	Supported
H2: Perceived autonomy has influence on intention to use VLE.	Not supported
H3a: Perceived competence has influence on behavioral intention to use VLE.	Supported
H3b: Perceived competency influences trust in website.	Supported
H3c: Trust in website has influence on behavioral intention.	Supported
H4: School support influences behavioral intention to use VLE.	Supported
H5a: VLE content design has influence on perceived media richness.	Supported
H5b: VLE content design influences behavioral intention.	Not supported
H5c: Perceived media richness has influence on behavioral intention to use VLE.	Supported
H6: VLE interactivity has influence on perceived media richness.	Supported
H7: Behavioral intention has positive influence on perceived instructional effectiveness of VLE.	Supported
Specialization has influence on behavioral intention to use VLE.	Supported
Teaching experience has influence on behavioral intention to use VLE.	Not supported
Educational level has influence on behavioral intention to use VLE.	Not supported

Table 6.1 continued

Hypothesis/Mediation	Key findings
Mediation 1: Trust in website mediates the relationship between perceived competence and behavioral intention.	Significant partial mediation effects of trust in website on the perceived competence-behavioral intention relationship.
Mediation 2: Attitude towards knowledge sharing mediates the association between perceived relatedness and behavioral intention.	Significant partial mediation effect of attitude towards knowledge sharing on the PR-BI association.
Mediation 3: Perceived media richness mediates the link between VLE content design and behavioral intention.	Significant partial mediation effect of VLE content design on the VLE content design-behavioral intention link.

6.4 Comparison and contrast with previous studies

Based on the findings from the study, comparison and contrast were made with respect to previous studies and the detail of the discussion is presented in the following sections.

6.4.1 Perceived relatedness and attitude toward knowledge sharing

The finding from this research showed that there is a significant influence of PR on AT. This is similar to the finding by Shen et al. (2010), Bock and Kim (2002). However, the finding is different in the sense that the relationship was validated from the context of cloud-based VLE rather than Shen et al. (2010), Bock and Kim (2002) who conducted their studies from the contexts of knowledge sharing in virtual communities and public organizations respectively. The new context of study has given new evidence and understanding about the influence of PR toward AT that has not been investigated in previous studies. This finding suggests that individual with strong PR will tend to more likely to share their knowledge in the cloud-based VLE with others. In this sense, it further support the claim by Yoon and Rolland (2012) who opined that

individuals who are in an autonomy-supportive state will have a sense of connectedness that will trigger their motivation in knowledge sharing behavior.

6.4.2 Perceived relatedness and behavioral intention

PR has been found to have insignificant effect on BI. This is in contrary to the findings from Sørebø et al. (2009), Roca and Gagne (2008) who have found indirect effect of PR on behavioral intention to use and continuance use from the e-learning context. The finding also contradicts with the SDT (Deci & Ryan, 2000) which states that individuals tend to be more supportive of their group's objectives if they are associated with others. This finding further validated that PR is not a significant predictor of BI in the context of cloud-based VLE. The difference between the findings from this study with previous studies may be attributed to the differences in the context of study. As explained in the earlier section, there are significant differences between the conventional grid computing based VLE and cloud-based VLE. Since the cloud-based VLE system allows for virtual instruction anywhere and anytime on the cloud as well as sharing and disseminating instructional ideas and resources, the perceptions of PR among teachers may be not as strong as those who are using the grid-based VLE (Chang, Fu & Huang, 2016). This may be due to the prevalence of the social networking capabilities of the Web 2.0 technology which make the teachers to have independence decision making in determining whether to use the VLE regardless of the influence of PR. Therefore, whether they have high perception of PR or not, it does not significantly influence their intention to use the VLE.

6.4.3 Attitude toward knowledge sharing and behavioral intention

The finding showed that there is significant influence of AT on BI. This is consistent with the work by Chow and Chan (2008). The finding has given evidence and support that individuals' behavioral intention to engage in a behavior is influenced by the attitude towards knowledge sharing specifically from the context of cloud-based VLE. It also further validated the theory that is being theorized in the theoretical development section which postulated that the degree of teachers' attitude towards knowledge sharing is associated with their intention to use the VLE. Unlike Chow and Chan (2008) who have examined the influence of AT from the context of social capital theory (i.e. shared goals, social network and social trust), this study examined the effect of AT in the context of cloud-based VLE adoption. This has provided new and useful understanding for scholars and practitioners as they will be able to use this understanding in further research and for managerial decision making. This new link will further advance the literature on the acceptance of cloud-based VLE and provide a foundation for future studies to be conducted.

6.4.4 Perceived autonomy and behavioral intention

Interestingly, the research found no significant relationship between PA and BI. This finding is contrary to Sørebø et al. (2009), Roca and Gagne (2008). The contrary finding may be attributed to the difference in the context of study. Sørebø et al. (2009), Roca and Gagne (2008) have examined PA from the context of the grid-based e-learning technology. As mentioned in previous chapter there are significant differences between grid computing and cloud computing technology. Grid computing does not allow for unlimited storage and sharing of information and resources as cloud computing does. Hence, the findings from Sørebø et al. (2009), Roca and Gagne (2008) do not apply in the cloud-based VLE context is logical, rational and justifiable.

Similarly, Gagne´et al. (2000) examined the effect of PA from the context of acceptance of change in work organization of a large Canadian telecommunications company. Due to the different working environments between a telecommunications company and school, the finding from Gagne´et al. (2000) is therefore inapplicable. The structure of a Canadian telecommunications company varies significantly from the structure of a Malaysian primary or secondary school. The differences in these structures also signify differences in the level of autonomy. Therefore the effect of PA may also be different. Besides differences in organization structures, there are also differences in organization cultures. Comparing a telecommunication company and a school is like comparing apple and orange. The differences are so huge since the working cultures are tremendously different from each other. Thus, the contrary finding from this research is therefore justifiable, reasonable and rational.

Besides that, the contradict findings may also be attributed to the differences in the Canadian and Malaysian cultural settings that lead to the contrary finding. This can be seen from the differences in the cultural dimensions by Hofstede. Hence, the finding showed that the degree of PA among Malaysian teachers does not significantly influence their behavioral intention to use the cloud-based VLE as compared to the managers of the Canadian telecommunications company. This evidence may provide new understanding to the Western scholars and practitioners about the effect of PA on behavioral intention of the VLE.

6.4.5 Perceived competence and behavioral intention

PC was found to have significant effect on BI. This is in similar to Roca and Gagné (2008). However, the finding further extended the literature on SDT as the previous study by Roca and Gagné (2008) was done from the context of grid computing e-

learning continuance intention in the workplace. The study on the other hand examined the effect of PC from the cloud computing VLE. Hence, it has given new evidence to support that in the cloud-based VLE context, the level of PC may significantly influence teachers' behavioral intention to use the VLE. It also validated the theory that was being theorized in the hypothesis development section that the increase in the level of VLE competence may lead to an increase in teachers' behavioral intention to use the VLE. This new finding may provide new perspective to scholars and practitioners about the influence of PC on BI that has not been validated previously.

6.4.6 Perceived competence and trust in website

Interestingly, this new finding has given evidence for support of the establishment of a new link between PC and TW from the context of cloud-based VLE. Hitherto there have been hardly any studies done on the investigation of the effect of PC on TW from the perspective of cloud-based VLE. Hence, the finding contributes significantly to the body of knowledge of cloud-based VLE by advancing the literature of PC and TW. With this evidence, scholars will be able to use it as a foundation to further investigate its effect in other contexts of study. For examples, future studies may be conducted by theorizing that PC may also have the same effect on TW in the Massive Open Online Courses (MOOC) context, Game and Gamification context, Wearable Technology context, Tablet computing context, Digital Text Book context and etc.

With this evidence, it is now clear that teachers' with low PC will have low TW in comparison to teachers who have higher degree of PC. As theorized in the hypothesis development, competency plays a very important role in determining the level of trust toward the VLE website. With high level of competency, the teachers will have more trust in operating and using the content in the VLE website.

6.4.7 Trust in website and behavioral intention

The study has managed to establish a new association between TW and BI from the perspective of cloud-based VLE. Nevertheless, the finding has given evidence to support the theory that trust in website does have significant influence on BI from the cloud-based VLE context. This showed that teachers who have higher trust toward the VLE website are more likely to use the VLE system compared to those who have lesser trust toward the website. The new association between TW and BI has further extended the current literature of trust in technology acceptance. With this finding, it has provided a strong foundation for future scholars to pursue in this direction but from other contexts of studies. It would be interesting to see whether the same finding can be applied in the contexts of MOOCs, Tablet Computing, Digital Text Book, Game and Gamification and etc.

6.4.8 School support and behavioral intention

The significant effect of SS on BI is similar to the finding by Huang et al. (2009) who have examined the effect of management support from the context of grid-based blog article. The finding from this study has provided evidence to support the influence of SS on BI from the context of cloud-based VLE. For example, there are many cases where school administrators have supported the teachers in implementation of the cloud-based Frog VLE by providing the necessary moral and financial supports through the provision of regular trainings and workshops as well as providing assistance and support to apply for the Frog Classroom or ChromeLab from YTL to further improve the infrastructure and facilities of the Frog VLE (FrogAsia.com, 2014). Due to the differences between the two contexts, the finding will provide new understanding and insight about the effect of SS on teachers' behavioral intention to use the VLE. Therefore, it may contribute theoretically to the extant literature regarding school

support and BI. Besides that, it may also serve as a basis for extending the finding to other contexts of study. For instances, future studies may be done to examine the influence of SS on BI in MOOC, e-book, gamification and etc.

6.4.9 VLE content design and perceived media richness

The significant influence of VLE content design on PMR has provided a new link between the two constructs as there have been no studies on this association previously. However, the newly established link may offer vital information and insight on the effect of content design on PMR of cloud-based VLE. This has given empirical evidence and support that the richer the content of the VLE the higher the perception of media richness among the school teachers. This further advances the existing literature on VLE content design and PMR particularly from the context of cloud-based VLE.

6.4.10 VLE content design and behavioral intention

The finding from the study is contradictory to Lee et al. (2009) who have carried out their study from the context of the grid-based e-learning. Owing to the huge differences between grid computing and cloud computing technology, the finding from Lee et al. (2009) has been shown to be inapplicable in this new context of study. Another reason for the contradictory result is the cultural differences between the Korean cultural setting and the Malaysian cultural setting. For examples, Malaysia's scores are 100, 85 and 100 in power distance, uncertainty avoidance and long term orientation in comparison to South Korea's scores of 60, 36 and 41 in the respective cultural dimensions. The cultural differences have rendered the inconsistency in the findings from both studies.

The finding also contradicts the study by Hong et al. (2002) who have conducted their study from the context of digital libraries. The inconsistency between these findings may be caused by the different contexts of study. Digital libraries are significantly different from the cloud-based VLE as two different technologies were involved. Digital libraries as grid-based whereas the VLE is cloud-based. These have contributed to the opposing findings from both studies.

Another justification for this difference is due to cultural differences between the two studies. Hong et al. (2002) has conducted their study using the students from Open University of Hong Kong (OUHK) whereas this study used the Malaysian teachers as sample. The cultural differences contributed significantly to the contrary findings from the two studies. For instances, Malaysia's scores in power distance and indulgence are 100 and 57 compared to Hong Kong's scores of 68 and 17 respectively. Anyway, the insignificant effect of VLE content design on behavioral intention may provide a new understanding and insight and provide a foundation for future studies by scholars and further enrich the extant literature on content design of cloud-based VLE.

6.4.11 Perceived media richness and behavioral intention

The significant effect of PMR on BI is similar to the direct effect found in studies of online learning (Agarwal & Prasad, 1999; Al-Gahtani & King, 1999; Davis et al., 1989; Huang, 2005; Liu et al., 2009; Seyal et al., 2002) as well as the indirect effects in the contexts of Second Life, blogs and podcasts (Saeed et al., 2010). It is also consistent with the finding by Saeed and Sinnappan (2010) who found significant influence of PMR on BI of blogs, podcasts and Second Life. However, it is different from these previous studies in the sense that the finding was validated from the context of the cloud-based VLE context instead of the conventional grid-based online learning,

Second Life, bogs or podcasts contexts. Therefore, the finding may provide useful insights on the effect of PMR on teachers' behavioral intention to use the VLE. Because of the new context of study, the finding has given new evidence and thus extended the existing literature on PMR and BI to practitioners and scholars. Furthermore, the study also showed support for the theory being theorized in the hypothesis development that the richer the media of the VLE (e.g. multimedia, video, audio, animation, graphic etc.), the more likely the teachers will use the VLE.

6.4.12 VLE interactivity and perceived media richness

This newly developed relationship shows that in the context of cloud-based VLE when users perceive that the degree of interactivity is high, their perception of perceived media richness of the system will also increase. This also support the finding by Ghose and Dou (1998) who found that higher degree of interactivity will lead to high level of attractiveness as it will provide more options, control, feedback and positive perceptions. Therefore the level of perceived media richness will also increase. The new finding has contributed theoretically to the cloud-based VLE literature and may be further extended to other contexts of study such as gamification, MOOC, digital textbook and etc.

6.4.13 Specialization and behavioral intention

Interestingly, the study has unveiled a new association between teachers' specialization and their behavioral intention to use the cloud-based VLE. Hitherto, there have been hardly any studies on this subject matter. Hence, the finding has therefore offered new empirical evidence and support on the influence of teachers' specialization on BI. The finding showed that specialization has a negative beta coefficient. Similar to Shinnar, Giacomin and Janssen (2012, p. 478), this indicates that teachers who specialized in science have lower behavioral intention than teachers who

specialized in arts. This may be justified by the nature of the arts-based teachers who are more artistic and creative (Eisner, 2002). The arts teachers seem to be more innovative (Burton, Horowitz & Abeles, 1999) and creative in using the VLE systems compared to the science teachers. The finding provided evidence to support that arts specialized teachers have higher propensity to use the VLE in comparison to the science specialized teachers.

The study has further validated the confounding effect of the control variable of teachers' specialization on their behavioral intention to use the cloud-based VLE. The finding also extended the current literature on teachers' specialization and cloud-based VLE and thus provided new understanding to scholars and practitioners. It may serve as a foundation for future studies on various different contexts of studies for example the MOOC, game and gamification, digital e-book and etc.

6.4.14 Teaching experience and behavioral intention

Unlike teachers' specialization, the control variable of teaching experience was found to have no significant influence on teachers' behavioral intention. Although this is contrary to the hypothesis being theorized, nevertheless the finding has provided imperative information to scholars and practitioners as now they are certain that there is no confounding effect of teaching experience on teachers' behavioral intention to use the cloud-based VLE. This empirical finding also extended the existing literature on cloud-based VLE and contributed to the body of knowledge. It has not supported the theory that the more experience the teachers, the more likely the teachers will intent to use the VLE. This may be due to the advancements in the VLE that is so user-friendly that even inexperience teachers will found it to be as easy to use as the experience

teachers do. Hence, irrespective of how experienced a teacher may be, the teacher's intention to use the cloud-based VLE is independent of the teaching experience.

6.4.15 Educational level and behavioral intention

Educational level was found to have no significant effect on BI. This is contrary to the finding by Leong et al. (2011). However, the two studies were conducted using two different contexts of study. Leong et al. (2011) examined the effect of academic qualification on behavioral intention to use mobile entertainment whereas this study examined the effect of educational level on teachers' intention to use cloud-based VLE. The contexts of mobile entertainment and cloud-based VLE are entirely different. Mobile entertainment involves primary hedonic constructs whereas this study involves utilitarian constructs. Furthermore, entertainment and education do not seem to match each other. Therefore the contradictory findings can be reasonably justified and explained. Even though the finding is inconsistent with previous study, it has given new evidence and support of the non-significance of educational level on behavioral intention of cloud-based VLE. This may offer useful insight and understanding to scholars and practitioners for their future studies and actions.

6.4.16 Behavioral intention and perceived instructional effectiveness

So far there has been no study conducted on the effect of behavioral intention on perceived instructional effectiveness from the Malaysian school teacher's perspective. However, the finding is consistent with the work of Šumak, Heričko, Pušnik and Polančič (2011) who found that BI is the immediate antecedent of use behavior. However, the contexts of study of both studies are different. Šumak et al. (2011) conducted their study on Moodle which is a grid-based VLE whereas this study is conducted from the context of the Frog VLE which is a cloud-based VLE. Thus, even

though the findings are similar, nevertheless this study has provided new and vital understanding and insight with regards to the effect of BI on PIE from the context of a cloud-based VLE. With this empirical support, scholars may use it as a platform for other contexts of study. For example, it would be interesting to investigate whether BI on digital text book, MOOC or gamification has any significant effects on perceived instructional effectiveness of these contexts of study. The finding further validated the theory that the higher the teachers' intention to use the VLE, the higher their perception of instructional effectiveness.

6.4.17 Mediating effect of trust in website

One of the significant findings of this study is the significance of the mediation effect of trust in website on the linkage between PC and BI. However, based on the Baron-Kenny's procedure and Sobel's test, the finding has provided new theoretical understanding on the mediating effect of the mediator of TW. This empirical evidence has supported the mediating role of TW in the PC-BI relationship. It further showed that TW partially reduces the effect of PC on BI. With this new finding, scholars and practitioners will be able to understand more about the mediating role of TW and therefore can make better decision makings.

Theoretically, this means that when trust in website is introduced, the effect of perceived competence on behavioral intention will be lessened. This is a new theoretical finding that has been overlooked in previous VLE-related studies. It has helped to address the noted research gaps in existing VLE literature. More specifically, it was found that based on the partial mediating effect of trust in website, perceived competence may have an indirect effect on behavioral intention through the mediating variable of trust in website.

Practically, MoE and FrogAsia need to pay attention and focus not just on the effect of perceived competence but also trust in website in order to increase teachers' intention to use Frog VLE. This is because the role of perceived competence cannot be ignored as there is no full mediating effect of trust in website, meaning that trust in website cannot take-over totally the influence of perceived competence in teachers' acceptance of the cloud-based Frog VLE. Hence, a two-prong approach may be used in promoting the levels of perceived competence as well as trust in website to further enhance intention to use among school teachers.

6.4.18 Mediating effect of attitude toward knowledge sharing

Thus far there has been no study conducted in examining the mediating effect of AT on the link between PR and BI. Therefore, the new finding has provided essential insight on the mediating role of AT on the association between PR and BI. The partial mediating effect of AT means that when AT is introduced, it partially reduces the effect of PR on BI. This finding has given new empirical evidence and support for the significance of the partial mediation effect of AT from the context of cloud-based VLE. Future studies may be conducted to further explore this mediating effect in other contexts of study such as e-textbook, MOOC and etc.

This finding has provided new theoretical implication and further closed the existing research gaps that exist in the VLE literature. Previously, there has been no theory that supports the mediating effect of attitude towards knowledge sharing on the association between perceived relatedness on behavioral intention to use the cloud-based Frog VLE. However, due to the partial mediating effect of attitude towards knowledge sharing, it signifies that the role of perceived relatedness cannot be totally taken by attitude

towards knowledge sharing. However, this effect can be partially lessened by the mediating variable.

From the perspective of practical implication, MoE and FrogAsia as well as other relevant stakeholders may use a two-prong strategy by emphasizing both attitude towards knowledge sharing and perceived relatedness among teachers in order to strengthen their intention to use the cloud-based Frog VLE. This is due to the fact that the effect of perceived relatedness still exists even with the introduction of the mediating variable of attitude towards knowledge sharing. Hence, the best way to promote the intention to use among teachers is to give due attention and effort to intensifying the level of perceived relatedness and attitude towards knowledge sharing.

6.4.19 Mediating effect of perceived media richness

Likewise, no study has been done to examine the mediating effect of PMR on the VCD-BI relationship. Anyway, the finding has given empirical evidence to support the significant mediating effect of PMR on the link between VCD and BI from the context of cloud-based VLE. It showed that when PMR is introduced, it may lessen the influence of VCD on BI partially. Through this new finding, scholars and practitioners will be able to garner better understanding on the effect of VCD on BI and therefore, better decision makings can be made.

The finding has provided new theoretical implication as it shows that perceived media richness has a partial role to play in stimulating teachers' intention to use the cloud-based Frog VLE. It also denotes that the effect of VLE content design on intention to use cannot be completely replaced by perceived media richness. This is a new theoretical finding that has significantly closed the existing research gaps in the

VLE literature. With this finding, scholars and researchers may further explore its validity in other contexts of study.

Practically, all VLE stakeholders including FrogAsia and MoE may consider using a two-prong policy by simultaneously focusing on strengthening the level of perceived media richness as well as VLE content design in order to further fortify teachers' intention to use the cloud-based Frog VLE. Various measures may be taken to accomplish this objective as elaborated in the practical implication section.

6.5 Chapter summary

This chapter has presented the discussion on the similarities and differences between the findings from this study and other existing studies. Justifications were given in explaining the differences between the findings from this study and other relevant studies. The next section will elaborate on the theoretical and practical implication as well as the limitations and directions for future studies.

CHAPTER 7: CONCLUSION

7.1 Introduction

This chapter will explain in more detail the contributions of the findings from the study. Generally, these contributions may be categorized into the methodological, theoretical and practical contributions.

7.2 Methodological contributions

The significant methodological contribution of the study is the development of an effective measurement instrument to measure teachers' behavioral intention to use the cloud-based VLE and the perceived instruction effectiveness of using cloud-based VLE from the context of SDT and CET in the Malaysian cultural setting. Through the rigorous instrument validation processes, the findings from this study may provide theoretical contribution in terms of validating the influence of cultural differences on the development of the measurement instrument. It is now confirmed that adapted items from existing VLE-related instruments should go through rigorous validations before they can be applied in different cultural settings. Therefore, it is hoped that this rigorously validated instrument may contribute methodologically to the integration of the SDT and CET in predicting the intention to use and the instructional effectiveness of VLE. This may further extend the literature in IS field thus filling the existing research gaps in terms of cloud-based VLE instrument development and validation.

7.3 Theoretical contributions

The study has offered several theoretical contributions. Since the study has engaged additional effort to corroborate instrumentation for established theoretical constructs, it was able to assess the robustness of the constructs and theoretical relationships to the measurement change or method thus may represent substantial contribution to the scientific practices in the technology adoption literature (Dwivedi, Choudrie & Brinkman, 2006).

Firstly, the newly developed SDT-CET integrated model has contributed to the IS adoption literature as it is the perhaps first time ever that direct effects of SDT and CET constructs were empirically tested and corroborated. This advances the IS adoption literature since very limited focus has been given to the role of SDT and CET on behavioral intention from the cloud-based VLE context.

Before this, much attention has been given to extrinsic motivation drivers such as TPB, TAM and UTAUT. However, in this study, intrinsic motivational drivers from SDT have been found to be strong predictors of BI. Prior studies have mainly concentrated on examining VLE from the students or learners perspective. Perhaps, this study is among the first to focus on the perspective of teachers and from the cloud-based VLE context. The new context of study and perspective of users have contributed theoretically in further extending the cloud-based VLE literature.

Secondly, several other novel associations have also been established for the first time and these include the effects of TW, AT, SS, PMR, VCD and ED on BI as well as the PR-AT and PC-TW associations. The validations of these novel relationships have further advanced the extent of extant IS literature. With these new findings, the study

has contributed theoretically in establishing new theories on the effects of TW, AT, SS, PMR, VCD and ED on the behavioral intention to use the cloud-based VLE. It has also contributed theoretically in developing new theories on the influence of PR on AT and PC on TW.

Thirdly, the study also theoretically advances the VLE literature in corroborating the partial mediating effects of TW on PC-BI, AT on PR-BI and PMR on the VCD-BI relationships. In addition, the partial mediations show that PC, PR and PMR by themselves are able to directly affect BI. Furthermore, the researcher also discovered no significant effects of PR, PA, VCD, ED and TEX on BI. These relationships have not been examined in previous studies. Hence, the findings may contribute theoretically as it is now empirically validated that there are no supports for the associations between these constructs and behavioral intention to use the cloud-based VLE.

Next, the introduction of the unique VLE-related constructs of PMR, VCD and VI as well as the AT and TW constructs have further enhanced the research model as the model is specifically tailored for the context of the cloud-based VLE. This has further extended the existing VLE-related body of knowledge. Several hypotheses being theorized have been empirically validated. These include the significant influence of AT, TW and PMR on BI. The other newly established theories are the significant effect of PMR on VI and the significant influence of VCD on PMR. Scholars may apply these newly developed theories in other contexts of study such as MOOC, digital text book, game and gamification and etc.

Finally, the research model has been able to predict BI, PMR, VI, AT, TW and PIE with 63.0%, 60.5%, 60.5%, 45.2%, 29.1% and 28.5% variance explained while verifying the research model from the new context of a cloud-based VLE for the first time using 608 respondents selected randomly from 351 Frog champion schools across the nation compared to the previous grid computing-based VLE-related studies which mostly used convenience sampling. Thus, the findings from the random sampling nationwide may provide better generalization compared to the convenience sampling used in previous VLE related studies.

7.4 Practical contributions

Basically, there are several important practical implications that can be derived from the research findings. Firstly, the methods used in developing and validating the measurement instrument may act as a reference for other researchers and scholars who wish to conduct researches in their respective cultural settings. Secondly, policy and decision makers as well as other educational stakeholders in Malaysia may utilize the findings from the use of this instrument to further enhance and promote the adoption of the Frog VLE. Teachers and instructors can also increase the level of instructional effectiveness based on the findings from the use of this instrument. VLE content and service providers such as YTL may incorporate the findings of the studies that use this instrument in raising the quality of the VLE content and services.

Thirdly, since PR and AT are significant predictors, MoE and FrogAsia may put in more efforts in promoting the connectedness and knowledge sharing among teachers. This may be carried out by providing more platforms of interaction among teachers through teamwork activities and collaborations. For example, more gatherings in the forms of colloquiums, seminars, conferences, workshops and in-house trainings can be

conducted for teachers to establish new connections especially in using the Frog VLE. More promotions may be given in encouraging teachers to use the Community and Forum applications so that teachers will be able to sharing the expertise, skills and knowledge.

Forth, as PC is a significant predictor, more hand-on trainings may be given from time to time to refresh and update the competencies and skills required in using the cloud-based VLE. Besides that, online tutorials may also be provided for teachers to get use to the Frog VLE interface. To ensure that all teachers possess the necessary skills needed in operating the VLE, online tests may be held from time to time. For those who have achieved the minimum requirement, a certificate of achievement may be given to them and for those who do not achieve the minimum requirement; further trainings may be given to them. To encourage teachers to master these skills, online competitions may also be held and prizes and gifts may be given to the winners of the competitions. Besides online competitions, star rating may also be given to teachers who have achieved different level of competencies. For example, teachers who score above 80% may be rated as 5-star Frog teachers. Besides the star rating approach, online rewards such as Frog credit and storage space may also be given to teachers who have attained high level of competency.

Fifth, trust in website is a significant predictor. Hence, without adequate security and privacy protection in the VLE platform, teachers may distance themselves from using the VLE. This is due to the lack of trust within the teachers in using the VLE system. Therefore, as the provider of the VLE, FrogAsia should always uphold the highest degree of security and privacy protection in the VLE platform to build trust among teachers as it is only with trust in the hearts of the teachers that will ultimately

lead to their intention to use the VLE. For examples, to build up the trust in the VLE website, encryption may be used for all the documents that are uploaded or downloaded from the website.

Online virus scanning may also be engaged for all uploads and downloads of documents and files. A strong Firewall should be provided to ensure that the website is not easily hacked by hackers and intruders. Another way to instill trust in the website is by ensuring that all instructional resources and contents in the website are screened, checked and endorsed by the Curriculum Development Center (CDC). A logo of CDC certification may be shown on screen so that all teachers will notice that the website is endorsed by the CDC. With this endorsement, teachers will feel more trust towards the website in comparison to other educational resources available from other websites.

Sixth, since school support is among the significant predictors therefore from the perspective of school administrators, strong support should be given to teachers in encouraging them to use the platform. For instance, this may be done by honoring and recognizing the efforts of teachers who have used the VLE frequently and effectively. Certificates or prizes may be given to these teachers or their success stories may be highlighted in the Frog VLE website and school bulletin boards. Besides that, principal and headmasters may also consider the frequency of usage as one of the criteria in the annual appraisal.

To provide further support, a special committee may be formed to monitor and oversee the implementation of the Frog VLE system. This committee may act as a bridge between the teachers and the school administrators whereby the teachers may

voice their problems and grouses to the school administrators while the school administrators may give their feedbacks and solutions during the committee meetings.

Besides the establishment of the committee, school administrators may work with the school's Parent-Teacher Association (PTA) to raise fund in order to provide the best hardware and software facilities to the school teachers. For examples, by organizing a Frog VLE Run or a Frog VLE Charity Dinner, monetary fund can be raised to buy more PCs, Chromebooks, Dongles, Routers, Switches, Bridges, Hubs, Repeaters and Modems. To further support the implementation of the VLE, school administrators may hold Frog VLE Awareness Campaign such as Frog VLE Launching Day, Frog VLE Week, Frog VLE Exhibition Day and etc. The administrators may also invite the trainers from FrogAsia to give talks and conduct workshops to teachers and students on the latest development of the Frog VLE systems. Finally, school administrators may also hold Frog VLE Site Creation Competition among the teachers or among the subject panels. The winners may be given certificates of achievement and prizes and for all participants; certificates of attendance may be given.

Seventh, since PMR and VCD are significant predictors, FrogAsia should make sure that the VLE platform is always upgraded with media-rich functionalities and whenever there is breakthrough of new media technology, the state-of-the-art development should be incorporated into the VLE. For instance, more media-rich apps can be uploaded in the FrogStore for teachers to download into their notebooks, tablets, smart-phones or other future mobile gadgets.

In line with the media richness of the VLE, the content design of the VLE should also be enriched and enhanced from time to time as this may allow teachers to save energy and time in preparing their lessons. For examples, standardized teaching courseware may be incorporated into the VLE systems. Based on these standardized coursewares, teachers may further enhance and customize them according to their needs.

Besides the teaching courseware, online examination recording and processing system such as the SAPS may also be integrated into the VLE system so that teachers may perform the evaluation and monitoring tasks under a same roof. Other contents to be incorporated into the VLE may include digital textbooks or e-textbooks and educational entertainment (edutainment) applications such as games and gamifications and educational simulations. Nevertheless, without interactivities from the teachers, a rich VLE content will be meaningless. Thus, efforts should be given in promoting the level of interactivity among the teachers. This can be accomplished by giving rewards in the form of recognition to teachers who have interacted most with the VLE system.

In line with these, FrogAsia may create apps in the VLE platform that can measure the frequency of use by teachers and create a 'house of fame' for the top 100 most active users. Besides that, other rewards such as data rewards (MB storage), the yes credit (monetary) or frog credits (i.e. reward points) and etc. can also be given out. To further encourage interactivity, competitions may be held from time to time whereby the top 10 most active Frog VLE users will be given a certificate of recognition, award or prize. Besides the competitions, star rating system may be introduced whereby teachers are given various star ratings based on their level of activeness. A 5-star teacher indicates the most active category of teachers.

Finally, since specialization is a factor that influences BI. As mentioned in the previous chapter, teachers specialized in arts seems to be more inclined towards using the VLE systems as they are more artistic, creative and innovative in creating teaching materials. Therefore, in order to raise the behavioral intentions among teachers who specialized in science, MoE may identify teachers who are less active and send them for enrichment or refreshment courses especially in the aspect of innovative and creative teaching approaches using the Frog VLE platform. Another alternative method is by inviting the winners from the 1BestariNet Teacher Award (http://www.1bnteacherawards.com/winners/) to give talks and conduct workshops on how to use the Frog VLE creatively and innovatively for enhancement of instructional processes.

7.5 Limitations and future research directions

Just as any other study, this study also has several limitations. Firstly, the study is limited to the Malaysia geographical area. The data was collected and analyzed in the Malaysian cultural setting. Hence the findings may not be relevant to other geographical areas. Thus, future studies may be conducted in other geographical areas or cultural settings.

Secondly, even though the research model is capable of explaining 63.0% of the variance in BI, there may be other factors that can be incorporated in to the research model in the upcoming studies. Hence, future studies may extend the research model by incorporating other theories or constructs in order to improve the predictive power of the research model. Thirdly, since the current study used a cross sectional approach, future studies may utilize a longitudinal approach in order to examine the temporal effect of time towards the intention to use the cloud-based VLE. Finally, gender, age

and other demographic variables may be taken as moderating variables in future studies to examine whether the strengths of the relationships are affected by these moderating variables.

7.6 Chapter summary

This chapter has presented the theoretical and practical contributions of the study. It has explained in detail each of these contributions. The theoretical contributions may provide scholars with new and useful insights on the effects of SDT and CET on the acceptance and perceived instructional effectiveness of the cloud-based VLE while the practical contributions have provided practical recommendations and suggestions to the practitioners including MoE, YTL Corp and all cloud-based VLE stake holders for better decision makings in their policy and strategic planning.

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LIST OF PUBLICATIONS AND PAPERS PRESENTED

Published paper:

1. Understanding cloud-based VLE from the SDT and CET perspectives: Development and validation of a measurement instrument, *Computers & Education* (ISI: SSCI, JCR 2016 Q1: Impact Factor: 3.819, SJR: Q1 in E-Learning, Computer Science and Education) - Published online.
   Citation: Hew, T.S., & Kadir, S.L.S.A. (2016). Understanding cloud-based VLE from the SDT and CET perspectives: Development and validation of a measurement instrument. *Computers & Education*, 101(Oct 2016), 132-149.

2. Predicting the acceptance of cloud-based Virtual Learning Environment: The roles of Self Determination and Channel Expansion Theory, *Telematics & Informatics* (ISI: SSCI, JCR 2016 Q1: Impact Factor: 3.398, SJR: Q1 in Communication, Computer Networks and Communications, Electrical and Electronic Engineering, and Law) - Published online.
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3. Behavioural intention in cloud-based VLE: An extension to Channel Expansion Theory, *Computers in Human Behavior* (ISI:SSCI, JCR 2016 Q1: Impact Factor: 3.435, SJR: Q1 in Human-Computer Interaction, Psychology and Arts and Humanities) - Published online.
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4. Predicting instructional effectiveness of cloud-based virtual learning environment: An artificial neural network approach, *Industrial Management & Data Systems* (ISI:SCIE, JCR 2016 Q3: Impact Factor: 2.205, SJR: Q1 in Management Information Systems, Industrial Relations, Industrial and Manufacturing Engineering) - Published online.
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6. The drivers for cloud-based Virtual Learning Environment: Examining the moderating effect of school category, *Internet Research* (ISI: SCIE & SSCI, JCR 2016 Q1: Impact Factor: 2.931, SJR: Q1 in Communication, Economics and Econometrics, Sociology and Political Science) - Published online.
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