COLLABORATIVE MOBILE INSTANT MESSAGING LEARNING PEDAGOGICAL MODEL FOR TEACHER TRAINING

KHAIRAH @ ASMA'A BINTI BAHARUN

FACULTY OF EDUCATION
UNIVERSITY OF MALAYA
KUALA LUMPUR

2018

COLLABORATIVE MOBILE INSTANT MESSAGING LEARNING PEDAGOGICAL MODEL FOR TEACHER TRAINING

KHAIRAH @ ASMA'A BINTI BAHARUN

PHA140028

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

FACULTY OF EDUCATION
UNIVERSITY OF MALAYA
KUALA LUMPUR

2018

UNIVERSITY OF MALAYA

ORIGINAL LITERARY WORK DECLARATION

Name of Candidate: **KHAIRAH @ ASMA'A BINTI BAHARUN**

Matric No: **PHA140028**

Name of Degree: **DOCTOR OF PHILOSOPHY (PhD)**

Title of Project Paper/Research Report/Dissertation/Thesis ("this Work"):

COLLABORATIVE MOBILE INSTANT MESSAGING LEARNING PEDAGOGICAL MODEL FOR TEACHER TRAINING

Field of Study: **CURRICULUM AND INSTRUCTIONAL TECHNOLOGY**

I do solemnly and sincerely declare that:

(1) I am the sole author/writer of this Work;
(2) This Work is original;
(3) Any use of any work in which copyright exists was done by way of fair dealing and for permitted purposes and any excerpt or extract from, or reference to or reproduction of any copyright work has been disclosed expressly and sufficiently and the title of the Work and its authorship have been acknowledged in this Work;
(4) I do not have any actual knowledge nor do I ought reasonably to know that the making of this work constitutes an infringement of any copyright work;
(5) I hereby assign all and every rights in the copyright to this Work to the University of Malaya ("UM"), who henceforth shall be owner of the copyright in this Work and that any reproduction or use in any form or by any means whatsoever is prohibited without the written consent of UM having been first had and obtained;
(6) I am fully aware that if in the course of making this Work I have infringed any copyright whether intentionally or otherwise, I may be subject to legal action or any other action as may be determined by UM.

Candidate's Signature Date:

Subscribed and solemnly declared before,

Witness's Signature Date:

Name:

Designation:

ABSTRACT

Mobile Instant Messaging (MIM) is one of a social media application that is increasingly being viewed as a tool to enhance learning delivery in the mobile learning environment. Its potential to support collaborative learning has gain interest in education because of its compelling features such as speed, interactivity and less cost. Therefore, this study was conducted to develop a Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model for teacher training. The study adopted the Design and Development Research (DDR) approach. Based on the approach, the study was conducted in three phases. The first phase is the Needs Analysis phase that aimed to identify a need to develop the CMIML pedagogical model for teacher training. This survey was based on lecturers' perceptions and level of acceptance and intention to use CMIML if incorporated in the formal course. This study involved 268 lecturers in Malaysia Institute of Teacher Education. The instrument used for this phase is a set of need analysis survey questionnaire which is constructed based on Unified Theory of Acceptance and Use of Technology (UTAUT). The second phase of the study is the design and development stage which adopted Nominal Group Technique (NGT) and Interpretive Structural Modelling (ISM) techniques in order to develop the CMIML Pedagogical Model for teacher training. The findings of the study constitute the result of the experts' collective views on the pedagogical activities and the relationships among the activities. The final phase of this study is to evaluate the CMIML Pedagogical model. This phase is to determine the suitability of the model as support to formal learning for teacher training. This evaluation phase has applied a modified Fuzzy Delphi Method (FDM) to determine the consensus' views and opinions from 25 selected panel of experts based on their responses to a five-linguistic scale survey questionnaire. The 'threshold' value 'd' was calculated to determine the experts' consensus for all questionnaire items while the defuzzification (Amax) values for the items would determine the agreement of the experts. The findings for Phase 1 indicated the need for the study to develop the model. Findings from Phase 2 resulted in the development of the model that consisted of 27 pedagogical activities determined by a panel of experts. From the model developed, the experts viewed that the pedagogical activities could be divided into five categories and four activity clusters to facilitate the interpretation of the roles of the activities. Finally, findings from Phase 3 showed

that all the items have met the requirements needed in the triangular fuzzy number and deffuzification process which revealed that all experts consensually agreed with these questionnaire items. The result of the study can be useful to policy makers, lectures and instructors as it provides guidelines and considerations required in conducting mobile learning. Thus, the pedagogical model is expected to improve the delivery of teaching and learning methods to be more efficient through planning in shaping the framework of the course better.

ABSTRAK

Aplikasi Pesanan segera mudah alih atau Mobile Instant Messaging (MIM) adalah salah satu media sosial yang semakin dipandang sebagai alat untuk meningkatkan penghasilan pembelajaran dalam persekitaran pembelajaran mudah alih. Potensinya untuk menyokong pembelajaran kolaboratif telah mendapat minat dalam pendidikan kerana ciri-ciri menariknya seperti kelajuan, interaktiviti dan kos yang kurang. Oleh itu, kajian ini dijalankan bertujuan untuk membangunkan satu model pedagogi "Collaborative Mobile Instant Messaging Learning" (CMIML) untuk latihan guru. Kajian ini menggunakan pendekatan Penyelidikan Reka bentuk dan Pembangunan (DDR). Berdasarkan kaedah ini, kajian ini dijalankan dalam tiga fasa. Fasa pertama adalah fasa Analisis Keperluan yang bertujuan untuk mengenalpasti keperluan untuk membangunkan model pedagogi CMIML untuk latihan guru. Tinjauan ini berdasarkan persepsi pensyarah dan tahap penerimaan dan niat untuk menggunakan CMIML jika digunakan dalam kursus formal. Kajian ini melibatkan 268 pensyarah di Institut Pendidikan Guru Malaysia (IPGM). Instrumen yang digunakan untuk fasa ini adalah satu set soal selidik analisis keperluan yang dibina berdasarkan teori penerimaan dan penggunaan teknologi "Unified Theory of Acceptance and Use of Technology" (UTAUT). Fasa kedua kajian ini pula adalah fasa reka bentuk dan pembangunan yang menggunakan kaedah "Nominal Group Technique" (NGT) dan "Interpretive Structural Modelling" (ISM) untuk membangunkan model pedagogi CMIML untuk latihan guru. Dapatan kajian ini merupakan hasil daripada pandangan kolektif pakar mengenai aktiviti pedagogi dan hubungan di antara aktiviti-aktiviti tersebut. Fasa terakhir kajian ini adalah fasa penilaian di mana ia bertujuan untuk menilai model pedagogi CMIML. Fasa ini adalah untuk menentukan kesesuaian model sebagai sokongan kepada pembelajaran formal untuk latihan guru. Fasa penilaian ini telah menggunakan kaedah "Delphi Fuzzy" (FDM) yang diubahsuai untuk menentukan pendapat dan pandangan konsensus dari 25 panel pakar yang dipilih berdasarkan kepada tanggapan mereka terhadap soal selidik tinjauan yang menggunakan skala lima linguistik. Nilai ambang 'd' dikira untuk menentukan kesepakatan para pakar untuk semua item soal selidik manakala "defuzzification" (Amax) untuk item soal selidik akan menentukan persetujuan pakar. Hasil dapatan kajian pada fasa 1 menunjukkan bahawa terdapat keperluan untuk membangunkan model ini. Dapatan daripada fasa 2 pula menghasilkan model yang terdiri daripada

27 aktiviti pedagogi yang telah dikenal pasti oleh panel pakar. Dari model yang dibangunkan, para pakar melihat bahawa aktiviti pedagogi boleh dibahagikan kepada lima kategori dan empat kluster aktiviti untuk memudahkan penafsiran peranan aktiviti-aktiviti tersebut. Dapatan daripada fasa ketiga kajian mendapati bahawa semua item telah memenuhi syarat yang diperlukan dalam Triangular Fuzzy Number dan proses defuzzification yang mendedahkan bahawa semua pakar bersetuju dengan item soal selidik ini. Hasil kajian ini diharapkan berguna kepada pembuat dasar, pensyarah dan pengajar kerana ia dapat menyediakan garis panduan yang diperlukan dalam menjalankan pembelajaran mudah alih. Oleh itu, model berstruktur ini dijangka dapat meningkatkan kaedah pengajaran dan pembelajaran yang lebih cekap melalui perancangan dalam membentuk rangka kerja kursus dengan lebih baik.

ACKNOWLEDGEMENTS

In the name of Allah, the All-merciful, the All-compassionate,

Foremost, I would like to express my gratitude to Allah SWT, The Most Gracious, The Most Merciful to enable me to complete my PhD thesis. My deepest appreciation to both my supervisors, Prof. Dr Saedah Siraj and Assoc. Prof. Dr Muhammad Faizal A. Ghani for their guidance, kindness, and supports along my PhD journey. Without their acknowledgement, patience, and commitment, it would not be possible to complete this thesis on time. I am blessed to have them in my life and may Allah grant them with the best reward.

I am honoured to express my utmost gratitude to my beloved husband, Jalili bin Alias, and my lovely angles: Nur Irdina, Nur Qasrina, and Izzul Iman. Thank you so much for your continuous pray and encouragement. I am blessed to have your support and understanding in every minute of my life. My special gratitude also goes to my mother, Pn Zainun Ibrahim and and my siblings as well. Without all of you, this effort would be nothing and my PhD journey would be lonely.

I would like to acknowledge Ministry of Education for awarding me with the scholarship (HLP) that had provided the necessary financial support and academic leave for this research. I also like to thank University of Malaya (UM) and its staff for the academic and technical support, which have facilitated this dissertation process.

My special thanks also go to my best friend, Shamsazila Sa'aban. We have gone through this PhD journey with laughters and tears and hope that our friendships will last forever. Not forgetting my friends from Majlis Profesor Negara (MPN) Community Service Project, MELoR, Peace Projects and Seminar on Future Education (SFED) committee for their helps, guidances, and encouragements.

Last, but not least, I would like to thank all my friends for their cooperation and participation in this study. Thank you so much and May Allah blessed all of you with 'Jannah' and happy life now and hereafter. Aamiin.

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION

CHAPTER 2 LITERATURE REVIEW

CHAPTER 3 METHODOLOGY

CHAPTER 4 FINDINGS OF PHASE 1: THE NEEDS ANALYSIS

CHAPTER 5 FINDINGS OF PHASE 2: DESIGN AND DEVELOPMENT OF THE MODEL

CHAPTER 6 FINDINGS OF PHASE 3: EVALUATION

CHAPTER 7 DISCUSSION OF FINDINGS, IMPLICATIONS AND RECOMMENDATIONS

LIST OF FIGURES

LIST OF TABLES

LIST OF SYMBOLS AND ABBREVIATIONS

MIM	:	Mobile Instant Messaging
IM	:	Instant Messaging
ICT	:	Information and Communcation Technology
LMS	:	Learning Management System
SMS	:	Short Message System
HEIs	:	Higher Education Institutions
PDA	:	Personal Digital Assistant
mLearning	:	Mobile Learning
Elearning	:	Electronic Learning
NHESP	:	National Higher Education Strategic Plan
CAP	:	Critical Agenda Projects
ISM	:	Interpretive Structural Modeling
NGT	:	Nominal Group Technique
FDM	:	Fuzzy Delphi Method
MOE	:	Ministry of Education
MKO	:	More Knowledgeable Other
ZPD	:	Zone of Proximal Development
UTAUT	:	Unified Theory of Acceptance and Use of Technology
SSIM	:	Structural Self-Interaction Matrix
TPACK	:	Technological Pedagogical and Content Knowledge

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

Introduction

In 21st century, a challenge to the education system in Malaysia is to shift the paradigm of the teachers towards changes in methods of learning to use computers and access the latest information and communications technology (ICT) as an alternative approach. According to Zamri Mahamod and Mohamed Amin Embi (2008), a good educator is not only efficient in pedagogy but also knows how to apply ICT in teaching and learning process. Therefore, changes in the pedagogical use of ICT are necessary in order to make teaching and learning process more interesting and effective.

The Ministry of Education Malaysia (MOE) has responded positively to this challenge by enhancing the strategic plan to increase the use of ICT in education by providing sufficient ICT infrastructure and equipment to all Higher Education Institutions (HEIs), restructure the curriculum and assessment and integrate ICT in teaching and learning process, conduct training for lecturers and practitioners to upgrade their knowledge and skill in ICT, and encourage HEIs to adopt ICT in their management (Farahizan Zaihan Azizan, 2010). Due to these efforts, the teaching and learning environment in Malaysian universities has changed tremendously. Numerous classrooms are presently furnished with PCs, online tools and LCD projectors and even equipped with smart boards and video-conferencing facilities (Ann Rosnida Mohd. Deni, Zainor Izat, & Malakolunthu, S., 2013).

This situation has attracted great interest from the practitioners in HEIs in Malaysia where many have started to adopt and implement ICT solutions for example e-Learning as a source for flexible teaching and learning process either in the classroom or outside the classroom (Farahizan Zaihan Azizan, 2010). This advancement in technology has additionally increased the channels for learning in which traditional learning, for instance, is presently upheld by various online learning platforms (Ann Rosnida Mohd. Deni et al., 2013).

However, many challenges are encountered in relation to the governance of ICT or E-Learning in teaching and learning. According to Farahizan Zaihan Azizan (2010), HEIs were focusing more to provide ICT infrastructure to support online learning compared to firm plan for using ICT as a tool for teaching and learning. Hence, a strategic plan to promote active implementation of online learning in HEIs should be considered. The new trend in ICT that incorporates mobile learning in formal education may be the way to overcome this problem. According to The Digital News Report 2017, the main devices used by Malaysians are smartphone with 65%, computer (45%) and tablet (18%). It is also reported that the high level of internet usage in the country was due to Malaysia having good internet penetration and facilities. Therefore, this suggests that there is a great potential to use mobile devices in teaching and learning as many people have access to it. In conclusion, mobile learning may be seen as one of the future learning in education in Malaysia

However, the implementation of mobile learning in formal education is still in its infancy and can be accomplished if it is made in proper planning by all parties involved from the beginning. Thus, developing a guideline will become the main focus of the study in order to improve the current practices in teaching and learning. Hence, this research comes with specific purpose and objectives to bring a new finding in a form of model that give significant contributions to the higher authorities of Malaysian education and other stakeholders involved.

Background of the Study

Over the past decade, the new trend in the ICT that incorporated mobile learning (mLearning) in formal education has developed tremendously. Some researchers have for the most part shed a very positive light on the potential of the role that mobile devices may play in education (Stockwell & Hubbard, 2013). Research by Analisa Hamdan and Rosseni Din (2013) pointed that mLearning can be implemented in the education system in Malaysia as it is inexpensive, does not require high costs and some educational applications available for android is offered for free. Other than that, mlearning allows the learner to access information anytime and anywhere (Saedah Siraj, 2004). Furthermore, aligned with the current mobile technology trend, mLearning in Malaysia is supported through the Critical Agenda Projects (CAP) in National Higher Education Strategic Plan (NHESP) (PSPTN, 2013). Through this CAPs project, together with the fact that majority of higher institution students own the devices, should provide the opportunity to increase learning effectiveness through mLearning (Muhammad Ridhuan Tony Lim Abdullah, 2014).

Hence, it is the right time to incorporate mlearning for teaching and learning due to the fact reported in a Google Survey Report (2014) that the use of smartphones among Malaysians are among the highest in the world. It is one of five places in the world with the use of smartphones is much higher than the computer at a level of 51% versus 39%. Thus, this indicate that there is large potential in using mobile devices for teaching and learning as mobile device usage is higher than the computer. As more people have access to mobile devices, mlearning may be the way forward for teaching and learning for the future in Malaysian education.

Furthermore, the potential of mobile phones, particularly mobile instant messaging (MIM) has become popular and opened up new opportunities of interaction and collaboration between teachers and learners (Rambe & Bere, 2013). Many researches point at the capacity of MIM to foster knowledge sharing, enhance peer-based support on education matters and nurture knowledge communities (Chipunza, 2013). With various features in the application of MIM, it offers active collaborative learning among users. In addition to text messaging, user can send each other images, video, and audio media messages. This combination of functionality and features has led to MIM being promoted as an emerging collaborative learning tools and they are potentially will be used to support group-based collaborative learning tasks.

MIM applications such as WhatsApp, Line, WeChat, KakoaTalk and many others alike have been phenomenally popular in the communication world. According to eMarketer Report (2015), the growth in popularity of MIM is projected to continue and predicted that by 2018, the number of MIM users worldwide will reach 2 billion and represent 80% of smartphone users. Simultaneously, according to Informa Telecoms & Media Research (2012), global MIM traffic is expected to increase from 1.6 trillion messages in 2011 to 7.7 trillion messages in 2016, doubling its share of global messaging traffic from 17.1% in 2011 to 34.6% in 2016. Thus, this indicates that there is a large potential in using MIM as a medium in teaching and learning process.

However, the most recent popular MIM is WhatsApp application. According to a report in The Wall Street Journal 2015, WhatsApp announced it had reached 800 million users and the continued growth allowed it to reach one billion users by the end of 2015. Malaysia is no exception to this phenomenon and it happens so fast.

According to The Digital News Report 2017, the internet users in Malaysia recorded the world's largest use of WhatsApp applications, 51 percent for information and sharing stories. This phenomenon in the growing used of MIM particularly WhatsApp in today’s world, indicates that it is a great potential of incorporated MIM in education other than its original function solely as a social networking tool.

Furthermore, students prefer to have a learning which involved the social platform as their mediation in learning. According to Hull and Dodd (2017), using the social network as a teaching and learning tool has had a positive impact on classroom success for students and it promotes best practices in pedagogy, supporting constructivism, experiential learning, and the Seven principles for good practice in undergraduate education. According to S. So (2016), students have showed positive perception and acceptance of the use of social network for teaching and learning where intervention of WhatsApp have improved the learning achievement of the students. They slightly rejected the view that receiving instructional materials and questions outside school hours could interfere with their private lives. The findings suggest that users who frequently use MIM application, develop experience which allows them to interact very richly with communication partners which enhancing social presence and user satisfaction.

Nevertheless, many students that have WhatsApp running on their mobile phones, always think about this capacity as a social networking and chatting platform but less people are thinking about how the hidden features of this mobile application can be effectively use for education collaboration and learning. Hence, this study is to explore on how the unique capabilities of MIM application could support collaborative learning in formal classroom. Thus, the results of this study are expected to improve the delivery of teaching and learning methods to be more efficient through planning of better course framework.

Problem Statement

The positive reception among Higher Education Institutions (HEIs) to the e-Learning has broadened its use in almost all universities in Malaysia. Most of the universities have developed their own Learning Management System (LMS) that supports traditional way of teaching and learning which is seen as evident of the readiness for the online delivery learning. Unfortunately, many challenges are encountered in relation to the governance of e-Learning as followed; lack of a clear e-Learning policy, the absence of a clear governance structure, and the lack of a clear line of responsibility on the task of planning and implementing e-Learning (Mohamed Amin Embi, 2011). Furthermore, based on the analysis of Strengths, Weaknesses, Opportunities, Threats (SWOT) project conducted, it was found that most HEIs have sufficient e-learning infrastructure but lacking of a strategic plan were found as one of the weakness in implementing online learning (Raja Maznah Raja Hussain, 2004).

Focusing more to provide an ICT infrastructure to support online learning compared to firm plan for using ICT as a tool for teaching and learning, course development, course structure and assessment are among the challenges faced by lecturers in integrating e-Learning in their teaching and learning (Farahizan Zaihan Azizan, 2010). As pointed out by Farahizan Zaihan Azizan (2010), planning for use of the ICT in teaching and learning seems to be still in the drawing boards or the mind of the person responsible for managing the e-learning.

Hence, it is time to think about a strategic plan to promote active implementation of online learning in HEIs because if this continues, the efforts showed to incorporate ICT in teaching and learning are futile. The implementation of online learning can be accomplished if it is made in proper planning by all parties involved from the beginning. Therefore, teacher training institution is one of the parties that play an important role to transform traditional education into ICT-oriented. According to Vrasidas and McIsaac (2001), teacher training should be responsible for the successful use of technology when teaching. The training should equip the pre-service teachers with a solid understanding of the various ICTs such as computers, interactive whiteboards, mobile technologies like smartphones and tablets, together with their affordances and their constraints when integrated into curriculum delivery (Vrasidas & McIsaac, 2001).

However, study conducted by Hosseini and Kamal (2013) indicated that in spite of attempts by teacher educational programs, the pre-service teachers showed deficiency in knowledge of using technology for instructional purposes. The researchers believe it may be the result of teaching technology in an isolated way in teacher educational programs. It appears that although teacher education programs are making strides to prepare teachers for using technology in their teaching, their progress still seems slow for equipping teachers with the special knowledge of how to effectively use technology in their teaching (Hosseini & Kamal, 2013). Similarly, the study conducted by Chigona (2015) revealed that the main contributing factor of the new teachers being unprepared to teach using ICT is the quality of instruction they received during their training.

Other than the weaknesses from the teacher training program itself, there is other factor that affect the implementation of online learning. Study conducted by

Zaidatun Tasir, Norah Mohd Noor, Jamalludin Harun, and Nurul Syazwani Ismail (2008) on online teaching preference among pre-service teachers revealed that pre-service teachers in educational institutions in Malaysia prefer combination of pedagogy and andragogy orientation in their learning. The results of the study showed that they still need a teacher-centered teaching method which is definitely contrary to the student-centered learning where in online learning, students are self-directed. This study has implications for educators involved in designing online learning applications in which they must consider student preference when planning their teaching and learning activities (Zaidatun Tasir et al., 2008).

According to Çam and Işbulan (2012), students prefer to have a learning which involve the social platform as their mediation in learning where it cannot be offered in the non-social system such as Learning Management System (LMS). Social networks such as Facebook, YouTube, MySpace, and SecondLife that have become very popular among students will have potential to increase learning outcome and provide new potential to generate creativity among students (Redecker, Ala-Mutka, & Punie, 2010; Stanciu & Aleca, 2012).

Unfortunately, most online learning courses are delivered using commercial course management systems which does not include the social factor. They seemed to design as a process of replicating traditional classroom instructional practices such as lecture notes, readings, quizzes, term papers, exams, etc. (Reeves, Herrington, & Oliver, 2004). Enochsson and Rizza (2009) who was referring to an example from the UK project 'Harnessing technology', shows that although the use of ICT in order to support an active pedagogy, the use of ICT is limited to presentations (documents) or evaluations (quizzes). If the location of the materials is all that has changed but the mode of instruction remains the same then nothing really has altered. Replicating face-to-face interaction in the ICT does not achieve the real goal of implementing ICT in teaching and learning because it does not aim to replace the traditional face-to-face interaction, but rather enhances it by providing more resources for learning (Suthers, 2006). Rather than replication of face-to-face types of interaction, we need to understand what tasks and learning activities online interaction can be better achieved than face-to-face learning (So & Bonk, 2010). Understanding the suitable activities and teaching methods play an important role in students' learning and further promote active implementation of online learning in traditional classroom.

Collaborative learning is seen to be a suitable activity to comfort with as Mohamed Amin Embi (2011) revealed that collaborative assignment is one of the online activities student's in HEIs in Malaysia were most interested in. Coupled with the emerging trend of using mLearning in teaching and learning, it is seen able to address the issue of implementing online learning. This is due to the multifunction of mobile phone that have led mLearning being promoted as powerful collaborative learning tools where they are increasingly being used to support group-based collaborative learning tasks.

Furthermore, many studies have been generally discussed lately of the surging popularity of mobile devices as technologies that support collaborative learning (Echeverría et al., 2011; Hwang, Huang, & Wu, 2011; Koole, 2009). The main reason behind this stems from its spontaneous, portable, personalized, ubiquitous and situated characteristics. According to Echeverría et al., (2011), there are multiple academic purposes of mobile devices such as encouraging collaboration, fostering interaction and information sharing among students.

However, regardless of the tremendous potential of mobile phones to promote active online learning, Mobile Instant Messaging (MIM) remains one of the least exploited functionalities of mobile devices in HEIs (Rambe & Bere, 2013). The potential of MIM application to support collaborative learning should be considered as its powerful features as speed, effectiveness and utilizing it at no cost are important factors in implementing it in teaching and learning. Other than that, Hwang et al., (2011) indicates that this social practice promotes subscriptions to information, builds social networks, supports brainstorming and fosters mutual understanding through sharing of assets like opinions. Furthermore, according to Ogara, Koh and Prybutok (2014) MIM application has the potential to optimize communication and collaboration among individuals or workgroups with secure real-time one-to-one and multi-party instant messaging. Therefore, referring to these encouraging factors, MIM application is seen able to enhance productive communication among learning clusters through the sharing of mutual intentions, social objects, learning resources, and needs (Rambe & Bere, 2013).

However, despite of the supporting factors above, MIM supported collaborative learning is still at its infancy in Malaysia and research studies are critically needed in the area of mobile assisted education (Mohamed Amin Embi & Norazah Nordin, 2013). Even though, there are numerous studies on collaborative mobile learning, until date the studies have largely concentrated on the use of Short Message Service (SMS) text messages to mediate and facilitate students' learning (Brett, 2011; Zamani-Miandashti & Ataei, 2015). However, negative factors such as intrusion into personal time, the culture of immediacy in texting, costs and lack of perceived pedagogic benefit (Brett, 2011) experiencing by students in implementing SMS which were noted in the literature should be addressed.

Hence, further studies in MIM learning should be explored in order to take full advantage of abundant studies on positive acceptance towards mlearning adoption (Mohamed Amin Embi & Norazah Nordin, 2013). Prior to this, in the studies of MIM for learning, most of the studies emphasize on the effect of MIM on learning process and outcomes (Kim, Lee, & Kim, 2014), MIM's potential to bridge formal and informal learning (Cook, Pachler, & Bradley, 2008), support the participation of muted voices (Ng'ambi, 2011) and support flexible personalized learning (Rambe & Bere, 2012). Yet, not many studies had been conducted in the implementation guideline of MIM for collaborative learning especially in Malaysia context. As the concept of mobile learning differs from the point of view of researchers, its practice and application can vary from community to community. Hence, there is 'no one size fit all' application in regards with mobile learning (Mohamed Amin Embi & Norazah Nordin, 2013).

Thus, pedagogical strategies in teacher training within mobile learning requires different conceptual frameworks for understanding learning process and implementing new teaching practices. According to Kirschner, Strijbos, Kreijns and Beers (2004), one of the major pitfalls of the design of online collaborative learning is by the absence of a proper pedagogy for this. Above all, online learning demands careful planning of all learning activities considered essential in a lesson or a course. In fact, within e-learning contexts, teaching cannot be performed as a spontaneous activity but as a conscious and carefully-planned procedure (Kordaki & Siempos, 2010). The new pedagogical strategies with ICT supported learning triggers innovation in the classroom that changed the teacher-centred learning to the student-centred learning. A consequence of this is that a strategic mobile learning implementation plan needs to be considered in teacher tranning institutions as their curricula need adjustments so as to be supportive to the new emergent role of the teacher in the existence of technology in education today. Many educational institutions have become accustomed in a traditional university environment that they have to deal with a few matters in the development and delivery of courses that have many times changed according to time. According to Saedah Siraj and Muhammad Helmi Norman (2012), even though the implementation of mobile learning can be carried out in two ways which are a major overhaul of the available system in an educational institution, or adding mobile learning to available systems, the latter way can avoid large investment of new infrastructure. Thus, in order to introduce a new didactical practice, the educational institutions especially teacher training institutions should be keen on establishing the innovative pedagogical practices as introducing new didactical practice is often problematic especially within the formal curricular.

Hence, it will be the focus of the study as this new pedagogical approach with the use of mobile devices particularly MIM application is not only as a complement but to augment formal learning. Hence, to fill the gap, focusing on the idea of such pedagogical activities to promote active implementation of ICT in teaching and learning, the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model for teacher training is going to be developed in this study.

Purpose of the Study

The general purpose of the study is to develop the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model. The model aimed at proposing a guide on how CMIML could be incorporated in a formal classroom not only as a complement but to augment formal learning. The development process of model consisted of three stages that are based on the Design and Development Research (DDR) approach (Richey & Klein, 2007) which are the needs analysis phase, the design and development phase, and the evaluation phase. The model is developed with the aid of experts' opinion and collective decision on choosing the appropriate pedagogical activities to be included in the model and determining the relationships among the activities in the model structure. Then, another panel of selected experts was also consulted to evaluate the model in order to validate whether the pedagogical model of the study could be suitable as a guide in implementing CMIML as teaching support for lecturers in formal learning.

Research Objectives

The main objective of this study is to design an interpretive structural model of Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model for teacher training. This study consisted three phases and the objectives of each phase are as described:

Phase 1: Need Analysis. To identify the needs for the development of the Collaborative Mobile Instant Messaging Learning pedagogical model based on lecturers' views referring to the following objectives:

1. To identify the lecturers' perceptions on their current ways of teaching and learning;
2. To identify the lecturers' perceptions on implementing ICT in teaching and learning;
3. To identify the lecturers' access to mobile devices and the capability level of the devices; and

4. To identify the lecturers' level of acceptance and intention to use collaborative mobile instant messaging learning if incorporated into the formal course.

Phase 2: Development of the model. To develop the Collaborative Mobile Instant Messaging Learning pedagogical model based on experts' opinion and decision based on the following objectives:

1. To identify the appropriate pedagogical activities, which should be included in the development of the Collaborative Mobile Instant Messaging Learning pedagogical model;
2. To determine the relationships among the pedagogical activities in the Collaborative Mobile Instant Messaging Learning;
3. To propose a structural pedagogical model of Collaborative Mobile Instant Messaging Learning; and
4. To classify the identified pedagogical activities into various categories.

Phase 3: Evaluation of the model. To evaluate the Collaborative Mobile Instant Messaging Learning pedagogical model based on experts' consensus according to the following research objectives:

1. To analyze the experts' consensus on the suitability of the pedagogical activities proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model;
2. To analyze the experts' consensus on the classification of the pedagogical activities as proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model;

3. To analyze the experts' consensus on the list of pedagogical activities in the respective four clusters (Independent, Linkage, Dependent, and Autonomous) as proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model;
4. To analyze the experts' consensus on the relationships among the pedagogical activities as proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model; and
5. To analyze the experts' consensus on the suitability of the Collaborative Mobile Instant Messaging Learning pedagogical model in the teaching and learning for teacher training.

Research Questions

The research questions are formulated according to three phases based on the design and development research approach.

Phase 1: Need Analysis. To seek the needs for the development of the Collaborative Mobile Instant Messaging Learning pedagogical model based on lecturers' views according to the following research questions:

1. What are the lecturers' perceptions on their current ways of teaching and learning?
2. What are the lecturers' perceptions on implementing ICT in teaching and learning?
3. What are the lecturers' access to mobile devices and the capability level of the devices?

4. What are the lecturers' level of acceptance and intention to use collaborative mobile instant messaging learning if incorporated into the formal course?

Phase 2: Development of the model. To seek for experts' opinions and decision in developing the Collaborative Mobile Instant Messaging Learning pedagogical model based on the following research questions:

1. What are the experts' collective views on the pedagogical activities, which should be included in the development of the Collaborative Mobile Instant Messaging Learning pedagogical model?
2. What are the relationships among the pedagogical activities in the development of the Collaborative Mobile Instant Messaging Learning pedagogical model based on the experts' collective views?
3. How is the structural pedagogical model of Collaborative Mobile Instant Messaging Learning based on the experts' collective views?
4. How should the pedagogical activities be classified in the interpretation of the Collaborative Mobile Instant Messaging Learning pedagogical model based on the experts' collective views?

Phase 3: Evaluation of the model. To evaluate the Collaborative Mobile Instant Messaging Learning pedagogical model based on experts' consensus according to the following research questions:

1. What is the experts' consensus on the suitability of the pedagogical activities proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?

2. What is the experts’ consensus on the classification of the pedagogical activities as proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?
3. What is the experts’ consensus on the list of pedagogical activities in the respective four clusters (Independent, Linkage, Dependent, and Autonomous) as proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?
4. What are the experts’ consensus on the relationships among the pedagogical activities as proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?
5. What are the experts’ consensus on the suitability of the Collaborative Mobile Instant Messaging Learning pedagogical model in the teaching and learning for teacher training?

Rationale of the Study

The study was conducted for several reasons especially for the selection of choosing the teacher training program. The implementation of mobile learning in formal education is still in its infancy and can be accomplished if it is made in proper planning, in terms of its acceptance into formal education by all parties involved from the beginning. According to Rahmad Sukor Ab Samad, Shahril Jamaludin, Zainudin Abu Bakar, and Mohd Ali Ibrahim (2008), the effort to instill and increase the capacity and skills in the use of ICT among teachers needs to be done since their college courses. Here, their interests can be enhanced so as to form a positive attitude towards the use of ICT. The institutions should ensure that all the facilities and accessibility are always in a satisfactory condition. Trainees should be given ample opportunity to raise the interest and skills in the field of ICT. Indirectly, they will make sure they have a positive perception and thus form a positive attitude towards the use of ICT in teaching and learning.

Through exposure and together with structured and organized education program courses will also be able to ensure the use of ICT as a tool in the learning process. In this case, the university must demonstrate the ability to use ICT in any day-to-day affairs that will indirectly affect the work culture would-be teachers to use ICT (Rahmad Sukor Ab Samad, et. al., 2008).

Thus, it is about time we look at whether the investment has been made to give a positive outcome to education in Malaysia. Therefore, this study is very necessary because if the implementation of ICT in teaching and learning provides the same results as the face-to-face methods, the government and the education stakeholders must evaluate the investment in ICT or maybe the academics can choose to explore new strategies in the face-to-face methods.

However, the emergence of mobile learning (mLearning) has created the new roles for teachers and students. The teacher's role is transformed to be a fasilitor and mentor providing guidance while the student's role has changed from information receiver to information generators. By knowing these new emergent roles, it is a useful guideline to develop teacher training programmes. With the new pedagogical approaches developed, a strategic mLearning implementation plan needs to be considered as it has strong implications on teacher training institutions. Therefore, this study is important as teacher training's curricula need adjustments so as to be supportive to the role of the teacher to the existence of technology in the institution.

Significance of the study

This study is in line with the seventh shift in the 11 major shifts to transform the country's education system in Malaysia Education Blueprint (PPPM) (2013-2025) that encourage utilizing ICT to enhance the quality of learning in Malaysia. Other than that, the study is in line with the ninth shift in Education Blueprint for Higher Education where it discusses on the important of technology-enabled mode of education through globalised online learning. One of the strategies and initiative in this shift is strengthening content development and delivery where lecturers will be required to innovate their teaching and learning practices in order to create conducive blended learning environments. Other than that, many educators are becoming aware of the benefits of integrating ICT into teaching and learning process, and how the new technologies form an important part of the learners today. Apart from enabling transformation of pedagogy, the new technologies also provide teachers and learners with new ways to access and process knowledge in different fields (Mishra & Koehler, 2006). Furthermore, it is believed that ICT provide more flexibility, greater convenience, and the ability for learners to work at their own pace (Ferguson & Keengwe, 2007). Thus, the results from this study are expected to provide learning benefits and drawing implications for online collaborative task design and pedagogy to various parties in the field of education.

The use of technology as a tool in the implementation of Collaborative Mobile Instant Messaging Learning (CMIML) will demonstrate the ability of lecturers to become effective facilitators of learning. The role of the lecturers has changed from being the provider of knowledge to a facilitator of learning to scaffold students as they collaborate on problem tasks. According to Panitz (1999), one of the obstruction to the use of collaborative activities in the classroom is that teachers are not well-prepared with this technique of teaching when they were at teachers' training colleges. They might have a tendency to adopt similar approach of teaching due to they were too familiar with lecture-style teaching in their teacher-training colleges. Moreover, switching from an 'expert mode' to a 'facilitator mode' made them feel not confident. This is due to the fear that students may think that they do not have enough knowledge about the subject when students start to ask questions during collaborative exercises discussion (Surina Nayan, Latisha Asmaak Shafie, & Mahani Mansor, 2010). Hence, adoption of Collaborative Mobile Instant Messaging Learning (CMIML) is optimistically will overcome this barrier normally occurred in implementation of collaborative learning in classroom.

The study is also significant to the policy makers as the methodology of the study could be adopted and adapted to develop solutions to other education issues. The instructional designers could follow the methodology of the study to gain experts' opinions to develop mobile instant messaging learning pedagogical model for other programmes or even develop a curriculum models to the course subjects. Other than that, the instructional designer could use the model to design and develop course modules to be used in classroom practices. The model could also assist instructional designers to specify appropriate mobile instant messaging application and both teaching and learning skills to be included in the modules.

Thus, the findings of this study is useful to policy makers, lecturers, instructors and instructional designers as it not only determines the feasibility of the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model, it also provides the guidelines and considerations that are required in a collaborative mobile learning environment. Hence, the Ministry of Education as the main body and other policy makers and also the stakeholders are expected to benefit from the results of this study which could improve the delivery of teaching and learning methods that are more efficient through planning in shaping the framework of the course better.

Limitation of the Study

The development of the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model is intended as an example in proposing how this could be incorporated in the formal classroom. However, this study has some limitations that constitute the way on how it is being conducted and to state the scope of the study.

In the needs analysis phase, this study relies on the lecturers' opinion in the institute of teacher educations to determining the needs to develop the model which could be different if the opinions accumulated from other related parties involved such as from students' view, opinions from the education officers in Malaysia Institute of Teacher Education (IPGM), and the Ministry of Education as the main body.

In the development phase, the study adopts the Nominal Group Technique (NGT) to determine the elements for the model, the Interpretive Structural Modelling (ISM) in developing the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model, and Fuzzy Delphi Method (FDM) to evaluate the model. These methods are based primarily on experts' opinions. Hence, the developed model is depended on the selection of experts and their opinions as the result may differ if the study would be conducted using different types and numbers of experts for different setting.

In the evaluation phase, the suitability of the model is being evaluated. Since the developed model is a prototype, the application of the model is not the focus of the study.

Another limitation of the study is in the scope of the program where this study was based on the teacher training program. However, this study could be replicated to form similar model customized for different sets of students in other programme and even for any course subjects. Other than that, the model was designed and developed based on Malaysia education context. Thus, the pedagogical model should not be generalized to be suitable for all teacher training programs in other Higher Education Institution (HEIs) around the world.

Finally, this study was conducted starting from the year 2015, where this pedagogical model might be appropriate when it was designed and developed. This is due to the rapid development of mobile devices particularly the mobile instant messaging (MIM) applications and the changing pedagogical practices enable MIM learning to be updated from time to time.

Definition of Terms

This section explains the operational definition for some key terms being used in this study. It briefly describes the meanings of the terms for better understanding on related concepts of this research. Description meaning of these terms are as follows:

Collaborative. Collaborative can be defined as an activity of sharing ideas, writing and distributing work equally among team members to achieve success for a project. It is the act of working with another person or group of people to create or produce something.

Collaborative learning. Collaborative learning is one of the student-centred teaching approach that involves groups of students working together to solve a problem, complete a task, or create a product.

Collaborative mLearning. Collaborative mLearning or CmL is acquisition of new knowledge and skills by the learner anywhere and anytime as a result of interactions in a group. These interactions are through computer-mediated communications which include discussions and text messages online or through the mobile phone (DeWitt, D., Saedah Siraj, & Norlidah Alias, 2103; DeWitt, D., Saedah Siraj, Mohd Nazri Abdul Rahman, Zaharah Hussin, & Norlidah Alias, 2013).

Delphi method. The Delphi method is a structured communication technique or method, originally developed as a systematic, interactive forecasting method which relies on a panel of experts. This method was introduced by Dalkey and Helmer (1963). It is a survey method with three features: anonymous response, iteration and controlled feedback and finally statistical group response (Hsu, Lee, & Kreng, 2010).

Development. Development as defined from the context of instructional development is the systematic study of designing, developing and evaluating instructional programs, processes and products that must meet the criteria of internal consistency and effectiveness (Seels & Richey, 1994). Based on this study, development is a process of identifying the appropriate collaborative mobile instant messaging pedagogical activities and the relationship among the activities to be included in the development of the model.

E-Learning. The delivery of a learning, training or education program by electronic means. E-learning involves the use of a computer or electronic device (e.g. a mobile phone) in some way to provide training, educational or learning material. E-learning can involve a greater variety of equipment as the name implies, "online" involves using the Internet or an Intranet. CD-ROM and DVD can be also be used to provide learning materials.

Experts. Experts are referring to individuals who are knowledgeable in a certain field and as in the context of this study, mobile learning field. It is based on four ‘expertise’ requirements: 1) knowledge and experience with the issue under investigation; 2) capacity and willingness to participate; 3) sufficient time to participate in the study; and, 4) effective communication skills in both written and in expressing priorities through voting procedure (Adler & Ziglio, 1996).

Instant Messaging (IM). Instant messaging (IM) software is one of the many applications of Web 2.0. It is a technological form of communication that allows users to find out who is online and available to receive messages (Cameron & Webster, 2005) and a computer-based one-on-one communication that can allow collaboration, scheduling, impromptu meetings, and contact with friends and family (Nardi, Whittaker, & Bradner, 2000).

Learning Management System (LMS). Learning Management System (LMS) is a software application for the administration, documentation, tracking, reporting and delivery of electronic educational technology (also called e-learning) courses or training programs (Ellis, 2009). It also facilitates interaction between teachers and students and among students themselves. Formerly called managed learning environments (MLE).

Mobile Instant Messaging (MIM). Mobile Instant Messaging (MIM) is an asynchronous communication tool that works on wireless connections, handhelds and desktop devices via the internet and allows students and peers to chat in real time (Dourando, Parker, & De la Harpe, 2007). In this study, MIM is referring to communication tools via smartphones applications such as WhatsApp, Line, WeChat, Telegram and etc.

Mobile learning (mLearning). Mobile learning, or mLearning, is any kind of learning that takes place via a portable, hand-held electronic device. Though the term instantly invokes images of smartphones, it in fact also refers to learning via other kinds of mobile devices, such as tablet computers, netbooks, and digital readers. However, in the context of this research, mLearning is learning solely through smartphones with MIM applications.

Needs analysis. McKillip (1987) defined needs analysis as a tool for decision making in the human services and education. On the other hand, Witkin (1997) described needs analysis as a method to identify the gap between the current situation and targeted situation. According to McKillip (1987), needs is a judgement value that a specific group has a problem, which can be solved. However, in the context of this research, the needs analysis is conducted to investigate existing issues and the needs to develop the Collaborative Mobile Instant Messaging Learning pedagogical model based on the lecturers' views.

Online learning. It is learning with the assistance of the internet and a personal computer. The term e-learning, or electronic learning, often is used interchangeably with online learning. Online learning can consist of both real-time interactions, such as in collaborate, as well as interactions, which occur over extended periods of time, such as email or an online discussion board.

Online collaborative learning. Online collaborative learning is a collaborative learning conducted via online using website technologies such as blogs, wikis, podcasts and file sharing services. These technologies embraces 'social' technologies and tools that enable users to create, publish, and share digital content within social networks.

Pedagogy. Pedagogy is defined as the discipline that deals with the theory and practice of education that concerns the study of how to teach in the best way. It is the method and practice of teaching, especially as an academic subject or theoretical concept. According to Watkins and Mortimore (1999), pedagogy is defined as any activity in which a person consciously designed to make learning something better. Therefore, in this study, pedagogy refers to teaching activities undertaken in the learning process with the aid of mobile devices especially mobile instant messaging application.

Pedagogical model. Pedagogical model refers to the concept of the mind that determines how we teach and educate the concepts of relation between mind and culture (Bruner, 1999). It is a cognitive model or theoretical constructs derived from learning theory that enable the implementation of specific instructional and learning strategies. In this study, pedagogical model refers to the procedures adopted for the presentation of the contents of the various subjects in the curriculum apart from techniques, teaching methods and teaching strategies.

Pre-service teachers. Pre-service teachers are college students involved in a school-based field experience. They are gradually introduced into the teaching role on classroom management and other instructional responsibilities by a mentor or a cooperating teacher. In this study, pre-service teachers are referring to the students studying in teacher training institution.

Social media. Social media is a collection of online platforms and tools that people use to share content, profiles, opinions, insights, experiences, perspectives and media itself, facilitating conversations and interactions online between groups of people (Clark, 2012).

Teacher training. Teacher training is training that a student must undergo in order to qualify as a teacher. It is a professional preparation of teachers, usually through formal course work and practice teaching. In this study, teacher training is referring to the training offered by different teaching institutions which are universities and institute of teacher education.

Summary

This chapter begins with an introduction of the study in brief. It is then followed by an overview of the research background of the study. Then, it continued with the problem statement which discussed in detail on the justification of using collaborative mobile instant messaging learning in formal learning. It is then, followed by research objectives and research questions of the study which systematically guided the development of the pedagogical model. The rationale and significance of the study further elaborate on the justification of the development of the pedagogical model. However, limitations of the study are discussed to state the scope of the study. Finally, the definitions of terms are briefly outlined for better understanding on related concepts of this research.

CHAPTER 2

LITERATURE REVIEW

Introduction

In the evolving world of the internet and technology, the increased use of newer, better and faster technologies are being used in the learning process. Social networks are among the most popular applications of the internet which rapidly advances on the way to being one of the most important means of communications among students. According to Çam and Işbulan (2012), this social network has potential for teaching and learning because of its unique built-in functions which offer pedagogical, social and technological affordances. Thus, mobile instant messaging (MIM) is one of the social media tools that is increasingly being viewed as a tool to enhance learning. Academic literature has provided extensive studies and research that are important in understanding how this mobile instant messaging could be implemented not only as a complement but to augment formal learning.

Therefore, this chapter discusses the important relevant concepts and theories of collaborative mobile instant messaging learning in its implementation to the formal classroom and the theoretical foundation, which serves to support the development of the model. The theories being discussed aim at guiding the selection of appropriate pedagogical activities and how the activities could be integrated to be included as elements in the development of the model.

Hence, this chapter starts with the discussion on the concepts and definitions related to Collaborative Mobile Instant Messaging Learning to provide a better understanding on how it can be incorporated in formal learning. It is then followed by the overview of ICT integration into pedagogy involving teacher training. Then, the chapter continues with the discussion on Mobile Instant Messaging learning in education, which provides an overview on how formal learning has been transformed in mobile learning environments, based on past and existing ICT initiatives and implementation.

The chapter then disscusses on theorizing mobile instant messaging learning that presents the underlying principles which serves as a guide on the development of the model. Next, the discussion presents the theoretical framework that elaborates on the theories and models as the foundation in this study.

Finally, the conceptual framework for the development of Mobile Instant Messaging Learning (CMIML) pedagogical model for teacher training is presented in the final part of this chapter.

Concepts and Definitions

To understand the concept of mobile instant messaging (MIM) learning, it is important to begin with understanding the concept of mobile learning or mLearning since MIM is one of the tools in mobile devices being used in mLearning. Then, it follows by a few concepts and definitions related to collaborative mobile instant messaging learning.

Concept and definition of mLearning. Mobile learning or mLearning is a new concept that is closely related to e-Learning. According to Stone (2004) mLearning as a 'special type of e-Learning, bound by a number of special properties and the capability of devices, bandwidth and other characteristics of the network technologies being used'. This is supported by Milrad (2003) that defines e-Learning as learning supported by digital electronic tools and media and mLearning as e-Learning using mobile devices and wireless transmission.

These definitions are in line with Brown (2005) that described in detail the concept of learning where according to him mLearning is a subset of e-Learning. Figure 2.1 below shows clearly the relationship between e-Learning and mLearning. E-Learning is a subset of distance learning while distance learning is a subset of flexible learning that takes place beyond a traditional classroom. Distance learning can be divided into two different types; 1) Non-electronic distance learning (correspondence by mail or paper-based (Brown, 2005). 2) The electronic distance learning supported by technology tools (laptop, table PC, palmtalk, PDAs, mobile phones, smartphones and etc.) and supported by the electronic facilities such as internet and Bluetooth which is mLearning.

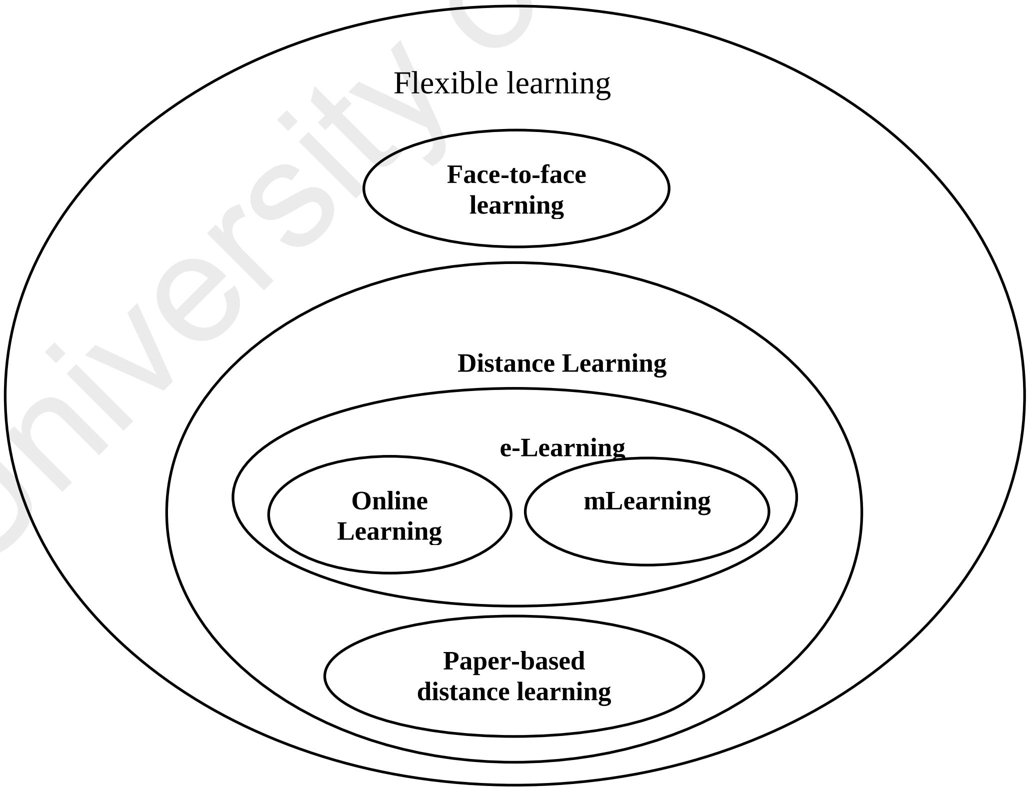


Figure 2.1. mLearning Model.

Adapted from *Towards a Model for mLearning in Africa*, by Brown, 2005, *International Journal on E-Learning*, 4(3), p. 310

However, mLearning has been defined differently by different researchers and organisations. According to Kukulska-Hulme and Traxler (2005), mLearning is a combination of learning and the breakthroughs of mobile computing and global marketing of mobile devices where it is rapidly being a reputable and cost-effective element of online and distance learning. While, Wexler, Brown, Rogers, Metcalf and Wagner (2008) describe mLearning as any activities that allows individuals to be more productive when consuming, interacting with, or creating information, mediated through a compact digital portable gadget that the individual carries all the time, with reliable connectivity, and fits in a pocket or even purse. Even though these definitions are offered from different facets, they reveal the same concept of engaging mobile devices for learning. Mobile phones such as personal digital assistants, smart phones, and tablets engage in a vital role in the learning activities no matter if the activities are conducted in the field or in the classroom (G. Hwang & Tsai, 2011; Vavoula, Sharples, Rudman, Meek, & Lonsdale, 2009). Although it has yet to come to a single agreement on the definition of it, a commonly accepted definition of mLearning is using mobile technologies to facilitate and promote learning anywhere and anytime (G. Hwang & Tsai, 2011; Shih, Chuang, & Hwang, 2010). However, in the context of this study, mobile learning is referring to the use of smartphones particularly mobile instant messaging (MIM) application to enhance learning anywhere at anytime.

Other than being defined based on the functionality of the devices and the relationship to e-learning, mLearning should be conceptualized from the learner's perspective. This led to the definition emphasized by O'Malley, Vavoula, Glew, Taylor and Sharples (2003) that mLearning is "Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of learning opportunities offered by mobile technologies”. MLearning has expanded covering any service or facility that provides a learner with general electronic information and educational content that assists in knowledge acquisition anywhere and anytime.

Furthermore, mLearning makes learning more compelling to its users by offering more in terms of performance and still allow for users to enjoy anywhere and anytime learning. Other than that, it allows students to self-pace their learning according to their levels and further create student-centered learning (Saedah Siraj & Muhammad Helmi Norman, 2012).

In the context of this study, mLearning is served as a tool for supporting traditional classroom where it can enhance collaboration amongst the students via online discussion.

Concept of Mobile Instant Messaging (MIM). Mobile Instant Messaging is an asynchronous connection tool that allows students and peers to chat instantly in real time. According to Dourando et al., (2007), this asynchronous connection can be performed by wireless connections, handhelds and also desktop devices through the internet. This mobile application has increased user benefits more than the short message service (SMS) can offered. SMS enables short messages to be sent at a cost on real-time from one mobile phone to another using the recipient’s mobile phone number and the wireless network (Oghuma, Chang, Libaque-Saenz, Park, & Rho, 2015). However, MIM application allows real-time multimedia communication happens without absolutely depending on the wireless network while using the recipient’s screen name instead of the mobile phone number as well as charging no cost on user.

Apart from that, MIM fosters unique social presence that is visually distinct from email systems. As Quan-Haase, Cothrel and Wellman (2005) propose, IM applications vary from emails essentially in their emphasis on the prompt conveyance of messages through (a) a "pop-up" component to show messages the minute they are gotten, (b) a user-generated visible list of other users (“buddy list”) and (c) a system for demonstrating when "buddies" are online and accessible to get messages. By providing details of the online user’s presence (online, offline, in a meeting, away), MIM offers open and transparent interaction that alerts communicants to the temporal and time-span restrictions of the interaction (Rambe & Bere, 2013).

MIM is expected to complement conventional learning environment like Learning Management Systems (LMSs) but they are distinct in many ways. According to Rambe and Bere (2013), MIM is more preferable to LMS due to its functions. LMS is used as providing instructional materials, evaluating student’s capabilities through online quizzes or exams and communication via synchronous and asynchronous interactions (Beatty & Ulasewicz, 2006). MIM on the other hand, supports academic instruction through mobile web interfaces that are perceived to be of a non-intrusive nature as well as mobile access to learning resources and instruction (Ng’ambi, 2011; Rambe & Bere, 2012). LMSs are often used as static repositories and fail to support personalization compared to MIM where various formats (text messages, videos, graphics, pictures) are offered that triggers student learning experience (M. Lee & McLoughlin, 2010; Veletsianos & Navarrete, 2012). Other than that, LMSs fail to support asynchronous interaction as messages posted when users are offline are not necessarily retrievable upon their logging on compared to MIM forum platforms (Rambe & Bere, 2013).

However, in this study, MIM is expected to be implemented solely without the use of LMS to complement conventional way of teaching nowadays.

Concept of Collaborative Learning. Collaboration can be defined as an activity involving sharing ideas, writing and distributing work equally among team members to complete a given task. According to Surina Nayan et. al. (2010), it can be applied in teaching and learning process as it enables students to be actively involved throughout the collaborative process. By doing that, the students gain better understanding on certain concepts or retain knowledge in their long-term memory. Moreover, teachers can produce students with strong academic performance when students learn collaboratively as they will experience lively and successful learning process (F. Brown, 2008). In fact, it is thought that learning cannot be achieved individually and is rather a process of communication and interaction with other learning groups, such as multiple peers, classmates and instructors (Albadry, 2017).

In a collaborative learning environment, information is co-made and shared among students as they work towards learning objectives or to find an answer for an issue. The information is transmitted among learners and not claimed by one specific learner after getting it from the course materials or teacher (Brindley, Walti, & Blaschke, 2009).

Through collaborative learning activities, students will be more engaged in learning as they are given opportunities to involve in the activities. These activities carried out in class can promote learners' academic progress, interaction skills as well as encourage learners' intrinsic motivation (Surina Nayan et. al., 2010). According to Tsai (2010), these students, have learned not only to restructure their knowledge and to make meaningful links with other forms of knowledge and experiences, but also to monitor and review their own learning. Peer interactions can help them to have better control of their learning, which leads to self-directed learning.

Regardless the positive responses on how the collaborative learning help to promote active participation of students in teaching and learning, the instructors should implement a variety of instructional strategies to improve the quality of group collaboration. These strategies are outlined below as proposed by Brindley, Walti, and Blaschke (2009):

1. *Facilitate learner readiness for group work and provide scaffolding to build skills*

   Scaffolding is important in preparing learners for small group projects. This can be accomplished through instructional design (sequencing activities within the course that build on previously learned skills) and positioning small group activity later in the course when students have acquired the confidence and skills to be successful. Learners often need help with acquiring information literacy skills (how to retrieve, evaluate, apply, and source information effectively) and with using the technology effectively.

2. *Establish a healthy balance between structure (clarifty of task) and learner autonomy (flexibility of task)*

   The instructor should provide guidelines for team member performance in conducting the group project and ensure that the task is achievable, sustainable, and properly timed within the course. Allowing learners to form their own groups and select their own topics facilitates socializing within groups and positive group dynamics. Effective course design will make the purpose and parameters of group task and the learning goals clear and explicit while still allowing students flexibility, such as choice of group membership, member roles, and specifics of the topic. When students have personal control over the task (content, process, intentions, goal setting, consequences, outcomes, group partners), their engagement, responsibility, and sense of the relevance of the task are heightened.

3. *Nurture the establishment of learner relationships and sense of community*

   In order for true collaboration to occur, a sense of community needs to be established within groups. Important elements for establishing successful learning communities are informality, familiarity, honesty, openness, heart, passion, dialogue, rapport, empathy, trust, authenticity, disclosure, humor, and diverse opinions. Instructors can model, discuss, and reinforce these elements in the main conference, helping students to prepare for smaller, more intense group learning experiences. If students develop relationships with their peers early, they can build on these relationships in group work.

4. *Monitor group activities actively and closely*

   During the collaborative process, the instructor needs to be available for feedback, general information, and private counsel. In addition, the instructor needs to intervene as required to keep discussions on track, support and animate dynamic conversation, help students stay focused on the task, assist with relationship building, and provide reassurance.

5. *Make the group task relevant for the learner*

   The more interested a student is in a group topic, the more motivated the student is in participating in the collaborative effort. Allowing learners to pursue topics according to mutual interest sets groups up to share and co-create knowledge. Authentic, real-world environments and relevant content provide motivation for collaborative learning. Enabling students to control and direct their learning to the greatest extent possible helps them to achieve a purpose that is specific to their needs and challenges their zone of proximal development (ZPD).

6. *Choose tasks that are best performed by a group*

   Individual learners make compromises regarding flexibility of study in order to participate in a collaborative exercise. Engaging in tasks that benefit from teamwork will increase their sense of purposefulness and motivation to participate.

7. *Provide sufficient time*

   Course design should allow sufficient time for collaborative learning activities, including time for scheduling, planning, and organizing. Most importantly, time is required for the discussion and exchange of ideas that are crucial to deeper learning.

To summarize, collaborative learning is a natural form of learning that occurs among learners, through discussions and interactions with other individuals in a learning environment. Through effective instructional strategies, the quality of collaborative learning could be improved and further increase the participation among students.

Concept of Online Collaborative Learning. Online learning is popular way of teaching and learning in this ICT era. This learning method is seen trying to change the mindset, methods and pedagogy of teaching, usually traditional teacher-centred to student-centred teaching. One of the approaches of student-centred teaching is collaborative learning that involves groups of students working together to solve a problem, complete a task, or create a product. The learning procedure in collaborative learning makes a bond between and among learners as their insight development relies on upon one another's contribution to the discussion (Palloff & Pratt, 2005). Students' sharing also revealed that their drive to learn was enhanced, probably because learning from peers is less intimidating than from teachers. There is companionship among students where they can relate to one another in a relaxed manner (Wei & Chen, 2006). As a consequence, the students were more at ease with their friends, appeared more motivated, and also believed that they could assist their friends.

The emergence of ICT in teaching and learning has led to the development of online collaborative learning (OCL). Many technologies such as blogs, wikis, podcasts and file sharing services are increasingly being used for OCL to support learning and teaching within the higher education sector (Kennedy et al., 2009). These technologies embraces 'social' technologies and tools that enable users to create, publish, and share digital content within social networks.

Among other technologies, Wikis have proven particularly popular in implementing OCL (Miyazoe & Anderson, 2010). Wikis are websites that can be interactively edited by any number of people using simple online tools. Its multifunctionality that cannot be find in other 'social' writing and publishing tools (e.g. blogs, photo-sharing, podcasts) has led to wikis being promoted as powerful collaborative learning tools and they are increasingly being used to support group-based collaborative learning tasks (Judd, Kennedy, & Cropper, 2010).

Research in e-Learning has shown that involving learners in online collaborative learning activities could provide them with essential opportunities such as: motivation to actively involved in their learning (Oshima, Scardamalia, & Bereiter, 1996), extend and deepen their learning experiences by trying the new ideas and improve their learning outcomes (Palloff & Pratt, 2009), to trigger their cognitive processes (Dillenbourg, 1999), as well as to collaborate socially and develop a sense of community and of belonging online (Haythornthwaite, Kazmer, Robins, & Shoemaker, 2000). Regardless of this, numerous teachers stay uncertain of why, when, and how to integrate collaboration into their teaching practices in general as well as into their online classes (Bruffee, 1999; Kordaki & Siempos, 2010; Panitz, 1999). Thus, teachers should be aware that it takes time to establish community, and 12 weeks (the common length of a semester in a paced program) is sometimes insufficient for those new to online learning to develop both the requisite skills and confidence to fully participate in collaborative learning (Brindley, Walti & Blaschke, 2009).

Computer-Supported Collaborative Learning (CSCL). Computer-supported collaborative learning (CSCL) is a pedagogical approach on how people can learn together with the assistance of computers (Stahl, Koschmann, & Suthers, 2006). The study of CSCL has drew attention of many researchers from various academic disciplines, including instructional technology, educational psychology, sociology, cognitive psychology, and social psychology (Hmelo-Silver, 2006).

The evolution of CSCL can be viewed from historical sequence of the use of technology in education. In the beginning of 1960s, software in educational instruction was developed based on the behaviorist approach where it drilled students on memorizing the facts. However, in the 1970s as cognitivism theory gained attention among educators, they rejected the behaviorist view that learning could be supported without concern for how students represented and processed knowledge. The designers began to envision learning technology that employed artificial intelligence models that could adapt to individual learners (Koschmann, 1996). This approach created computer models of student understanding and then responded to student actions based on occurrences of typical error identified in student mental models (Stahl et al., 2006). Studies in collaborative learning and technology took place throughout the 1980s and 90s and they emerged in line with the growing philosophies of constructivism and social cognitivism (Resta & Laferrière, 2007). CSCL approaches began to explore how computers could bring students together to learn collaboratively in small groups and in learning communities.

The field of CSCL draws heavily from a number of learning theories that emphasize that knowledge is the result of learners interacting with each other, sharing knowledge, and building knowledge as a group. Since the field focuses on collaborative activity and collaborative learning, it inherently takes much from constructivist and social cognitivist learning theories. Other learning theories that provide a foundation for CSCL include distributed cognition, problem-based learning, group cognition, cognitive apprenticeship, and situated learning. Each of these learning theories focuses on the social aspect of learning and knowledge building, and recognizes the learning and knowledge building involve inter-personal activities including conversation, argument, and negotiation (Resta & Laferrière, 2007).

The roots of collaborative epistemology as related to CSCL can be found in Vygotsky's social learning theory. Of particular importance of CSCL is the theory's notion of internalization, or the idea that knowledge is developed by one's interaction with one's surrounding culture and society. The second key element is what Vygotsky called the Zone of Proximal Development (ZPD). This refers to a range of tasks that can be too difficult for a learner to master by themselves but is made possible with the assistance of a more skilled individual or teacher. These ideas feed into a notion central to CSCL where knowledge building is achieved through interaction with others.

The rapid development of social media technologies has brought CSCL to be implemented and used in instructional plans in classrooms both traditional and online from primary school to post-graduate institutions. Like any other instructional activity, it has its own prescribed practices and strategies which educators are encouraged to employ in order to use it effectively. However, CSCL may in its next phase constructing new ways to collaborate in respond to the rapid evolving technology-based learning today. The evolution of theories in CSCL is illustrated in Figure 2.2.

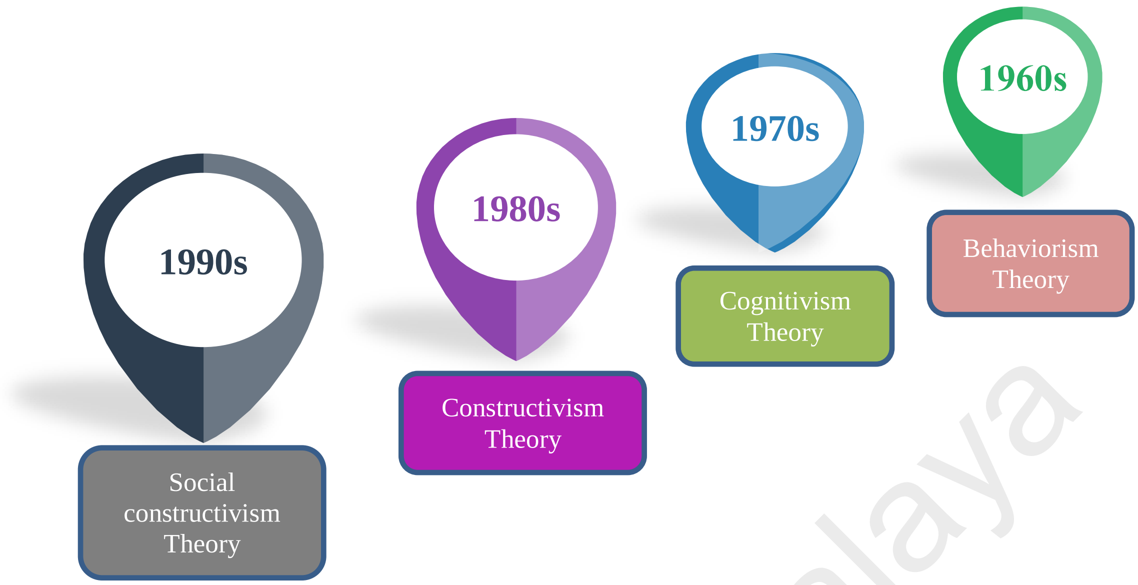


Figure 2.2. Evolution of Theories in Computer-Supported Collaborative Learning (CSCL)

Collaborative Mobile Learning. Collaborative Mobile Learning (CmL) is an interactive collaborative learning conducted in a mobile learning environment. According to DeWitt et. al. (2013), CmL is the acquisition of new knowledge and skills by the individual learner anywhere and anytime as a result of interactions in a group through computer-mediated communication (CMC). It can be conducted via mobile devices (mobile phones, laptops, PDA and etc.) or through computer connected to the internet. CmL requires the use of a mobile device but not all CMC tools can be used for CmL as some of CMC tools are static. In the context of this study, a collaborative mLearning environment is designed using mobile instant messaging tools. The relationship between CMC, collaborative learning and mLearning is shown in Figure 2.3.

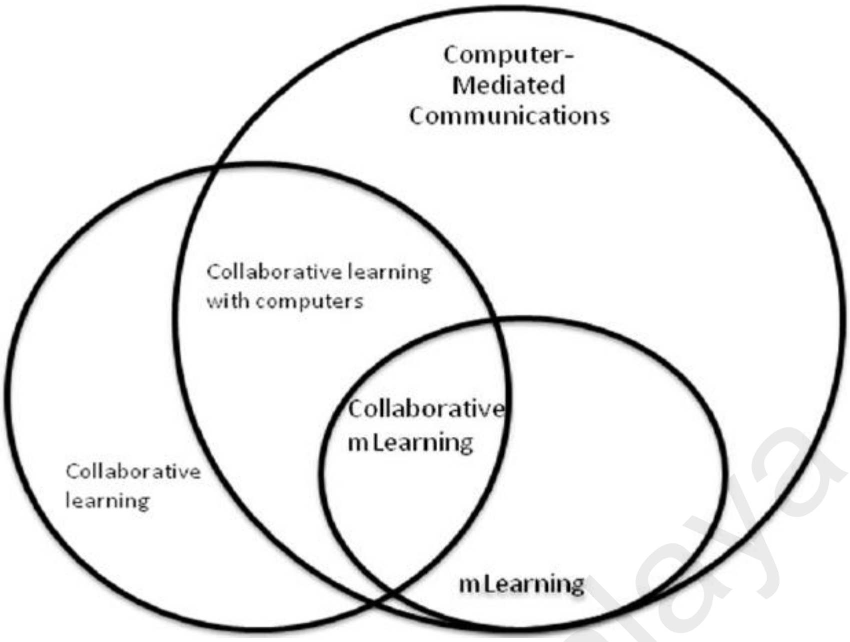


Figure 2.3 The Relationship between CMC, Collaborative Learning and mLearning.

Adapted from *Development of Collaborative mLearning Module for Secondary School Science* by DeWitt, D., 2010.

Collaborative mLearning combines both the benefits of collaborative learning and mobile learning. The devices are portable and compact, cost less than computers, and are easy to use (Colley & Stead, 2004; Saedah Siraj, 2004). Besides, CmL enables learners to share their experience and expertise with others of different cultures and contexts (Driscoll, 2007; Kaye, 1992). CmL engages learners to experiment, communicate and collaborate using new techniques and tools such as SMS, blogs, wikis, and live messenger service (Ragus, 2006). Learners are engaged and motivated to contribute to the group discussion and are generally more active and vocal compared to a face-to-face environment (Driscoll, 2007; Kaye, 1992).

Working in a collaborative environment in an informal setting, the learning experience is also less formal as knowledge in areas other than the school curriculum is addressed (Graham Attewell & Hughes, 2010; Saedah Siraj, 2006). This type of learning engages learners who are normally not interested in learning (G Attewell &

Webster, 2005; Savill-Smith, Attewell, & Stead, 2006). Using mobile devices enables such learners to be focused for a longer period of time (G Attewell & Webster, 2005; Proctor & Burton, 2004) and show interest in learning and sharing information (Colley & Stead, 2004; Geddes, 2004).

In conclusion, besides helping learners to gain more self-confidence and improve their ICT skills, the main affordances of CmL are to provide just-in-time learning where learning is provided anytime, anyplace and with learner-centered content.

Pedagogical Model. Pedagogy is the method and practice that concerns on how to teach in the best way to achieve lesson planning. Therefore, according to Rajendran, N. (2001), pedagogical model is a blueprint for teaching where the model is a strategy designed to achieve the lesson objectives. The design of the model is to explain and clarify the responsibilities of teachers in the planning, implementation and evaluation of teaching. Therefore, teachers should have knowledge of pedagogy to be able to achieve satisfaction in their careers. This is because one of the factors of satisfaction in teaching a subject depends on the knowledge of pedagogy (Schempp & Manross, 1998).

According to Kreber (2012), pedagogy is knowledge about how a person learns and how learning can be facilitated. It refers to the teaching of the principles of planning, strategy and control classes (Shulman, L. S., 1987). Pedagogical knowledge includes an understanding of learning styles, cognitive styles, cognitive processes in learning and group dynamics. It is a great way to teach subject content, ways of helping students to master learning and how to use critical thinking and independent learning. In other words, the pattern of teaching is influenced by knowledge of pedagogy, especially strategies, approaches and techniques that have been used.

According to Bonner (2001), knowledge is pedagogical beliefs and perceptions that have affected the implementation of the curriculum as well as to reflect on what they have taught, and the teaching and learning strategies used. Therefore, teachers' knowledge and teaching practices have a very close relationship. This is because the acquisition of knowledge and understanding of the content of a subject is important in determining the ability of teachers to transfer their knowledge to students (Brophy, 1991; Cochran-Smith & Lytle, 1993). Students' understanding depends on effective teaching and on how it is conveyed in a form that is easily understood. Therefore, teachers need to be aware of the level of content knowledge and their ability to convey the contents. By mastering content knowledge of a subject, it will allow teachers to teach well and effectively.

Teachers will also be more comfortable and excited to teach the subjects that they are expert in due to the ability to adjust their pedagogical knowledge with students' various abilities. Meanwhile, students' interest in a subject can be related to the teaching method. A subject that does not interest students may sometimes be due to unattractive way of teaching. In this context, educators should be more alert and creative to apply pedagogical knowledge in their teaching so that they are compatible with student learning situations and ultimately achieve the objectives.

According to Morrison, Ross, Kemp and Kalman (2010) pedagogy or instructional design is a systematic process in order to have an effective model that is both flexible and adaptable.

In addition, pedagogical models usually align with a particular pedagogical approach or learning theory where Mayes and Freitas (2004) have grouped learning theories into these three categories:

1. *Associative* (learning as activity through structured tasks),
2. *Cognitive* (learning through understanding),
3. *Situative* (learning as social practice).

Conole, G. (2010) summarises the frameworks and models that are categorized according to these groups as shown in Table 2.1.

Table 2.1

Pedagogical Models Based on Learning Theories

Perspective	Approach	Characteristics	E-learning application	Models and frameworks
Associative	Behaviourism Instructional design Intelligent tutoring Didactic E-training	Focuses on behaviour modification, via stimulus-response pairs; Controlled and adaptive response and observable outcomes; Learning through association and reinforcement	Content delivery plus interactivity linked directly to assessment and feedback	1. Merrill's instructional design principles 2. A general model of direct instruction
Cognitive	Constructivism Constructionism Reflective Problem-based learning Inquiry-learning Dialogic-learning Experiential learning	Learning as transformations in internal cognitive structures; Learners build own mental structures; Task-orientated, self-directed activities; Language as a tool for joint construction of knowledge; Learning as the transformation of experience into knowledge, skill, attitudes, and values emotions.	Development of intelligent learning systems & personalised agents; Structured learning environments (simulated worlds); Support systems that guide users; Access to resources and expertise to develop more engaging active, authentic learning environments; Asynchronous and synchronous tools offer potential for richer forms of dialogue/interaction; Use of archive resources for vicarious learning;	3. Kolb's learning cycle 4. Laurillard's conversational framework 5. Community of Inquiry framework 6. Jonassen's constructivist model 7. n-Quire model
Situative	Cognitive apprenticeship Case-based learning Scenario-based learning Vicarious learning Collaborative learning Social constructionism	Take social interactions into account; Learning as social participation; Within a wider socio-cultural context of rules and community;	New forms of distribution archiving and retrieval offer potential for shared knowledge banks; Adaptation in response to both discursive and active feedback; Emphasis on social learning & communication/collaboration; Access to expertise; Potential for new forms of communities of practice or enhancing existing communities	8. Activity Theory 9. Wenger's Community of Practice 10. Salmon's 5-stage e-moderating model 11. Connectivism 12. Preece's framework for online community
Assessment				13. Gibbs and Boud models 14. Nicol and the REAP framework
Generic				15. The OU (SOL) model 16. The OU LD & Course Business Models 17. The 3D pedagogy framework 18. Bigg's constructive alignment 19. The Hybrid Learning model 20. Gee's affinity model

Adapted from *Review of Pedagogical Models and Their Use in E-learning*, by Conole, G. (2010), p.3.

However, as this study takes social interaction into account with collaborative learning approach, a few models and framework such as Simon 5-stage e-moderating and connectivism theory have been chosen as the foundation of this study.

Mobile Learning Pedagogy. Since the term mobile learning (mlearning) emerged for the first time, many researches have been conducted to research the cognitive and pedagogical aspects in the use of mobile devices in education. Research has also been conducted to see how mobile equipment can be used for reading and for workplace activities. Some writers like Roibás and Sánchez (2002) are trying to provide guidance to application designers in this area about what forms of mobile equipment are most useful, how and why fit in with their experiences with students. Other researchers such as Johnson and Johnson (2009) analyze the theory of informal learning of adults. Adults are more likely to learn independently without being bound by the long learning period as they become easily tired. Therefore, mLearning will be able to support the pattern of adult learning.

Ally, Schafer, Cheung and McGreal (2007) in his study of providing English grammar lessons to adults as an interactive practice. The mLearning system developed is interesting because students can make interactive exercises using mobile phones that have internet access anytime and anywhere in the free time.

In many of the investigations, many interesting uses of new technology are outlined, for example the participants are passionate about new technology and want to try it out. Many studies have found when introducing new forms of teaching, it makes students spend more time on those subjects than any other subject. New technologies provide new opportunities for students and teachers to train their abilities (Mifsud, 2002). Evaluation and analysis on the mLearning project so far shows a lot of positive results. Most researchers recommend PDAs and other portable equipment should be seen as a continuation instead of replacing existing learning tools (Kukulska-Hulme & Traxler, 2002; Waycott, Scanlon, & Jones, 2002). Furthermore, not all learning content or learning activities are appropriate for mobile devices (Keegan, 2002).

MLearning can be applied in various forms of technology but is still in use for the same learning context. It can be described as a combination of different jobs for different purposes in different places as well. According to Syed Ardi Kamal and Tasir (2008), mobile technologies such as wireless networks (WiFi), hotsport, 3G mobile phones (3rd Generation), laptop computers and so on are a craze for adults and teens. So, when these mobile devices become a necessity for teenagers, then mLearning will be easy to implement.

Thus, Franklin and Harmelen (2007) propose the need for new pedagogic models expecially for using Web 2.0 technologies for learning. They say: "our consultative work revealed a strong feeling that educationalists do not as yet know how the increased use of Web 2.0 technology will interrelate with learning and teaching, and in turn demand new pedagogies and new assessment methods" (p.21).

Beetham, McGill, Littlejohn, and Mcbeth (2009) have produced a useful table summarizing new pedagogic approaches, along with key theorists as shown in Table 2.2. According to this table, a few pedagogical approaches with the key concepts and theorist proposed such as Vygotsky (Scaffolding theory), Siemen (Connectivism theory) and Lave and Wenger (Situated learning theory) as stated in the table are in line with this study.

Table 2.2

New Pedagogical Approches

Pedagogics approach	Key concepts	Key theorists
Learning 2.0	Learners' familiarity with web 2.0 technologies opens up a completely new space for and style of learning, focusing on: collaborative knowledge building; shared assets; breakdown of distinction between knowledge and communication	Downes, Anderson, Alexander, Walton
Learning 2.0 counter evidence	Evidence that pro-active, creative web 2.0 practitioners are still in the minority of users (1:9:90 rule): many learners are introduced to such practices by teachers. Ubiquity, accessibility and ease of use are, however, features of technology that are changing informal learning practices	Redecker
Connectivism	Individual processing of information gives way to development of networks of trusted people, content and tools: the task of knowing is offloaded onto the network itself	Siemens

Table 2.2 (Continued)

New Pedagogical Approches

Pedagogics approach	Key concepts	Key theorists
Communities of enquiry	Building on Wenger's notion of communities of practice, (higher) learning conceived in terms of participation, with learners experiencing social, cognitive and pedagogic aspects of community.	Wenger, Garrison and Anderson
Theory/practice, practical inquiry	Action (practice) and discussion (theory) in shared worlds is internalised, leading to personal capability (practice) and conceptualisation. Specifically facilitated through social technologies and computer supported cooperative work (CSCW)	Vygotsky, Garrison
Academic apprenticeship	Literacy as situated social practice is best acquired through apprenticeship model, situated in disciplinary ways of knowing	Holme
E-learning, e-pedagogy	New forms of learning and teaching are enabled – and required – by digital technologies. Typically more constructivist and learner-led.	Mayes and Fowler, Cronje

Adapted from *Pedagogic approaches to using technology for learning: Literature review*, by Attewell, G., & Hughes, J. (2010).. Lifelong Learning UK, (September), 1–86

Development of Teaching and Learning System

There are various types of teaching and learning methods that have been implemented including conventional learning, E-Learning and Mobile learning (Devinder, S. & Zaitun Abu Bakar, 2006). Figure 2.4 shows the fraction of the present learning system being practiced.

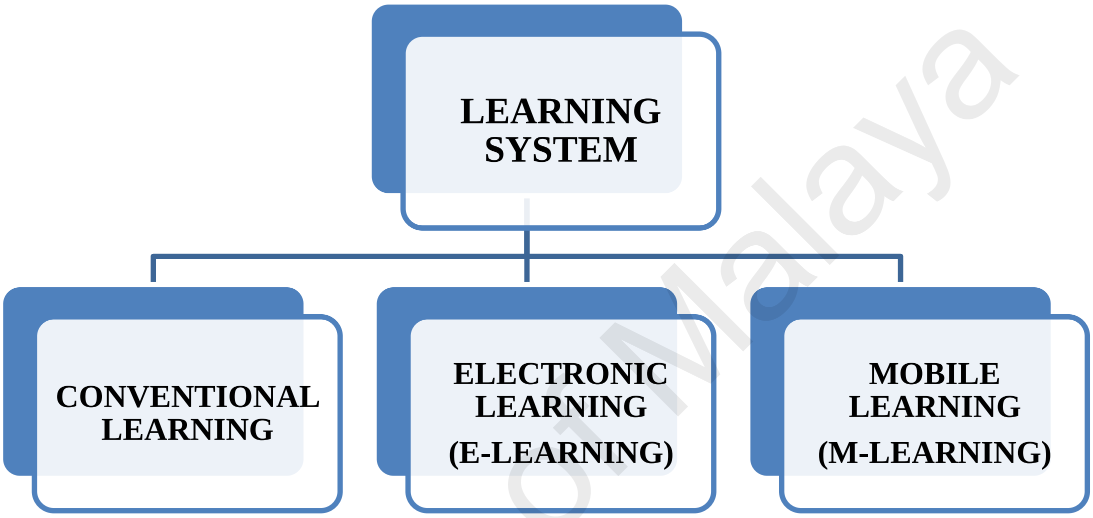


Figure 2.4. Learning System.

Adapted from *Mobile Learning in Wireless Classrooms*, by Devinder and Zaitun (2006). *Malaysian Online Journal of Instructional Technology (MOJIT)*, 3(2), 26-42

Conventional Teaching and Learning. There are some advantages in the conventional learning system among them are students attending lectures at designated locations e.g. in class, lab or workshop. Through this method students can strengthen the socialization network that is abstract among them and enable them to learn from each other. In addition, students can also hold group discussions, complete collaborative projects and assist weak partners in their learning. Conventional learning is synonymous with 'surface learning', which is the only level of learning. This method of learning does not help to improve academic performance and student knowledge. The conventional system of teaching and learning is not the best method in modern times as it can be modified to a more sophisticated and relevant form of current educational situation (Jonassen, 2000).

Therefore, there are some conventional learning disadvantages. Among the weaknesses that can be identified are weak interaction, learning is happened in one-way mode, lack of learning resources and less feedback from weak students (Narayanansamy, M., & Issham Ismail, (2011). Additionally, when lecturers deliver lectures by writing on blackboards, students simply take notes. Things like making students less stressful and acting just copying notes from lecturers. Therefore, creative and critical thinking methods cannot be achieved. According to Devinder, S. and Zaitun Abu Bakar (2006), student interaction and lecturers become less current in the lecture room. This is because the interaction of students with lecturers is limited in large lecture rooms. The prevalence in large lecture rooms, the learning session takes place in a non-uniform mood where students are actively communicating information and passive students are just observing. Sometimes learning also happens individually (Devinder, S. & Zaitun Abu Bakar, 2006).

In addition, conventional learning also caused a lack of reference sources in the lecture room. This is because students only expect notes that have been provided by lecturers. Access to the latest information cannot be carried out to help students understand the subject more clearly. This resulted in poor students not moving in tandem with the presentation of lecturers and subsequently lack of feedback from students to lecturers in lecture delivery.

E-Learning. E-learning is a method of using the latest technologies to improve teaching and learning delivery. It is the process of teaching and learning that uses electronic networks (LAN, WAN or internet) to deliver content, information, and also interact through it. Internet, satellite, audio-video tape, interactive TV and CD-ROM are part of the electronic media used to practice E-Learning (Kaplan, 1999). E-Learning was also introduced to attract students and to create a wider understanding. It can also happen at home or at college. According to Moore and Richardson (2002), E-Learning means a learning that can be accessed in a fixed location with an internet connection. Generally, E-Learning contains graphical and audio visuals (Chen, Kao, & Sheu, 2003). In addition, Chen et al, (2003) also states that distance education materials can be presented simultaneously. Lecturers will use slide or video and this will have a real impact on students in understanding a subject.

However, there are some disadvantages in E-Learning where among others are dependent on the internet connection service continuously and cannot be used when internet connection is not available. In addition, E-Learning also relies on a fixed location to access the internet and does not support mobile learning. E-Learning also led to less interaction between lecturers and students and this led to a lack of social interaction.

Mobile Learning. Mobile learning is a new concept in learning process that emphasizes the ability to facilitate the transfer of learning process without being bound to the physical location of a learning process (Kukulska-Hulme et al, 2005). According to Syed Ardi Kamal and Zaidatun Tasir (2008), mobile learning is an ICT-based learning tool that uses latest mobile devices such as PDAs, mobile phones, laptop computers and tablet PCs. It is a learning that uses wireless devices to enable the deployment to happen anytime and anywhere (Saedah Siraj, 2006).

Mobile learning is part of e-learning and distance learning. This is because, if mobile learning is linked to the internet and wireless, the concept of mobile learning is not much different from the original concept of e-learning. However, mobile learning has the ability to happen wherever the students are regardless the time.

The advantage of mobile learning is that it can happen anytime and anywhere. This is because communication and support for teaching can occur beyond the class schedule. Teachers can combine interactive multimedia presentation techniques during student demonstrations, and can hold on-site feedback sessions such as quizzes or surveys. With mobile learning, teachers can conduct quizzes at any time by entering questions and setting the time they need to take for each quizzes. Even teachers can obtain the quizzes' scores directly without having to calculate scores manually.

Through mobile learning, students can organize individual and group learning activities such as browsing the website. Brown (2001) states that the lecturer can deliver more effective teaching such as simulation and access documents from the web. More importantly, students do not have to waste time copying notes given by teachers. Attewell (2005) summarizes mobile learning to a positive impact on several areas:

1. Help students improve literacy and numeracy skills to identify real capabilities.
2. Promote independent learning experiences and collaborative learning.
3. Help students identify things that need help and support.
4. Assist the use of information and communication technology as well as help to reduce the gap between mobile phone literacy and information technology literacy.
5. Help students refuse some formality from learning comprehension.
6. Assist students in maintaining a learning focus for longer periods of time.

7. Help students to increase self-esteem.

ICT-Pedagogy Integration in Teacher Training

Teaching is becoming one of the most challenging professions in our society where knowledge is expanding rapidly and modern technologies are demanding teachers to learn how to use these technologies in their teaching. While new technologies increase teachers' training needs, they also offer part of the solution. According to Jung (2005) information and communication technology (ICT) can provide more flexible and effective ways for professional development for teachers, improve pre-service and in-service teacher training, and connect teachers to the global teacher community. However, ICT integration in teacher training can take in many forms. Teachers can be trained to learn how to use ICT or teachers can be trained via ICT. ICT can be used as a core or a complementary means to the teacher training process (Collis & Jung, 2003). Jung (2005) has organized various ICT teacher training efforts found in different countries into four categories using the framework of Figure 2.5.

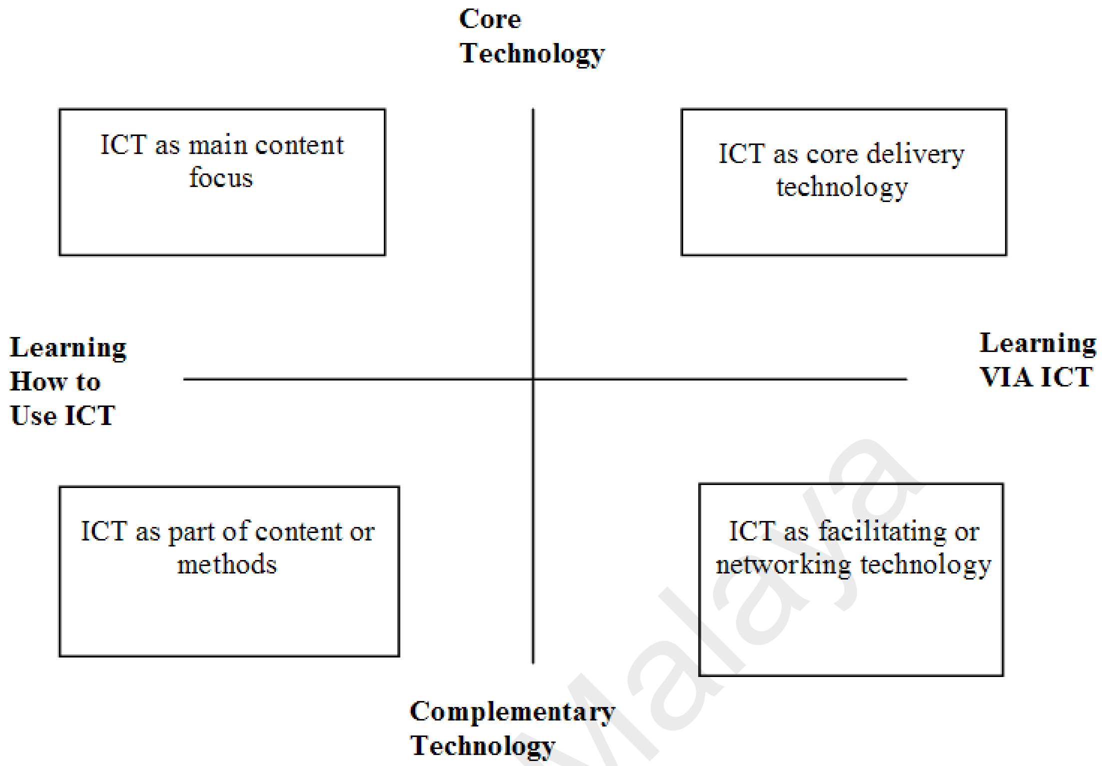


Figure 2.5 Categories for ICT in Teacher Training.

Adapted from Collis & Jung, 2003, p.176.

The categories of ICT integration in teacher training are elaborated by Jung (2005) as follows:

1) ICT use as main content focus of teacher training

Most of the early ICT teacher training programs in the 1990's focused on ICT use as the main training content. This approach has an emphasis on teacher training in how to use ICT in the classroom. It addresses issues such as selecting appropriate ICT tools and supporting students in the use of those tools, using ICT to promote learning activities, developing new methods of facilitating learning and evaluating student performance, and so on.

2) **ICT use as part of teaching methods**

This approach integrates ICT into teacher training to facilitate some aspects of training. Teachers are provided with examples of ICT-pedagogy integration in their training process. It uses videotape and CD-ROM to help teachers to see how technology can be integrated into their work. These CD-ROMs contain video descriptions and demonstrations of how technology is used in teachers' classrooms. Teachers also learn how to use ICT in their classrooms by actually being engaged in the process of ICT-integrated training.

3) **ICT as core technology for delivering teacher training**

In this approach, ICT is used as the major way of providing the learning experience of teacher training. The content of this approach does not necessarily focus on ICT skill itself but rather covers a variety of ICT applications. The digital technology is frequently becoming the core technology of ICT in teacher training.

4) **ICT used to facilitate professional development and networking**

The use of ICT as core technology for delivering teacher training can be found in limited contexts. There are many examples of ICT, particularly internet and Web-based communication technologies, being used to support teachers' on-going professional development and networking. Many countries have developed a website or websites to provide online resources for teachers and facilitate teachers' networking based on the assumption that professional development should be an integral part of daily practice for all teachers and the use of the internet would enhance continuous professional development activities of teachers, connecting teachers to larger teaching communities and allowing for interaction with expert groups.

Eventhough there are various efforts and initiatives in integrating ICT into teacher training, many aspects should be observed to provide more effective ICT training. According to Jung (2005), there are possibilities and challenges in adopting ICT in teacher training and professional development. First, teacher training approaches need to adopt cost-effective strategies. Most nations have limited resources for teacher traning and must make decisions based on cost-effectiveness. The teacher training experiences provide several cost-saving strategies (Collis & Jung, 2003). Second, support and investment in teacher trainer training is important for the adoption of ICT for teacher training. Finally, national and international partnerships across public and private sectors need to be formed to share resources, knowledge, and experiences in providing effective and efficient ICT teacher training.

Overall, governments and teacher training instititutions seem to recognize the importance of integrating ICT in education and teacher training. In many cases, the national vision for ICT use in education has been integrated into teacher training. In Malaysia, utilization of ICT to enhance the quality of learning is the seventh shift in the 11 major shift to transform the country's education system in Malaysia Education Blueprint (PPPM) (2013-2025). Other than that, the ninth shift in Education Blueprint for Higher Education discusses on the important of technology-enabled mode of education through globalised online learning. One of the strategies and initiative in this shift is strengthening content development and delivery where lecturers will be required to innovate their teaching and learning practices in order to create conducive blended learning environments.

Thus, this study is one of the initiatives to promote active ICT integration in teacher training as teachers tend to integrate ICT in their teaching if they experience ICT skills as a learner through the implementation of proper guideline as proposed in the pedagogical model developed in this study.

Technological Pedagogical and Content Knowledge (TPACK)

TPACK is a framework for teacher knowledge for technology integration called technological pedagogical content knowledge. This framework builds on Lee Shulman's construct of pedagogical content knowledge (PCK) to include technology knowledge. TPACK theory was developed by Mishra and Koehler (2006) that was deemed important because it:

"…. is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones." (Mishra and Koehler 2006, 1029)

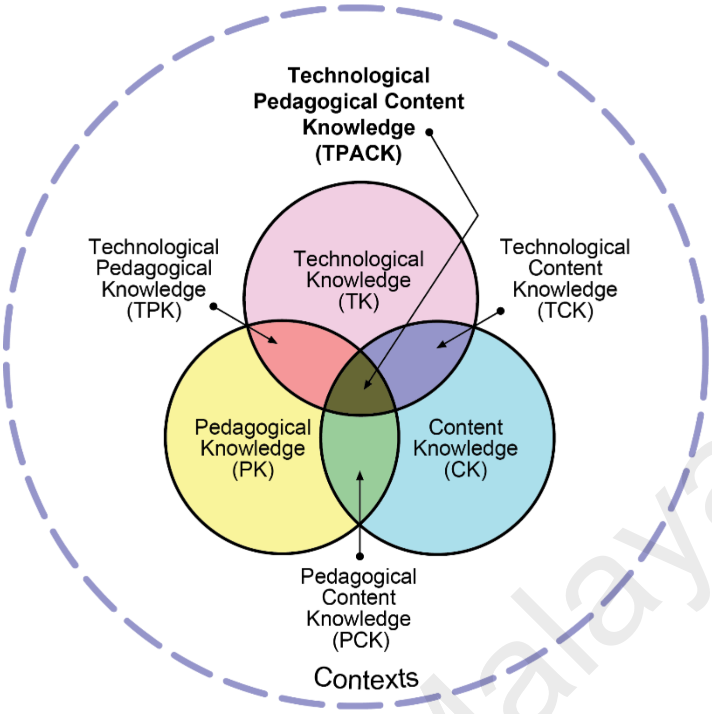


Figure 2.6 The TPACK Framework and Its Knowledge Components.

Adapted from *Technological Pedagogical Content Knowledge: A framework for Teacher Knowledge*, Mishra, P., & Koehler, M. J. (2006).

In the TPACK framework (Figure 2.6), there are three main components of teachers' knowledge: content, pedagogy, and technology. Equally important to the model are the interactions between and among these bodies of knowledge, represented as PCK (Pedagogical Content Knowledge), TCK (Technological Content Knowledge), TPK (Technological Pedagogical Knowledge), and TPACK.

Content knowledge (CK) is teachers' knowledge about the subject matter to be learned or taught. Knowledge of content is of critical importance for teachers. As Shulman (1986) noted, this knowledge would include knowledge of concepts, theories, ideas, organizational frameworks, knowledge of evidence and proof, as well as established practices and approaches toward developing such knowledge.

Pedagogical knowledge (PK) is teachers' deep knowledge about the processes and practices or methods of teaching and learning. They encompass, among other things, overall educational purposes, values, and aims. This generic form of knowledge applies to understanding how students learn, general classroom management skills, lesson planning, and student assessment. It includes knowledge about techniques or methods used in the classroom; the nature of the target audience; and strategies for evaluating student understanding.

PCK is consistent with and similar to Shulman's idea of knowledge of pedagogy that is applicable to the teaching of specific content. According to Shulman (1986), this transformation occurs as the teacher interprets the subject matter, finds multiple ways to represent it, and adapts and tailors the instructional materials to alternative conceptions and students' prior knowledge. PCK covers the core business of teaching, learning, curriculum, assessment and reporting, such as the conditions that promote learning and the links among curriculum assessment, and pedagogy.

TK goes beyond traditional notions of computer literacy to require that persons understand information technology broadly enough to apply it productively at work and in their everyday lives. It requires a deeper, more essential understanding and mastery of information technology for information processing, communication, and problem solving than does the traditional definition of computer literacy. Acquiring TK in this manner enables a person to accomplish a variety of different tasks using information technology and to develop different ways of accomplishing a given task.

TCK, then, is an understanding of the manner in which technology and content influence and constrain one another. Teachers need to master more than the subject matter they teach; they must also have a deep understanding of the manner in which the subject matter (or the kinds of representations that can be constructed) an be changed by the application of particular technologies. Teachers need to understand which specific technologies are best suited for addressing subject-matter learning in their domains and how the content dictates or perhaps even changes the technology or vice versa.

TPK is an understanding of how teaching and learning can change when particular technologies are used in particular ways. This includes knowing the pedagogical affordances and constraints of a range of technological tools as they relate to disciplinarily and developmentally appropriate pedagogical designs and strategies. To build TPK, a deeper understanding of the constraints and affordances of technologies and the disciplinary contexts within which the function is needed.

TPACK is an emergent form of knowledge that goes beyond all three "core" components (content, pedagogy, and technology). Technological pedagogical content knowledge is an understanding that emerges from interactions among contents, pedagogy, and technology knowledge. TPACK is the basis of effective teaching with technology, requiring an understanding of the representation of concepts using technologies, pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help to rectify some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones.

According to Koehler et al. (2013), before the twenty-first century, an expert teacher is the one that able to fuse the knowledge of subject matter (refer to as content knowledge) with pedagogy (which is the understanding of how to make the content accessible to the learner). Now, with technologies coming in to enhance the process of teaching and learning, TPACK was developed to assist teachers in identifying the nature of knowledge for technology integration in their teaching.

According to Mishra and Koehler (2006), expert teachers now are those who can bring together knowledge of subject matter, what is good for learning, and technology. Mishra and Koehler (2006) argue that this is more than simply bringing in ICT to the old ways of teaching. They say it all depends on the skill of how technology is utilized to access content and to understand how it can support learning processes in combination with pedagogical and content knowledge. Neverthesess, the expectation today is that the newly-qualified teachers should be equipped to fuse the TPACKs and be able to teach in this digital age effectively.

Thus, a well-designed teacher training program is essential to meet the demand of today's teachers who want to learn how to use ICT effectively for their teaching. TPACK can be a guide in the development of teacher training program as proposed in this study. This is because lecturers in teacher training program have the responsibility to show or model effective ways of teaching with digital technologies for pre-service teachers. According to Chigona (2015), the instructors or lecturers themselves are in need of TPACK and recommended that teacher education institutions to ensure that the intended users (instructors) are in a position to adopt and use the technologies effectively. Thus, it is in line with this study as the pedagogical model is developed as a guideline for the lecturers to adopt the teaching and learning with current technologies namely, mobile learning assisted by mobile instant messaging application.

Mobile Instant Messaging in Education

Instant messaging (IM) software is one of the Web 2.0 applications that is already very propular in schools, workplaces, and homes. The potential offered by IM in education has becoming widespread in universities where it is being used for online discussions, chatting, file transfer, library access and usage. Farmer (2005) pronouncing IM as having powerful applications and incredible potential within educational and learning environments. Jacobs (2006) agreed that IM should be viewed as a writing technology that builds skills needed at school and at work, such as collecting, assembling, and distributing information.

The original purpose of IM applications such as MSN Messenger, Yahoo Messenger, and Google Talk was to communicate with friends and family (Goldsborough, 2001). Nardi et al. (2000) described IM as a near-synchronous computer-based one-on-one communication that can allow collaboration, scheduling, impromptu meetings, and contact with friends and family. However, it was found that IM had the potential to support informal communication within an organization (Goldsborough, 2001). In addition, Nicholson (2002) claimed that IM could enhance distant education, and provide a 'virtual hallway' between students and teachers.

Many researches have been conducted in relation to the potential of using IM to support online courses. Jeong (2007) studied feedback from senior high school students in order to understand their feelings regarding the online courses, with IM software. The study found that students considered that IM software helped to enhance their communication, made them feel at ease during the communication, and increased their office hours with the lecturer. Nicholson (2002) found that students who use IM have a stronger sense of community than those who do not, and such students used IM to discuss course issues. This is supported by Farmer (2005) who suggested that IM can be used as a tool to foster an engaging learning environment since many students are already familiar with instant messaging.

Contreras-Castillo and Pérez-Fragoso (2006) developed a system named CENTERS IM. They aimed to understand the acceptability and utilization conditions of the students upon adopting the IM function under a learning context via the IM system.The study indicated the importance of the IM software concerning aspects of social interaction.

IM becoming mobile with the introduction of mobile phone. Research conducted by Y. Chen, Handy-Bosma and Walker (2005) has showed the evident of mobile phone usage patterns shifting the trend from traditional message such as email to newer technologies such as instant messaging. Since MIM can provide a much faster response compared to email, this should encourage students to become more engaged with course material outside the classroom, and help them communicate better among themselves.

Many mobile instant messaging (MIM) software such as WhatsApp, Line, and WeChat can be easily downloaded using smarts phone. Nowadays, the dominance of MIM applications has remained a global phenomenon in the world of fast-moving and changing mobile communications technologies. Besides being labelled as a natural mode of communication in today's world, the pervasiveness of MIM has also found its way into educational settings. According to Hwang et al. (2011), the use of MIM to facilitate students' learning and to enhance their belonging to the learning community seems a positive and emerging trend. Other than that, MIM is found as one of the most widely-used mobile application for education as it supported social bonding between students and instructors (Rau, Gao, & Wu, 2008).

Many studies have been discussed about the affordances MIM can offer in education. Through MIM, it is convenience for both students and instructors to contact each other from wherever they have internet access, and the opportunity for students to receive immediate feedback from their instructors or other students (Chipunza, 2013). Other than that, the use of instant messaging applications may assist students in overcoming shyness. Rambe and Bere (2013) found that MIM asynchronous collaborative learning allowed shy, less confident students to engage more productively. In addition, Yengin, Karahoca, Karahoca and Uzunboylu (2011) investigate the potential of using mobile instant messaging for education, and they also discovered in previous studies how successful MIM can offer as a quiz tool, an assessment tool and discussion tools (Graham Attewell, 2007; Bollen, Eimler, & Hoppe, 2004; Holley & Dobson, 2008; Markett, Sánchez, Weber, & Tangney, 2006; Stone, 2004). Other studies suggested that by using MIM as a discussion tool, it can promote interactivity and led to more active collaboration (Bollen et al., 2004; Holley & Dobson, 2008; Markett et al., 2006). MIM is used as a social tool were social interaction via MIM technology is not limited to student-student conversations but with both their peers and instructors. The open style discussion enables the teachers to get to know their students in depth and to create a positive atmosphere as well as promote a sense of proximity (Bouhnik, Deshen, & Gan, 2014).

While there are many advantages and positive findings from several studies to using MIM in educational contexts, there are also possible shortcomings. Ryu and Parsons (2012) and El-Hussein and Cronje (2010) indicate that there is still a need to conduct further research on how mobile instant messaging could facilitate collaborative learning beyond the 'novelty effect' of new mobile technology. One of the most common drawbacks mentioned in previous literature is that IM may increase instructors' workload (Farmer, 2005; Repman, Zinskie, & Carlson, 2005). For instance, it may require instructors to be available at all times to reply to students' questions and comments. Another concern with MIM use in schools is that, instructors and teachers may need to be introduced to the intricacies of MIM technology as MIM is more frequently used by younger age groups (Lenhart & Shiu, 2004; Repman et al., 2005).

In the context of this study, implementation of MIM in learning is expected to transformed pedagogy by fostering social constructivist environments for lecturer-student and peer-based development of knowledge. The lecturer's role is expected to become a facilitator and mentor providing guidance on demand. Whereas, students' roles will also transformed from information receivers to information generators, collaborators, information seekers, critical thinkers and group leaders (Rambe & Bere, 2013).

Theorizing Collaborative Mobile Instant Messaging Learning

Based on the past researches, a few learning theories have been adopted in designing the instructional strategies such as behaviorism, cognitivism, and constructivism theories. Behaviorism theory involves learning activities that target learning as a change in learners' observable actions. In constructivism theory, learning involves activities in which learners actively construct new ideas or concepts based on previous and current knowledge. However, these theories have limitations in relation to the present learning trend where they were developed when learning had not yet affected by technology (Siemens, 2005).

Regardless the theories being argued, there are a few theories that could aid in designing the instructional technology such as social constructivist learning theory

(Vygotsky, 1978). This theory emphasis on the concept of scaffolding which is the Zone of Proximal Development (ZPD) through interaction with more knowledgeable others (MKO) in pursuit of a learning goal. In the context of this study, during their early stage of using collaborative mobile instant messaging learning (CMIML), some of the students might need helps in downloading the mobile instant messaging (MIM) applications and learning basic technical skills through their instructors or friends with more knowledge in it. Besides giving supports in technical part, this is the stage where the instructors welcoming the students by giving motivation to students help each other by giving motivation and encouraging each other to participate in the CMIML. By implementing MKO at the zone of proximal development, students should receive appropriate scaffolding to help them to the next stage of their study. This scaffolding practice then can be developed through collaborative learning activities where capable peers could help less competent learners and further create the network socialization environment.

In connectivism theory, Siemens (2005) pointed out that, learning in the digital age relies on the connected learning that occurs through interaction with various sources of knowledge including the internet and learning management systems (LMS) and participation in communities of common interest, social networks, and group tasks. This situation has changed the role of the instructor as the center of information dissemination to become the facilitator for acquiring new knowledge through online learning. In the context of CMIML, the most significant is the facilitation of mobile instant messaging in preparing the platform for collaborative activities. Through CMIML, students are expected to gather information through idea sharing among themselves. This information exchange has made the interaction becomes more collaborative and knowledge construction are developed throughout completing their group task.

In situated learning theory, it promotes learning within an authentic context and culture. According to Lave and Wenger (1991), situated learning theory promotes the development of competences through social learning activities occurring in context and culture as opposed to classroom learning activities which deals with abstract knowledge that usually out of context or in simulated context. Through CMIML, social relationships are created outside the physical confines of the course room through online discussion. This is on the gound that mobile instant messaging learning able to create environment for students to initiate interaction that contributing to networks socialization. Thus, the role of instructors in employing CMIML is very important as the online activities have to be properly planned. The instructors have to encourage the students to participate in the group discussions and may as well requiring all assignments to be completed in any digital tools format. This is to allow the learners to indirectly absorb an online-mentality where they are comfortable with an online interaction (Wan Mohd Fauzy Wan Ismail, 2012).

In conclusion, CMIML could be theorized based on many theories either on new theories or conventional e-learning theory, or even the traditional one. However, theorizing CMIML in this study is based on the theories (social constructivist learning, connectivism and situated learning) mentioned above which is hoped to be the most appropriate theory options to help address the problem or issues in this study.

Theoretical Framework of the Study

This section discusses the theoretical foundation for the study. The foundation consists of several theories and models to guide in the study in order to achieve the learning outcomes. The study adopted Social Constructivist Learning theory (Vygotsky), Scaffolding theory (Bruner), Situated Learning theory (Lave and Wenger), Connectivism theory (Siemens), Five-Stage Scaffolding Model (Salmon), and the FRAME model (Koole) as theoretical framework for the development of the model. The theories and models involved will be elaborated to frame on how Collaborative Mobile Instant Messaging Learning (CMIML) could be implemented in formal course.

Social Constructivist Learning Theory. In social contructivist learning theory, Vygotsky (1978) sees learning as a process of socialization and acculturation through interaction with more knowledgeable others (MKO) in pursuit of a learning gold. This social learning theory characterises the developmental perspective and emphasises the important role of peer-based interaction and knowledge sharing in individuals' construction of knowledge and understanding. This MKO theme suggests that a learner could learn from another person who has a better understanding or higher ability in a particular task, process, or concept. The MKO is normally thought could be a teacher, trainer, coach, a lecturer or other adult but the MKO may also come from their peers or a younger person. However, the MKO may not necessarily be in human form. In the context of this study, MKO could be a mobile phone where it is believed that knowledge and understanding are co-constructed throught interaction supported and assisted in dialogue via mobile instant messaging (MIM) application.

Another theme to describe Vygotsky's theory is the concept of scaffolding which is Zone of Proximal Development (ZPD). Vygotsky defined the ZPD as "The distance between the actual developmental level as determined by individual problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978). In other word, referring to Figure 2.4, ZPD is the distance between what a learner can do by himself (expert stage) and what can be achieved with the support of a knowledgeable or capable peer or instructor. The ZPD helps to create an engaging and challenging classroom as students are provided with tasks that are neither boring and not just catering for their current achievement levels, but stimulating and exploratory. With the assistance of educational support, anxiety can be reduced and students can achieve higher levels independantly and be able to reach their full potential. Lessons must not be structured to be inachievable or boring but to address the gap which is the ZPD. By implementing the scaffolding practices with the help of MKO at the zone of proximal development, Vygotsky was certain that students could be taught efficiently. Once the students are in ZPD, they should receive appropriate scaffolding by their MKO where they are escorted and monitored through learning activities to get them to the following stage. In the context of this study, lecturers may include collaborative learning activities where capable peers could help less competent learners within the learner's zone of proximal development.

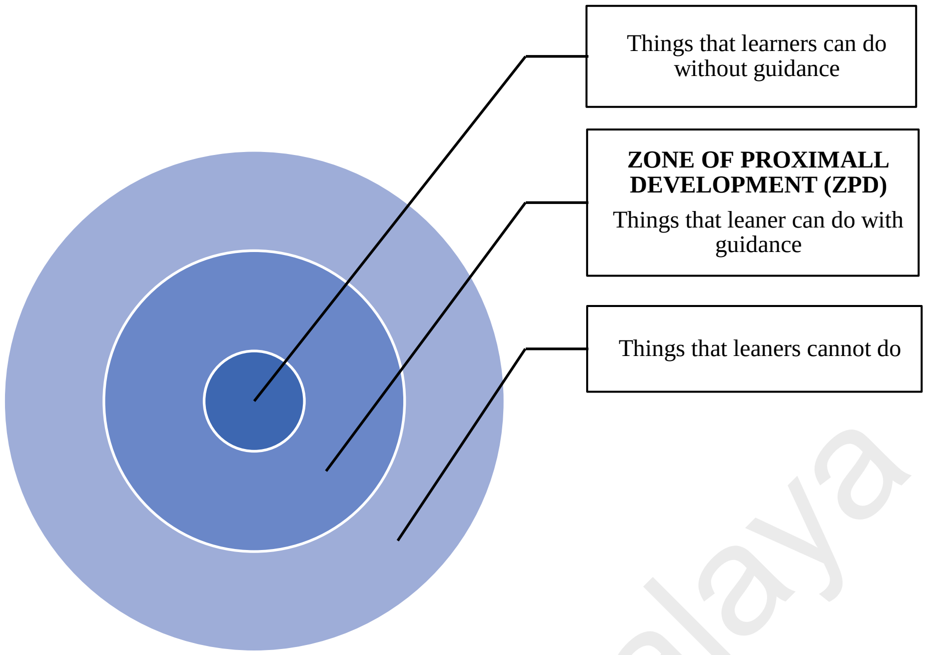


Figure 2.7 Zone of Proximal Development (ZPD).

Scaffolding Theory. Scaffolding theory was first introduced by Jerome Bruner, a cognitive psychologist. He used the term to describe young children's oral language acquisition. Young children are provided with informal instructional formats within which their learning is facilitated with the helped by their parents when they first start learning to speak (Bruner, 1970). Inspired by Lev Vygotsky's concept of scaffolding where an expert assisting a novice, or an apprentice, Wood, Bruner and Ross (1976) described scaffolding as the support given to a younger learner by an older, more experienced adult. Though the term was never been used by Vygotsky, interactional support and the process by which adults mediate a child's attempts to take a new learning has come to be termed "scaffolding". Scaffolding represents the helpful interactions between adult and child that enable the child to do something beyond his or her independent efforts. A scaffold is a temporary framework that is put up for support and access to meaning and taken away as needed when the child secures control of success with a task.

There are a few types of scaffolding being discussed by previous researchers. In instructional setting, Brush and Saye (2002) identified two levels of scaffolding which are soft and hard scaffolds. Soft scaffolds are dynamic, situation-specific, immediate, and continuous assistance provided by a teacher or peer in the learning process. A teacher may approach her students one after another in a classroom and converse with them in monitoring their progress. In the other hand, hard scaffolds are static supports that are planned in advanced to assist students with a difficult task. This level of scaffolding is more student-centered where the teacher could provide cues or hints.

Another type of scaffolding is the reciprocal scaffolding where it is a method involving pair or a group of learners working collaboratively on a task (Holton & Thomas, 2001). In reciprocal scaffolding, the instructor and the student may switch their roles as an expert or a student, where learning would be a mutual goal. The student might learn about a new learning experience while the instructor could learn a new technique in doing a certain thing that is discovered by the student.

The next type of scaffolding is self-scaffolding which capitalizes on the idea of a learner who takes charge in assessing his or her ZPD using available and appropriate scaffolds (Holton & Clarke, 2006; Knouzi, Swain, & Lapkin, 2010).

A newer type of scaffolding approach is the technical scaffolding where the experts or guides are in the form of technology devices and applications. Thus, in the context of this study, the experts are in the form of technology devices and applications such as computers, mobile devices, web links, online tutorials, help pages, or social software (Yelland & Masters, 2007).

Situated Learning Theory. Situated learning was first proposed by Jean Lave and Etienne Wenger as a model of learning in a Community of practice. In social cohesion perspective, Lave and Wenger (1991) indicate that the development of competences through social learning activities is an important factor in successful induction into a community of practice and the acquisition of a shared professional discourse. Through this, learning which occurring in context and culture as opposed to classroom learning activities which deals with abstract knowledge that usually out of context or in simulated context. In the context of this study, social relationships are created outside the physical confines of the course room through online discussion. Online learning communities provide support for individual learners who can test assumptions, try out new ideas, and ask questions in the company of other learners with common interest (Ioannou & Georgiou, 2009).

At its simplest, situated learning is learning that takes place in the same context in which it is applied. Lave and Wenger (1991) argue that learning should not be viewed as simply the transmission of abstract and decontextualized knowledge from one individual to another, but a social process whereby knowledge is co-constructed. They suggest that such learning is situated in a specific context and embedded within a particular social and physical environment.

Lave and Wenger assert that situated learning is not an educational form but much less a pedagogical strategy. However, since their writing, others have supported different pedagogies that include situated activity:

i) Workshops, kitchens, greenhouses, and gardens used as classrooms

ii) Stand-up role playing in the real world setting, including most military training (much of which takes a behaviourist approach)

iii) Field trips including archaeological digs and participant-observer studies in an alien culture

iv) On the job training including apprenticeship and cooperative education

v) Sports practice, music practice and art are situated learning by definition, as the exact actions in the real setting are those of practice with the same equipment or instruments.

Connectivism Theory. Siemens (2005) proposes a contemporary theory of learning called connectivism that recognizes the impact of technology on society and ways of knowing. Although some writers have challenged both the need for a new learning theory and whether connectivism meets the parameters of theory (Kop & Hill, 2008), Siemens provides a premise and a framework that are very useful for understanding collaborative learning in an online environment. From his viewpoint, learning in the digital age is no longer dependent on individual knowledge acquisition, storage, and retrieval. It relies on the connected learning that occurs through interaction with various sources of knowledge (including the internet and learning management systems) and participation in communities of common interest, social networks, and group tasks.

From this perspective, learning consists of retrieving information from self, others, and machines, collaborating to create knowledge, and applying information to current contexts. Hence, this learning theory is about individuals connecting with each other and with technology. Effective learners are those who can cope with complexity, contradictions, and large quantities of information, who seek out various sources of knowledge, and who can create and sustain learning communities and networks. According to Siemens, learning ecologies (communities and networks) facilitate important information sharing and co-construction of knowledge while encouraging life-long learning in the individual as well as the group.

Siemens recognizes that in the online learning environment, seeking and constructing knowledge is most often accomplished through interaction and dialogue. Brindley et al., (2009) agree with Siemens and like most online educators acknowledge the importance of creating learning environments that promote group connectivity and collaboration experiences that help students to acquire the skills necessary to create and effectively participate in learning communities and social networks. The question that arises for online teachers is how to incorporate small group learning experiences into courses that are inviting and provide productive, engaging, and skill building spaces for learners, which encourage them to repeat the collaborative learning experience independently.

Siemens (2002) noted that learner-learner interactions in an e-learning course can be viewed as a four stage continuum:

1) Communication – People ‘talking’, discussing
2) Collaboration – People sharing ideas and working together (occasionally sharing resources) in a loose environment
3) Cooperation – People doing things together, but each with his or her own purpose
4) Community – People striving for a common purpose

This continuum of involvement provides a useful framework for thinking about scaffolding with learners through progressively more complex interaction skills leading to the creation of an effective working group. Siemens (2002) proposes that in an online course, interaction will probably not go beyond communication or collaboration most of the time. He notes that while it is not realistic to expect community in many online courses, it should be possible in graduate level programs with high learner-learner contact.

In the context of this study, acquisition of skills associated with collaborative learning is an explicit goal. The courses will have little static content, other than a comprehensive syllabus and course outline, and they are heavily driven by interaction among learners and between instructor and learners. Small group projects are a common learning method, and discussion has intensified about the merits of grading students' collaborative group work as a means of motivating student participation.

Salmon Five-Stage Scaffolding Model. Salmon's five-stage scaffolding model, teaching and learning through online networking, adopts constructivist theory. This model promotes online networking and group work while allowing the scaffolding of individual development. The two building blocks in the model are essential in promoting student interaction and learning where they describe the followings;

1. The teacher is an e-moderator who initiates and moderates discussions to promote student learning.
2. Educational online activities (e-tivities) develop students' abilities to collaborate online, so they can construct new knowledge via discussions.

This model was particularly useful for the online task designed by the instructor as it stresses the personal character of learning. It emphasizes that the learner is central in an online activity and that online learning is a social process. The model also demonstrates that both interaction and reflection are key in online learning. Thus, it is important to engage students in learning from one another through online interactions and reflection.

Salmon (2004) distinguishes five stages of online learning that an instructor should bear in mind when structuring and organizing an online activity as shown in Figure 2.8.

1. Stage 1 – Access and motivation: As new online learners may experience apprehension and frustration in accessing an online interactive site, it is the role of the e-moderator to motivate and encourage them to learn online while ensuring that access to the online network is easily available.
2. Stage 2 – Socialization: It is vital for an e-moderator to create an environment for online learners to share and exchange ideas by facilitating online work and cooperation.
3. Stage 3 – Information exchange: At this stage, online learners interact with course content and other people involved in the online network (including the e-moderator). The e-moderator assigns tasks and requires learners to explore all relevant information available to them.
4. Stage 4 – Knowledge construction: At this stage, learners hold online discussions regarding a task(s). These interactions can promote knowledge construction. In maintaining the online group, the e-moderator interacts with the learners and encourages them to contribute to the discussion.
5. Stage 5 – Development: Online learners at this stage must become critical and self-reflective, as well as responsible for their own learning. They must be able to build on ideas acquired through online activities and apply them to their individual contexts.

In the context of this study, teacher participant is a solution for effective technology integration. Many educational technologies developed without the presence of teacher input are not easy and too inflexible to fit into classroom pactices (Saedah Siraj & Muhammad Helmi Norman, 2012).

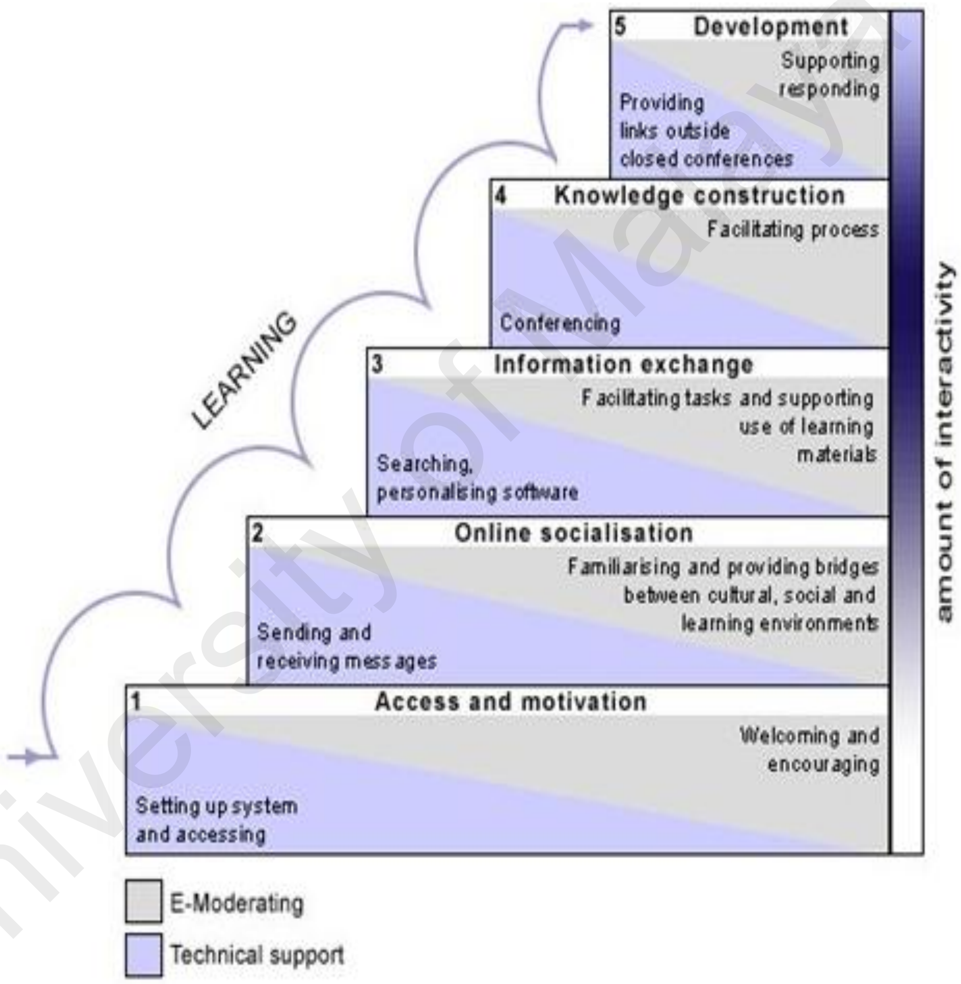


Figure 2.8 Model of Teaching and Learning Online.

Adopted From E-Moderating: The Key To Teaching and Learning Online (2nd ed., p. 29) by Gilly Salmon (2004), New York and London: Routledge.

The FRAME Model. Koole (2009) proposes a Framework for the Rational Analysis of Mobile Education (FRAME) to grasp learning that emerges from the convergence of mobile technologies, learning capacities and social interaction. The FRAME model conceives collaborative construction of knowledge in mobile contexts as dependent on the intersection of interactions (between individuals, dyads, groups), and mediaton of conversational technology. Figure 2.9 illustrates the convergence of the three aspects.

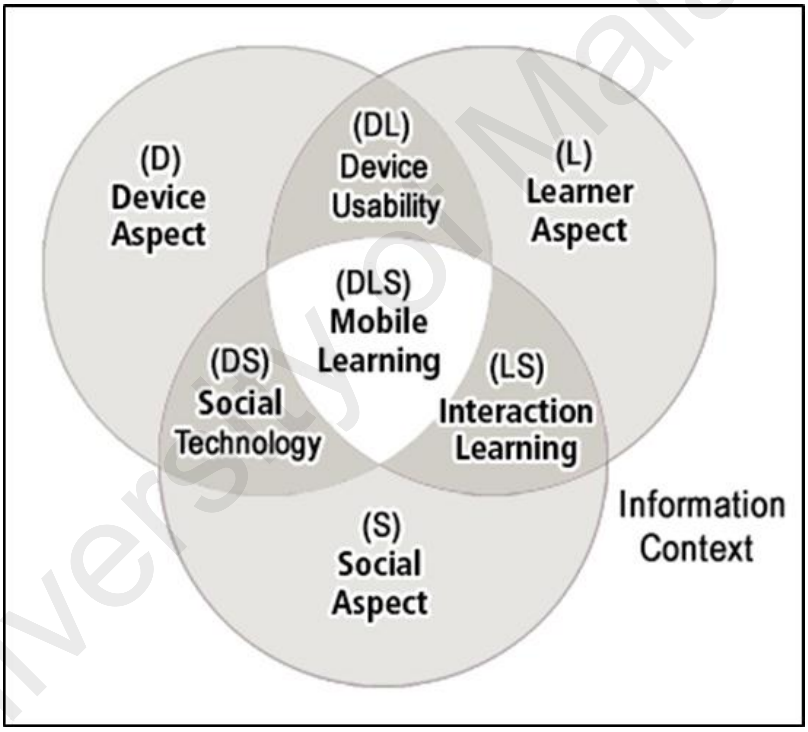


Figure 2.9. The FRAME Model (Koole, 2009, p.27)

As shown in Figure 2.9, the device aspect (D) refers to the physical, technical and functional characteristics of mobile devices, which invariably affect the interface between the mobile learner and the learning task(s). The learner aspect (L) underscores the cognitive abilities, memory, prior knowledge, emotions and possible motivations of the individual learner. It emphasizes understanding how learners use prior knowledge to encode, store and transfer information. Mobile learners in this context bring tacit, peer-based and pedagogical content knowledge and perspectives to their dialogic conversations via networked devices. The social aspect (S) constitutes the seedbed of interaction and cooperation, which enable information exchange, knowledge construction and sustenance of cultural practices.

Koole (2009) suggests that device usability intersection (DL) draws on considerations from both device aspect functionalities and individual/collective individuals' attributes. It foregrounds technology's technical aspects, which impact on users' cognitive demands psychological satisfaction, thus influencing their cognitive load, access to information and ability to traverse different physical and virtual locations.

Social technology intersection (DS) emphasizes devices' capacity to trigger and sustain communication and collaboration among multiple individuals and systems. Device technical capabilities such as short messaging service, telephony and internet access directly influence information exchange and collaboration between people with diverse needs, intentions and priorities. The interaction learning intersection (LS) synthesizes learning and instructional theories and rides on social constructivism philosophy.

The primary intersection of the model is effective mobile learning (DLS), where it results from the integration of the device (D), learner (L), and social (S) aspects. Mobile learning provides enhanced collaboration among learners, access to information, and a deeper contextualization of learning. Effective mobile learning can empower learners by enabling them to better assess and select relevant information, redefine their goals, and reconsider their understanding of concepts within a shifting and growing frame of reference (the information context).

Furthermore, effective mobile learning provides and enhanced cognitive environment in which distance learners can interact with their instructors, their course materials, their physical and virtual enviroments, and with each other.

In the social aspect (S), lecturers and learners must adhere to the rules of engagement and cooperation. With lack of teacher guidance and intervention having a negative effect, instructional decisions have been shown to influence the quality of student-to-student online discussions (Hou, Chang, & Sung, 2007). Even though this shortcoming could be addressed with teacher training both at in-service and pre-service settings, available resources may hamper efforts to introduce teachers to yet another technological innovation.

Conceptual Framework of the Study

This section presents the conceptual framework based on the review of related concept and definitions, mobile instant messaging in education and theoretical framework of the study. The conceptual framework will be elaborated based on three components that are the needs analysis phase, the design and development phase and the evaluation phase. Hence, the conceptual framework of this study consists with the following foundations:

a) The objective of the study.

   Based on the problem statement of the study, the main objective of the study is to develop an interpretive structural pedagogical model of collaborative mobile instant messaging learning for teacher training. This serve to contribute to the body of knowledge as a proposal on how CMIML could be incorporated in the formal classroom to promote active implementation of ICT in teaching and learning process for teacher training.

b) The theories underpinning the variables and how the variables are connected to serve the purpose of the study.

The theories and models underpinning the variables are the Social Constructivist Learning theory (Vygotsky), Scaffolding theory (Bruner), Situated Learning theory (Lave and Wenger), Connectivism theory (Siemens), Salmon Five-Stage Scaffolding Model (Salmon), and the FRAME model (Koole) as theoretical framework for the development of the model.

c) How the variables are positioned in the development process of the model.

The variables are connected to the development process of the model through the theories and models connected to them as shown in the framework according to the phases of the methodology (Design and Development Research approach)

d) The theories and models involve in guiding the development process of the model.

The conceptual framework also included the models and approaches adopted in each phase of the methodology to guide in the development of the pedagogical model. For example, the Unified Theory of Acceptance and Use of Technology (UTAUT) model is adopted to guide in the needs analysis stage of the study. The Nominal Group Technique (NGT) and the Interpretive Structural Modelling (ISM) technique are connected to Phase 2 of the methodology as main tool in development of the model. Finally, the model is evaluated using Fuzzy Delphi method (FDM) as shown in the framework.

e) How the theories, models and development process are connected resulting the end purpose of the study.

This conceptual framework aims to illustrate how the purpose of the study is fulfilled through the connection of the variables, theories, framework, and models to develop the CMIML pedagogical model.

Thus, the conceptual framework of this study is shown in Figure 2.10.

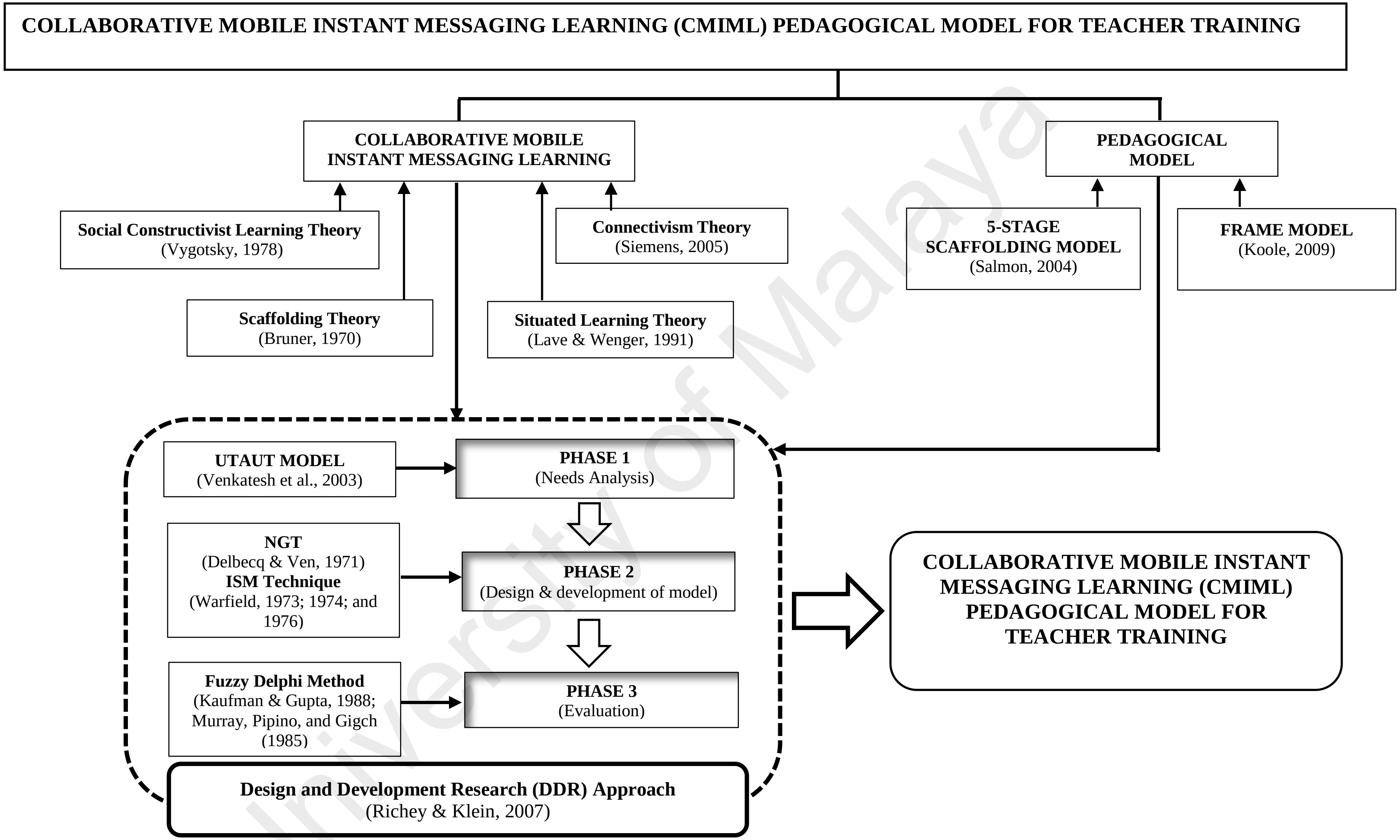


Figure 2.10 Conceptual framework of Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical Model for Teacher Training

Summary

The aim of this chapter is to present the relevant concepts and theories of mobile learning to guide in the development of Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model. The theories are adopted to guide in determining the appropriate pedagogical activities and integrating the activities as elements in developing the model.

The first part of the chapter elaborates the relevant concepts and definitions related to CMIML to provide a better understanding on how it can be incorporated in formal learning. It is then followed by the overview of ICT integration into pedagogy involving teacher training. Then, it continues with the overview of how the pervasiveness of MIM application has found its way into educational settings. The discussion then further proceeds to the theoretical framework of the study involving a few learning theories and models which serves to support the development of the model. In this section, the Social Constructivist Learning theory (Vygotsky), Scaffolding theory (Bruner), Situated Learning theory (Lave and Wenger), Connectivism theory (Siemens), Five-Stage Scaffolding Model (Salmon), and the FRAME model (Koole) were adopted and presented to frame and describe the selection of pedagogical activities as elements in the model. Finally, based on the above discussions, a conceptual framework for the development of CMIML pedagogical model for teacher training is presented in this chapter.

CHAPTER 3

METHODOLOGY

Introduction

This study is carried out to develop the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model for teacher training. The research objectives are divided into three main phases that are the Need Analysis phase, the Design and Development of the model phase, and the Evaluation phase. Based on the focus of the study, the objectives of the study are as follows:

1. To identify the needs for the development of the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model based on lecturers' views.
2. To develop the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model based on experts' opinion and decision.
3. To evaluate the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model based on experts' consensus.

In order to fulfill the research objectives, a systematic research methodology is required to ensure for good findings. Therefore, this chapter describes the methodology and procedures that were applied in the development of the model. Thus, the elaboration of the methodology includes research design, population and sampling, research instruments, procedures for data collection and data analysis according to the phases.

Research Design

This research is known as a development study as it employs the design and development research (DDR) approach to develop the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model. It is a research approach introduced by Richey and Klein (2007) where this design and development research method was shaped by a combination of the foundational research and theories of many disciplines as well as theory particularly related to instructional design and development.

Design and development research can be categorized into two forms (Norlidah Alias, Saedah Siraj, Mohd Nazri Abdul Rahman, & DeWitt, D., 2013; Richey & Klein, 2007):

1. Product development studies or a specific program of design development, and evaluation. The findings in the lessons learned from the use of a particular product or program and situation analysis supports the conclusion that its use to specific contexts.
2. Study design process, development or evaluation process, equipment or model. The findings of this study will produce procedures and or model design, development and evaluation of new and situations that support the use of general conclusions.

There are multiple research methodologies and designs frequently used in the various types and phases in the two general types of development research. In Type 1 studies critical design and development processes are oftern explicated using case study methods. Interviews, observations, and document analysis are techniques used to gather the case study data and to document the processes used and the conditions under which they are employed as well. In Type 2 research models of the full design and development process, or of a particular part of the process, are constructed in a variety of ways, including the following:

1. By conducting surveys of designers and developers with regard to projects in which they have been involved,
2. By synthesizing models from the literature,
3. By arriving at a consensus of opinion of respects experts in the field using Delphi techniques,
4. By conducting experiments to validate particular design dan development models.

Table 3.1 presents a summary of those research methodologies and designs frequently being utilized and multiple types of persons commonly participate according to phases conducted in developmental research.

Table 3.1

Common Participants and Research Method Employed in Developmental Research Studies.

Developmental Research	**Function/Phase**	**Type of Participants**	**Research Methodologies Employed**
Type 1	Product design & development	Designers, Developers, Clients	Case study, In-depth interview, Field observation, Document analysis
	Product evaluation	Evaluators, Clients, Learners, Instructors, Organizations	Evaluation, Case study, Survey, In-depth interview, Document analysis
	Validation of tools or technique	Designers, Developers, Evaluators, Users	Evaluation, Experimental, Expert review, In-depth interview, Survey
Type 2	Model development	Designers, Developers, Evaluators, Researchers, Theorists	Literaturer review, Case study, Survey, Delphi, Think-aloud protocols
	Model use	Designers, Developers, Evaluators, Clients	Survey, In-depth interview, Case study, Field observation, Document analysis
	Model validation	Designers, Developers, Evaluators, Clients, Learners, Instructors, Organizations	Experimental, In-depth interview, Expert review, Replication

Adapted from *Developmental Research: Studies of Instructional Design and Development,* by Richey, Klein, & Nelson (2004).

According to Richey and Klein (2007), the procedure used in this research method shows its ability to develop new procedures, techniques, and tools based on identified needs analysis. This rationalizes the use of this method for this study as it satisfies the aim to develop CMIML Pedagogical model. Thus, this study was conducted in three phases which are the Needs Analysis phase, the Design and Development phase and the Evaluation phase as illustrated in Figure 3.1. Below are the elaborations for the three phases in developing the model.

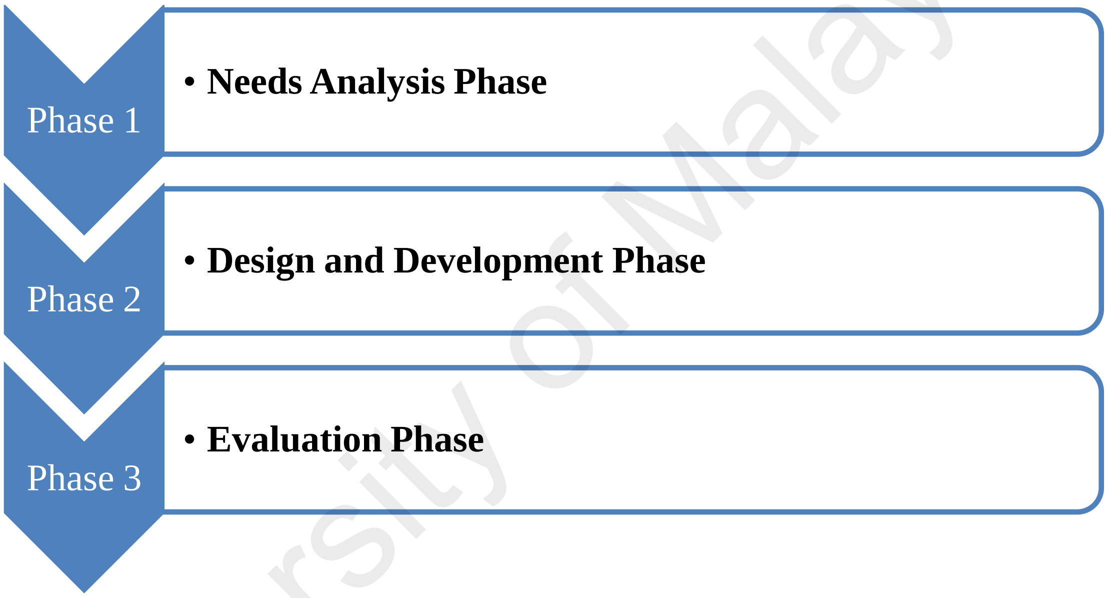


Figure 3.1 Phases in Design and Development Research (DDR).

Phase 1: Needs Analysis

The section elaborates on the research methodology of the Need Analysis phase according to research design, population and sampling, instruments, data collection procedures, data analysis and flowchart of the procedures involved.

Research Design. This phase is known as the needs analysis phase that aimed at identifying the needs to develop the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model. This needs analysis is conducted to assess the needs to develop the model based on lecturers' views. McKillip (1987) defined needs analysis as a tool for decision making in the human services and education. On the other hand, Witkin (1997) described needs analysis as a method to identify the gap between the current situation and targeted situation. According to McKillip (1987), needs is a judgement value that a specific group has a problem, which can be solved. Thus, this phase aimed at investigating existing issues and the needs to develop the CMIML pedagogical model based on the lecturers' views.

The phase employs quantitative aspects with the aim of deriving the best possible findings at the end of the research. It will be conducted via survey technique using a set of questionnaires in order to solicit their needs for CMIML. Thus, the questionnaires were designed to answer the following research questions:

1. What are the lecturers' perceptions on their current ways of teaching and learning?
2. What are the lecturers' perceptions on implementing ICT in teaching and learning?
3. What are the lecturers' access to mobile devices and the capability level of the devices?
4. What are the lecturers' level of acceptance and intention to use collaborative mobile instant messaging learning if incorporated into the formal course?

Hence, the nature of this design is seen well suited to be employed in completing the needs analysis phase. Thus, the overall findings justify the development of the model for this study.

Population and sampling. This phase involves 268 lecturers in Institute of Teacher Education campus in central zone to participate in answering the survey questionnaire. The sample size is selected according to Krejcie and Morgan (1970) from the whole population of 833 lecturers at the Institute of Teacher Education in the central zone.

The location of the study which is the lnstitute of Teacher Education in the central zone was based on the view of Sabitha (2005) that the selection of a location was due to the population in which it fulfilled the requirements of the study. Besides, according to Marshall and Rossman (2014), researcher can determine the location of a study based on a location that is easily accessible by researchers and a rich environment with the relevant events or related to the study patterns. In fact, Bogdan and Biklen (2007) argues that researchers have their own reasons to determine the location of the study based on their own views.

Thus, these five campuses in central zone have been chosen as the campuses are easily accessible due to their locations are around Klang valley. Other than that, the campuses offers the education training for all the major subjects being taught in primary schools such as Malay Language, English Language, Mathematics, Science and Islamic education. These major subjects are the subjects that normally being conducted with the help of ICT during teaching and learning. Therefore, the need to instill and increase the capacity and skills in the use of ICT especially among the major subjects' teachers need to be done since college courses.

Other than that, it depends on the criteria of lecturers with at least 1 year experience using ICT in teaching and learning, and lecturers who are willing to participate in the study. Table 3.2 shows the population and sampling according to five campuses.

Table 3.2

Population and Sampling

No.	Campus	Population (No. of lecturers)	Sample
1	Institute of Teacher Education A	246	75
2	Institute of Teacher Education B	126	38
3	Institute of Teacher Education C	120	36
4	Institute of Teacher Education D	187	57
5	Institute of Teacher Education E	204	62
	Total	**883**	**268**

Instruments. The instrument used for this phase is a set of needs analysis survey questionnaire (refer to Appendix J). The items for the survey questionnaire is constructed based on the Unified Theory of Acceptance and Use of Technology (UTAUT), a technology acceptance theory proposed by Venkatesh, Morris, Davis, and Davis (2003). UTAUT explains user intentions to use an information system (IS) and subsequent usage behaviour. This theory explains the four main constructs Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating conditions as determinants directly about the intention to use behavior and as shown in Figure 3.2.

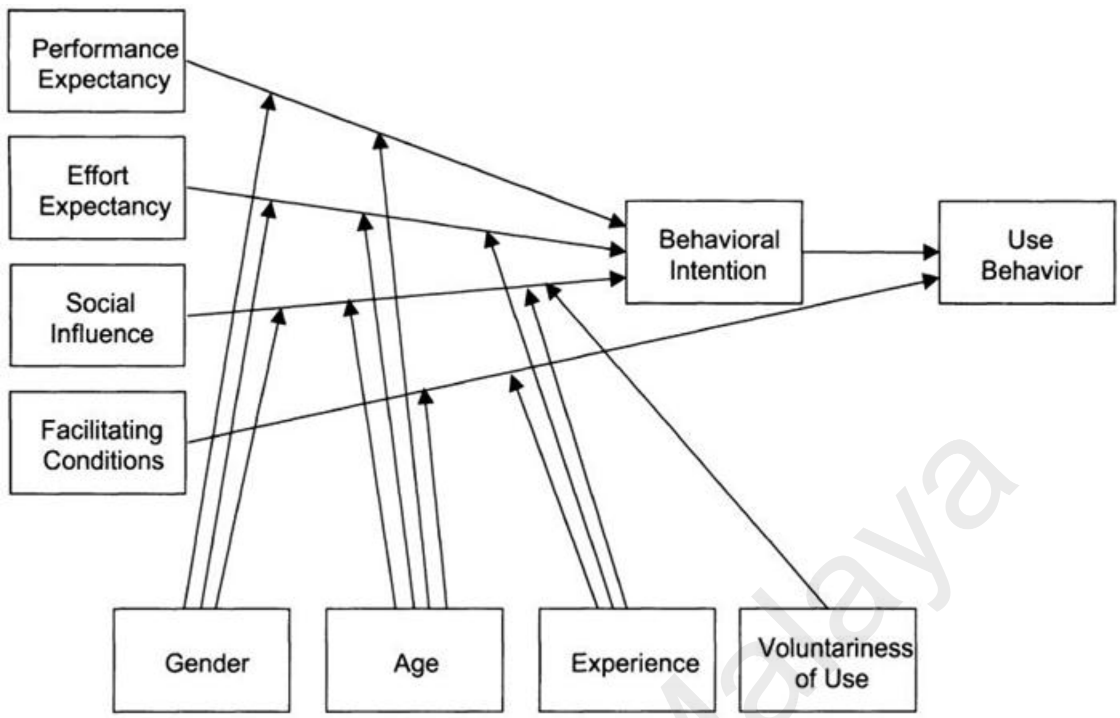


Figure 3.2 Unified Theory of Acceptance of Use of Technology (UTAUT) Model. Adapted from "Venkatesh et al., 2003"

Based on these major keys, questionnaire items are divided into eight expectations, namely:

1. Performance Expectancy - In this study, the expected performance is the level of confidence of lecturers that use mobile technology to help them improve their performance in teaching. The use of mobile devices is expected to help lecturers access to teaching materials and communicate directly with students. Mobile devices are also expected to open up opportunities for virtual classrooms, online discussions and download teaching materials (Venkatesh et al., 2003).

2. Effort Expectancy - Effort expectancy refers to the degree of ease in using technology. It is a powerful determinant and directly to individual behavior on the actual use of the system or the intent to use the system (Venkatesh et al., 2003).

3. Social Influence - Social influence is the level at which an individual believes how important others believe he or she should use technology in teaching. Social influence is a direct determinant of behavioral intention. In the context of this study, the effect of social influence is important for the lecturers to use mobile devices in teaching.

4. Facilitating Conditions - Facilities condition is a situation in which lecturers believe the organizational and technical infrastructure exists to support the use of a system or mobile learning (Venkatesh et al., 2003).

5. Behavioral Intention - In this study, behavioral intention refers to a strong desire to use applications and mobile learning technology in the teaching process. The questionnaires will indicate the length of time the lecturer intends to implement mobile learning or mobile instant messaging application in teaching and learning process.

6. Attitude towards mobile learning - can be defined as teachers respond positively and affective in using mobile learning (Venkatesh et al., 2003). In this study, the questionnaires are designed to elicit lecturers' attitude toward

using mobile learning or mobile instant messaging application in teaching and learning process.

7. Self-efficacy - Self-efficacy refers to individual perceptions about his or her own ability and the skills to use mobile learning or mobile instant messaging application.

8. Anxiety - Anxiety refers to lecturers' concerns about the uncertainty about what is expected of them in using mobile learning or mobile instant messaging application in formal learning.

The survey questionnaire was also constructed based on the study conducted by Muhammad Ridhuan Tony Lim (2014) and was amended to suit the need of this study. It consisted of 46 questions and divided into five sections as shown in Table 3.3.

Table 3.3

Elaboration of questionnaires

Section	No. of items
A) Lecturers' demographic details	3
B) Lecturers' perception on current teaching	5
C) Lecturers' perception on implementing ICT in teaching	5
D) Lecturers' mobile device capabilities	4
E) Lecturers' acceptance and attention to use CMIML	29
Total	46

In order to investigate lecturers' perception on the current teaching and implementing ICT in teaching and also lecturers' acceptance and attention to use CMIML, lecturers were tested using a 5-point Likert scale as follows:

1 – Strongly Disagree

2 – Disagree

3 – Neutral

4 – Agree

5 – Strongly Disagree

Pilot Test. A pilot study is the best method to determine the adequacy of the study because it is able to solve a problem before the field study was conducted. This allowed the researchers to overcome any negative risks, the questionnaire structure and grammar errors can be reduced and researchers able to gain meaningful experience (Fraenkel & Wallen, 2006; Gay & Airasian, 2000; Leedy & Ormrod, 2001). Therefore, a pilot study should be conducted on all instruments that will be used in the actual study.

Thus, a pilot test was conducted on 30 lecturers from Institute of Teacher Education in central zone using the instrument to improve the questionnaire items. According to Hill (1998) and Issac and Michael (1995), the sample size of pilot test is 10 to 30 participants in a survey research. Furthermore, the total sample of 30 and above is an appropriate amount to apply statistical analysis (Cohen, Manion, & Morrison, 2007). Thus, 30 respondents involved in the survey are adequate to conduct a pilot study. Hence, the reliability test was conducted on the survey questionnaire for all items, which indicate a Cronbach's Alpha coefficient of .852 as shown in Table 3.4. The Cronbach's Alpha coefficient corresponds to the views of

George and Mallery (2003) which states that the value of reliability coefficient greater than 0.8 is evaluated as good. They provided the following rules of thumb: "_ > .9 – Excellent, _ > .8 – Good, _ > .7 – Acceptable, _ > .6 – Questionable, _ > .5 – Poor, and _ < .5 – Unacceptable".

Table 3.4

Reliability Testing of Needs Analysis Questionnaire

N of Items	Cronbach's Alpha
46	.852

Data collection procedures. This needs analysis was conducted with the aims at investigating existing issues and the needs to develop the CMIML Pedagogical model based on the lecturers' views. The model could serve as a practical guide on how CMIML could promote active implementation of ICT in teaching and learning and further complement the current way of their teaching. This is due to many challenges were encountered in relation to the governance of ICT in teaching and learning process (Embi, 2011a). Hosseini and Kamal (2013) indicated that in spite of attempts by teacher educational programs, the participants showed deficiency in knowledge of using technology for instructional purposes. Although teacher education programs are making strides to prepare teachers for using technology in their teaching, their progress still seems slow for equipping teachers with the special knowledge of how to effectively use technology in their teaching (Hosseini & Kamal, 2013).

Hence, the effort to instill and increase the capacity and skills in the use of ICT among teachers needs to be done since college courses to form a positive attitude towards the use of ICT in teaching and learning (Rahmad Sukor et al., 2008). Through exposure and together with structured and organized education program courses, they will also be able to ensure the use of ICT as a tool in the learning process.

Thus, the needs analysis survey was conducted not only to investigate the issues encountered but to explore the need to develop CMIML as a strategic plan to promote active implementation of ICT in teaching and learning. It was conducted via survey technique using a set of questionnaires in order to solicit the lecturers' needs for CMIML. The survey questionnaires had been distributed among the lecturers in Institute of Teacher Education in central zone which involved five campuses. Hence, the findings are anticipated to justify the development of the model for this study.

Data analysis. The data from the questionnaires were analyzed using Statistical Package for Social Science (SPSS) version 22 software. The data comprised of descriptive statistics with the analysis of mean, standard deviation, percentage and frequency to determine the needs of CMIML pedagogical model based on lecturers' view. It suited the purpose of analyzing the perception of lecturers on the implementation of ICT in teaching and learning and also to identify the level of acceptance of the lecturer if the MIM is used in teaching and learning. In order to analyze that, the level of measurement as shown in Table 3.5 were used as referred to Pallant (2007).

Table 3.5

Interpretation of Mean

Mean	**Interpretation (Level)**
0.0 to 1.66	Low
1.67 to 3.33	Moderate
3.34 to 5.00	High

Flowchart of Needs Analysis phase

In order to obtain the data in the Needs Analysis phase, the survey instruments were used. Analysis of the findings of this phase is the input to justify the need to develop the CMIML pedagogical model in the next phase which is the Design and Development phase. Hence, Figure 3.3 shows the activities conducted in this Needs Analysis phase.

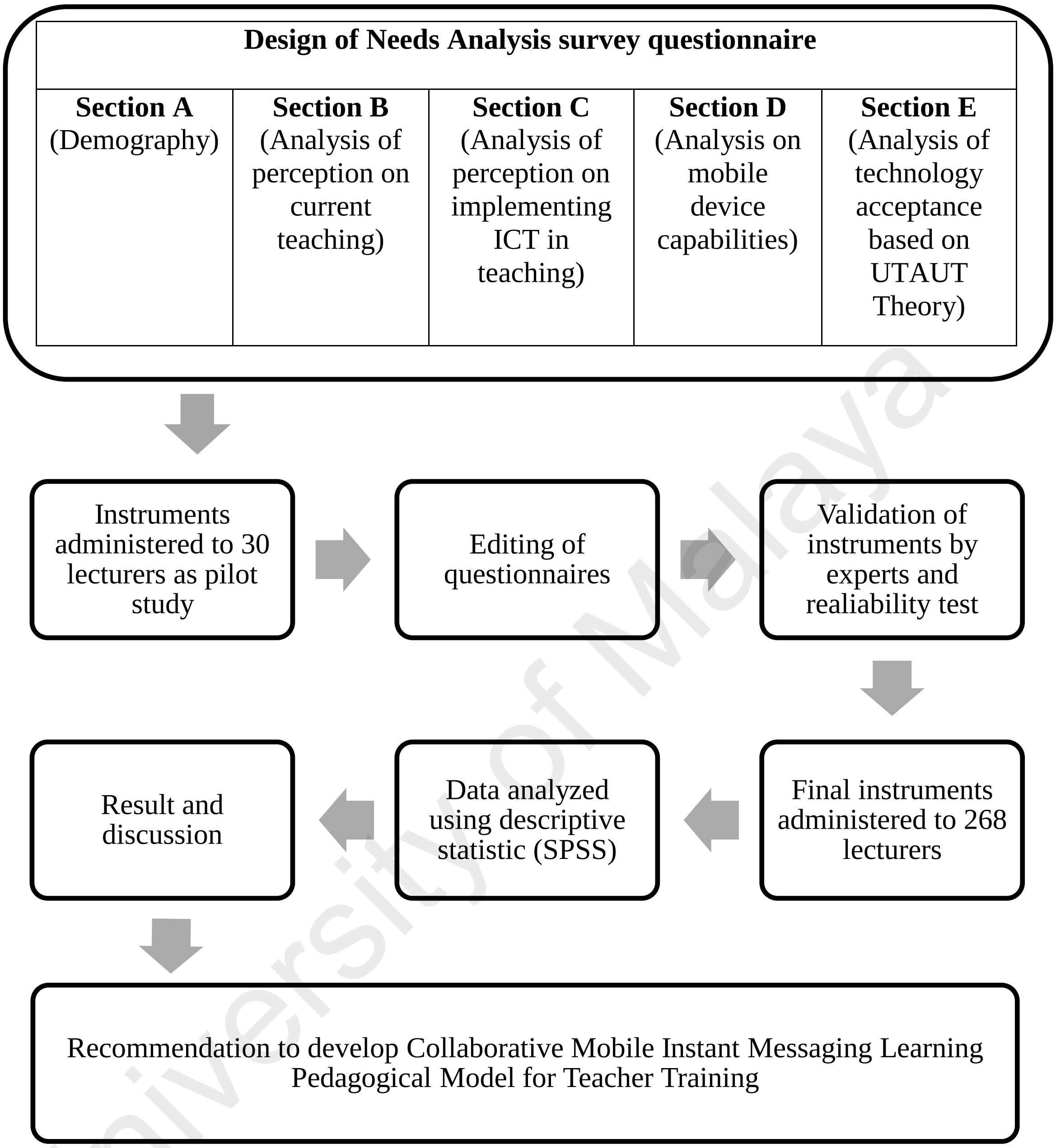


Figure 3.3 Flowchart of Needs Analysis Phase

Phase 2: Development of Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical Model for Teacher Training

The section elaborates on the research methodology of the Design and development phase according to research design, population and sampling, instruments, data collection procedures, data analysis and flowchart of the procedures involved.

Research Design. This phase is where the intended model is developed based on the integrated views and opinions of panel of selected experts. Thus, the views and opinions from the experts are obtained focusing on answering the following research questions:

1. What are the experts' collective views on the pedagogical activities, which should be included in the development of the Collaborative Mobile Instant Messaging Learning pedagogical model?
2. What are the relationships among the pedagogical activities in the development of the Collaborative Mobile Instant Messaging Learning pedagogical model based on the experts' collective views?
3. How is the structural pedagogical model of Collaborative Mobile Instant Messaging Learning based on the experts' collective views?
4. How should the pedagogical activities be classified in the interpretation of the Collaborative Mobile Instant Messaging Learning pedagogical model based on the experts' collective views?

The experts' contributions and involvement were obtained to assist in the development of the model for this study through the interview, the Nominal Group

Technique (NGT) session and Interpretive Structural Modelling (ISM) session. The interview session was conducted due to its nature that allows the researcher to discover something from the experience of the participants (Corbin & Strauss, 2008). Through the interview sessions and review of literatures, a list of initial pedagogical activities was identified. The list was then being reviewed in the NGT session.

Nominal Group Technique (NGT). Nominal Group Technique (NGT) was employed to identify the elements in this step. It is a group process involving problem identification, solution generation, and decision making. This technique was originally developed by Delbecq, Ven and Gustafson (1975) and has been employed as a useful technique in curriculum design and evaluation in educational institutions (Chapple & Murphy, 1996; Lloyd-Jones, Fowell, & Bligh, 1999; O'Neil & Jackson, 1983). It is a well-known method to generate ideas or variables linking to an issue, problem, or situation.

Nominal Group Technique is a method for a small group to generate, clarify, and prioritize a large number of ideas in a relatively short period of time. This technique helps to reduce the influence of dominant group members (based on status or personality) and allows everyone to participate equally in the idea generation and selection processes. Although this technique is generally used with smaller groups of 6 to 12 people, it can be modified for a larger group by dividing it into subgroups (C. M. Moore, 1994).

Nominal Group Technique, or a variation of it, is frequently used to generate and rank the list of ideas for structuring with ISM. The basic steps for applying NGT (Janes, 1988; C. M. Moore, 1994) are as follows:

1. Clarification of the trigger question to focus idea generation. The group leader or facilitator usually develops the trigger question prior to the NGT session. It is read at the start of the session to help the group to create the type of ideas that would be most beneficial to the issue at hand.
2. Silent generation of ideas in writing by each member of the group (4 – 10 minutes). This reflective period gives everyone a chance to clarify their thoughts and quickly put them on paper so they will be remembered. This activity is kept short so that the participants do not get a chance to filter the ideas, causing them to abandon ideas prematurely.
3. Round-robin recording of ideas on flipchart or board (15 – 25 minutes). The purpose of this step is to collect all ideas generated by the group. Each idea should be presented as simply as possible. Each member decides if any of his ideas has already been presented.
4. Brief discussion and clarification of ideas (2 to 3 minutes per idea or less depending on time available). The purpose of this step is to clarify the meaning of the ideas. Although a brief mention of an idea's merits may be permitted, prolonged discussion about its advantages or disadvantages is not recommended.
5. Voting to rank the ideas by importance (15 minutes). Usually, NGT will produce more ideas than can possibly be used. It is necessary to select the best ideas from this large group for further evaluation.

The final result of NGT is a list of ideas ranked in order of importance to the group. Sometimes the topmost idea or ideas are chosen for implementation. When NGT is used to generate ideas for ISM, the ranking information is important because usually there is insufficient time to structure all of the ideas generated. The ranking information allows efficient use of time by ensuring that the most important ideas are structured first. In addition, it is not unusual for ideas to be ranked several times using different criteria. For example, to select ideas that require further research, the ideas are first ranked by importance and then by lack of knowledge. The ideas selected for research would be both important and have lack of knowledge. For a budgeting process, ideas may be ranked by importance and by financial impact. For scenario planning, the ideas may be ranked first by importance, then by lack of knowledge (to select ideas for research) and then by level of uncertainty.

Thus, NGT was employed in this phase as this method can offer additional ideas on the activities that are deemed fit for the development of the model.

Interpretive Structural Modelling (ISM). Interpretive Structural Modelling (ISM) was first proposed by Warfield (1974). This method is to analyze a complex socioeconomic system. However, this approach has been increasingly used by various researchers since it is a well-established methodology to represent the interrelationships among various elements related to an issue (Attri, Dev, & Sharma, 2013). Other than that, ISM is defined as a management decision-making tool that interconnects ideas of individuals or groups to facilitate thorough understanding of a complex situation using a map of relationships between many elements involved in the complex decision situation (Charan, Shankar & Baisya, 2008). According to Warfield (1974), it is an interactive learning process where a set of different directly and indirectly related elements are structured into a comprehensive systematic model.

ISM uses pair-wise analyses of ideas to transform a complex issue, involving a lot of ideas, into a structured relationship model that is easier to understand. This model is then used to develop ideas and solutions to the problem at hand. ISM organizes many elements of a complex issue, thus synthesizing a model which makes the situation understandable and logical. Figure 3.4 illustrates the fundamental steps on how to use ISM effectively.

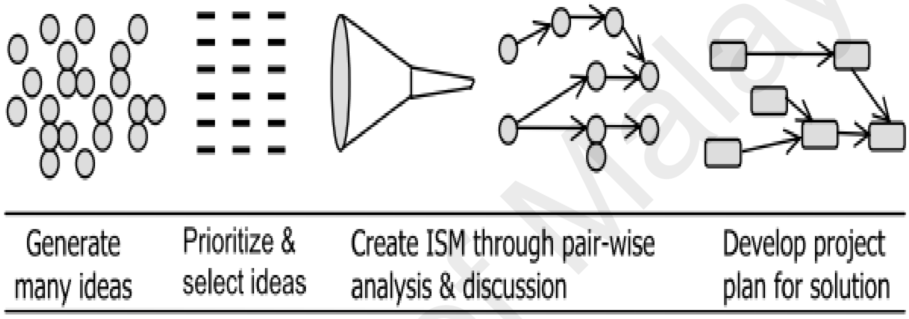


Figure 3.4 Fundamental Steps to Construct an Effective ISM.

Adapted from *Structured Decision Making with Interpretive Structural Modeling (ISM)* (p. 3), 1999, Canada: Sorach Inc.

ISM is a learning process that is guided by computer to allow individuals or groups to develop a model or map the relationship between the elements involved in a complex issue. The use of this methodology include the ISM for the dismantling of a complex system into several subsystems using practical experience and expert knowledge to build the structure Hierarchical Model (Multiple Structural Model). In addition, ISM can also be used to identify and analyze the relationship between certain variables to define a problem or issue that is complex (Janes, 1988; Sage, 1977; Warfield, 1974; Warfield & Jr, 1999). In other words, ISM will produce a directed graph (Diagraph) to describe the relationship between elements, and the next element structuring complex issues in Hierarchical Structure Model (Porter et al., 1980).

Three main steps involved in applying the ISM (Hansen, McKell & Heitger, 1979) are:

Step 1	:	Identify the issue or complex problem
Step 2	:	Identify and list the elements involved in the issue or problem
Step 3	:	The elements identified will be matched through a graphic representation or a relationship matrix that forms the ISM hierarchical structure model.

In the field of manufacturing and the construction industry, ISM methodology has been applied to solve issues related to cost savings and operational. Kannan and Haq (2007) applied the ISM methodology to analyze the interaction between criteria and sub criteria influencing the choice of supplier 'built-to-order' in the vicinity of the supply chain industry. Singh and Khamba (2011) applied the ISM methodology to identify obstacles in the implementation of Advanced Manufacturing Technology and further develop the relationship model between the structures of obstacles to achieve success manufacturing sector.

ISM methodology is also widely used in the fields of management and administrative organization. Haleem, Sushil and Qadri (2012) applied ISM methodology to analyze the main factors behind the successful implementation of world-class manufacturing practices, and further develop the structure Hierarchical Model. Mohd Nishat Faisal (2010) used the ISM to identify obstacles to social responsibility (Corporate Social Responsibility) in the vicinity of the supply chain and further develop Hierarchical Structure Model in Qatar. Dorothy DeWitt, Saedah

Siraj, Mohd Nazri Abdul Rahman, Zaharah Hussin and Norlidah Alias (2013) have applied ISM to identify the implications of homeschooling for the management of teacher education services in Malaysia.

In addition, the ISM methodology was applied in the field of design, marketing and business. Chen (2012) has applied the ISM methodology in developing design solutions razors based product in the market through customer preference criteria. Salimifard, K., Abbaszadeh, M. A., & Ghorbanpur, A. (2010) also applied the ISM methodology in order to understand and identify the key elements for the successful implementation of the Banking Process Re-engineering project in Iran. Liu and Gorvett (2006) applied the ISM to build hierarchical structure model and illustrated the correlation between the risks of the firm. M. Singh and Kant (2008) used the ISM to develop relations between the knowledge management obstacles identified in the areas of business and develop hierarchical structure model to reflect those obstacles.

Application of ISM methodology in education field is becoming an emerging trend. Georgakopoulos (2009) has applied the ISM methodology to investigate the effectiveness of the teacher as a multi-dimensional and holistic phenomenon. Sahney, Banwet and Karunes (2006) applied the ISM methodology to identify the characteristics set or quality component that can meet the needs of students as key customers in quality education system. Upadhyay, Gaur and Agrawal (2007) used the ISM methodology to identify the parameters that affect the quality of engineering education system and to develop an integrated model and hierarchical structuring concept maps related to the quality of engineering education. Rohani Abd. Aziz, Mohd Nazri Abdul Rahman, Roslina Ibrahim, Saedah Siraj and Norlidah Alias (2012) used the ISM methodology for identifying the elements of assessment and evaluation that are required in a high school textbook. The ISM methodology was also used to develop a model of Homeschooling Based on Technology in Malaysia (Norlidah Alias, Mohd Nazri Abdul Rahman, Saedah Siraj & Ruslina Ibrahim, 2013). Mohd Nazri Abdul Rahman, (2014) also continued to develop a model of homeschooling based on values and practices of indigenous children using ISM methodology. Whereas, Muhammad Ridhuan Tony Lim Abdullah (2014) has developed an activity-based mLearning Implementation model for undergraduate English language learning using the ISM methodology.

However, most of the studies in the field of education that uses ISM have yet to be applied to the maximum level. Therefore, as a powerful decision-making tool, ISM is capable to be exploited to achieve effective and practical solutions to the issue of education. For example, the ISM can be used to identify issues in school assessment, based on collective and integrative views of policy makers and implementers as well as the target group in school and not forgetting the views of parents. Based on the result, more effective solutions to target the cause of the problem. ISM can also be used to develop innovation in the diversification of teaching methods. This study is an example of an application in developing innovation where it offers a guideline to implement mobile instant messaging application into formal teaching. Thus, ISM is employed in this study to develop a Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model for teacher training to improve the delivery of teaching and learning methods towards more efficient use of ICT.

ISM can be used in combination with other methods in research studies such as nominal group technique (Delbecq et al., 1975), Delphi technique (Dalkey, 1972), focus group interview (Krueger & Casey, 2001), and others. Thus, in this study, Nominal Group Technique (NGT) was used to generate the elements to be discussed by experts in the ISM session.

Population and sampling. The participants in the design and development phase involved a number of experts who have been carefully selected. Since this phase was conducted in a few stages, the number of experts involved was different in each stage. The experts were required to generate ideas and contributed their views and opinions in the interview session, during Nominal Group Technique (NGT) and finally, in the Interpretive Structural Modelling (ISM) session.

During the interview session a number of three experts were selected to identify the initial pedagogical activities as the elements in the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model. According to Merriam (2009), the sample size for purposeful sampling is determined by informational consideration. No additional sample is needed in situation where the date has reached the saturation level if the purpose is to maximize information. Nevertherless, Creswell (2007) cites Dukes (1984), has suggested three to 10 subjects in the phenomenology study in order to reach a satisfied level of information.

Since the output of the study is based on experts' opinion, a correct selection of experts is vital for the success of the study (Parente et al., 2005; Skulmoski, Hartman, & Krahn, 2007). Thus, for the requirement of this study, 3 lecturers were chosen during the interview session with the following criteria:

i. Lecturer should possess a Masters degree in education or information technology with at least 10 years' experience in teaching instructional technology subjects;

ii. Lecturer of instructional technology department with knowledge in curriculum and curriculum implementation; and
iii. Lecturer in information technology or instructional technology who are willing to participate in the study.

The participants for the next two sessions which are Nominal Group Technique (NGT) and Interpretive Structural Modelling (ISM) were the same panel of experts. This is due to the same experts were needed in both sessions where the sessions took place continuously with NGT sessions was conducted first and then followed by the ISM session. According to Adler and Ziglio (1996), the selection of experts should be based on four ‘expertise’ requirements: 1) knowledge and experience with the issue under investigation; 2) capacity and willingness to participate; 3) sufficient time to participate in the study; and, 4) effective communication skills. Based on the above experts’ criteria of selection, the selection of the participants depends on four criteria:

i. Experts should possess a masters or doctorate degree in education or information technology with at least 10 years’ experience in teaching in the subject matter;
ii. Experts should have knowledge in curriculum and curriculum implementation;
iii. Experts should have at least 3 years experiences in implementing collaborative learning;
iv. Experts in information technology or instructional technology who are willing to participate in the study; or

v. Experts in mobile learning or Instant Messaging learning who should at least involve in conference paper presentations; researchers in mobile learning or Instant Messaging Learning especially those who have journal publication in mobile learning or Instant Messaging learning related field, and mobile learning or Instant Messaging learning project implementers, or involved in such projects.

Another important consideration is the number of experts involved in NGT and ISM sessions. It plays an important role as the quality and diversity of opinion are required and thus, it is generally comprises of five to nine members for NGT (Deip, Thesen, Motiwalla & Seshardi, 1977). According to Moore (1994), this technique is commonly used with smaller groups consists of six (6) to 12 people. However, in ISM session, Janes (1988) limited the numbers of experts to the maximum of eight (8) participants. Since every individual experts has to interact with every other expert in the panel, the quality of debates will be at stake with the increase in group size (Janes, 1988). Furthermore, large groups produce more interpersonal differences, which lengthens the process without a substantial increase in the quality of output (Deip et al., 1977).

Thus, the selected experts for both NGT and ISM sessions for this study comprised of 10 participants based on the criteria mentioned above. The list of experts involved is summarized in Table 3.6.

Table 3.6

Experts for NGT and ISM sessions

Experts	Highest Academic Qualification	Field	Working experience
E1	Doctor of Philosophy (PhD)	Instructional Technology, E-Learning and Mobile Learning	15 years
E2	Doctor of Philosophy (PhD)	Curriculum and Instructional Technology, ICT	10 years
E3	Doctor of Philosophy (PhD)	Curriculum and Instructional Technology	12 years
E4	Doctor of Philosophy (PhD)	Educational Technology, E-Learning, Online collaborative Learning	15 years
E5	Doctor of Philosophy (PhD)	Educational Technology, Learning Management System (LMS), ICT	18 years
E6	Doctor of Philosophy (PhD)	Educational Technology, ICT	12 years
E7	Doctor of Philosophy (PhD)	Educational Technology, System Management	20 years
E8	Doctor of Philosophy (PhD)	E-Learning, Information Science	18 years
E9	Masters	Educational Technology, Learning Management System (LMS)	15 years
E10	Masters	Curriculum and instructional technology, E-Learning, Mobile Learning	15 years

Instruments. Two instruments were employed in this phase. First, a draft or pre-listed pedagogical activities for collaborative mobile instant messaging learning (refer to Appendix K) generated from literature review was used in the first step of phase 2 during the interview and NGT session. This list served as a guide for the experts to identify the appropriate pedagogical activities for inclusion in the model.

The second instrument was the interpretive structural modelling software developed by Sorach Incorporation called Concept Star. The software was used to facilitate discussion and decision making among experts in a closed session to determine the relationships of the pedagogical activities that were loaded into the software (Muhammad Ridhuan Tony Lim Abdullah, 2014).

Data Analysis Procedures. In this phase, the NGT was used together with the ISM technique since both techniques are comparable (Georgakopoulos, 2009). Even though ISM can be conducted with the aid of computer software (unlike NGT), according to Muhammad Ridhuan Tony Lim Abdullah (2014), both NGT and ISM techniques complement each other. Among the previous studies that had employed the integration of these two techniques was Muhammad Ridhuan Tony Lim Abdullah (2014), who had conducted research on mobile learning activities for undergraduate English Language Learning. In addition, Mohd Paris Salleh (2015) also employed a combination of both techniques NGT and ISM in his study on the mobile learning based on inquiry methods for secondary level History subject.

Therefore, the procedure of data analysis in this phase involved eight (8) steps in developing an interpretive Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model as described in the following:

Step 1: Identifying the elements that are relevant to the problem or issues

NGT technique was employed in this study as it is a well-known method to generate ideas or variables linking to an issue, problem, or situation. According to Broome and Cromer (1991), there are five (5) standard steps in classic NGT, which has been described as follows:

1) A query in a form of question is presented to a group of people to initiate interest in the situation being studied;
2) Ideas are generated as individuals;
3) The ideas are then displayed to be shared with others in the group;
4) Familiarization of ideas trhough discussion and clarification of each item among the individuals in the group; and
5) Voting procedure where the participants select the most relevant items.

Unlike the classic NGT that involves iterative and time-consuming process, this study modified the NGT session to shorter process where it began with a survey of pre-listed pedagogical activities. This list guides the experts with a starting point of ideas to begin with as well as offers the scope of the study.

Thus, this phase began with a short survey of pre-listed CMIML pedagogical activities obtained from interview session. In response to the survey during the Nominal Group Technique (NGT) session, experts could agree or disagree with the list. The experts could then presented additional ideas on the activities that were deemed fit for the model. Each pedagogical activity was presented, familiarized, and clarified to allow the experts to make appropriate judgment on whether to include the activity in the final list (Broome & Cromer, 1991). In the final stage of NGT, the final list was given to the experts individually for them to vote for suitable pedagogical activities by giving a ranking number for every activity. The ranking used was in the scale of one (1) to seven (7) and the interpretation of the scale is as follows; 1 = 'Least favorable', 2 = 'Slightly favorable', 3 = 'Moderately favorable', 4 = 'Favorable', 5 = 'Very favorable', 6 = 'Highly favorable', and 7 = 'Most favorable'. The ranking numbers given by the experts were accumulated to give the priority values for the pedagogical activities. Finally, the pedagogical activities were prioritized based on the total ranking number. Pedagogical activity with the highest number would be the most priority activity in the list. The flowchart for the NGT session is summarized in Figure 3.5.

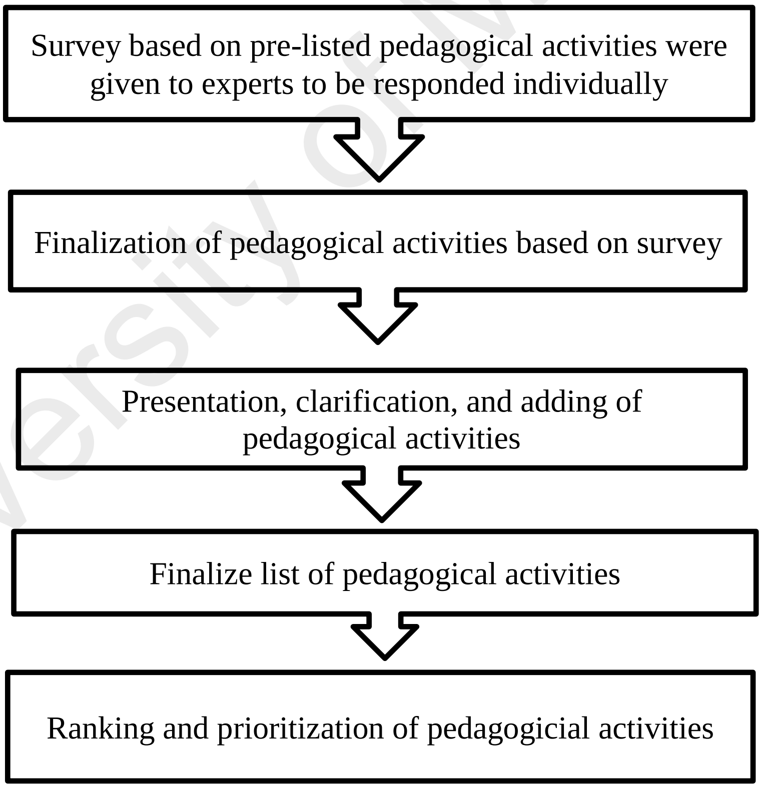


Figure 3.5 Flowchart of Nominal Group Technique (NGT) Session

Step 2: Determine the contextual relationship and relation phrase

This step is conducted to determine the contextual relationship and relation phrase with respect to how the pedagogical activities (elements) should be connected with each other. The contextual relationship phrase is used to guide the discussion and decision-making process. It defines what is to be accomplished and sets boundary conditions for the problem solving or planning activity. It is displayed during construction of the ISM to guide the discussion and decision making by keeping the participants (experts) focused on the problem. The relation phrase is used to structure the idea where it determines how the relationships between ideas are analyzed during construction of the ISM. It specifies the meaning of the links between ideas in the completed model, and thus, the interpretation of the ISM. For group ISM sessions, the facilitator is generally the best person to select the relation phrase because he understands the ISM process and is familiar with the problem and the goals for solving it. However, the facilitator could ask the opinions from the panel of experts for the contextual relationship and relation phrase before starting the voting process.

Step 3: Develop a Structural Self-interaction Matrix (SSIM)

The SSIM of the pedagogical activities was developed to show the connection among the elements. In this study, the SSIM was developed with the aid of ISM software. Pairs of elements were displayed by the software to allow the experts to decide through voting on the relationship before the next pair of elements was displayed. This process was repeated until all the elements were paired.

Step 4: Generate the ISM model

The software generated the model after all the pairings of elements were successfully conducted. It generates the model based on the concept of pair wise comparison and transitive logic. Transitive logic states that for any 3 elements (A, B, C) with a given relation when:

- A has the relation to B, (written A → B),
- And B has the relation to C, (written B → C),
- Then, A has the relation to C, (written A → C or A → B → C)

ISM uses Transitive Logic to reduce the number of votes required to construct the model and to simplify the display of the model.

Step 5: Review of the model

The model then was reviewed by the experts to check for conceptual inconsistency and making the necessary modifications if any. Since the structure was developed through a systematic process of discussion, and argument, only minor amendments could be allowed (Janes, 1988). Janes stated that ISM is a learning process and participants' perceptions towards a situation could change during the ISM session as new information emerged. However, amendments decided by the experts should be fed back into the computer software to generate the final model.

Step 6: Presentation of the final model

The final model then was presented after necessary amendments if any are made. The next steps 7 and 8 are to interprete the model further.

Step 7: Classifying the pedagogical activities into different levels (Reachability Matrix)

Based on the reachability matrix, the pedagogical activities were partitioned according to levels of influence. This was done based on the model generated in step (4). In general practice, the reachability matrix was achieved based on SSIM by substituting V, A, X and O by 1 and 0 as per given case. The substitution of 1s and 0s are as per the following rules:

i. If the (i, j) entry in the SSIM is V, the (i, j) entry in the reachability matrix becomes 1 and the (j, i) entry becomes 0;

ii. If the (i, j) entry in the SSIM is A, the (i, j) entry in the reachability matrix becomes 0 and the (j, i) entry becomes 1;

iii. If the (i, j) entry in the SSIM is X, the (i, j) entry in the reachability matrix becomes 1 and the (j, i) entry also becomes 1; and

iv. If the (i, j) entry in the SSIM is O, the (i, j) entry in the reachability matrix becomes 0 and the (j, i) entry also becomes 0.

The symbols V, A, X, O actually denote the relationships between pairs of elements (pedagogical activities) as indicated below:

V – Pedagogical activity ‘i’ will help to achieve Pedagogical activity ‘j’;

A - Pedagogical activity ‘i’ will help to achieve Pedagogical activity ‘j’

X - Pedagogical activities ‘i’ and ‘j’ will help to achieve each other; and

O - Pedagogical activities ‘i’ and ‘j’ are unrelated.

Step 8: Classifying the pedagogical activities according to clusters (MICMAC Analysis)

The pedagogical activities are also classified according to clusters based on their driving and dependency powers using MICMAC (cross-impact matrix multiplication applied to classification) analysis. The classification is divided into four clusters (Attri et al., 2013). The description of each cluster is shown in Table 3.7.

Table 3.7

Description of Clusters in MICMAC Analysis

Clusters	Descriptions
Autonomous	Autonomous activities have weak driving power and weak dependence power. As such, they are relatively disconnected from the system. The model can be applied with or without the variables.
Linkage	Linkage activities have strong driving and strong dependence power. Any action on these activities will have an effect on the other activities.
Dependent	Dependent activities have weak driving power but strong dependence power. In order for these activities to be involved in aiding the learners achieve their learning outcomes, these activities depend on other activities connected to them.
Independent	Independent activities have strong driving power and weak dependence power. These activities would have to be conducted first to have effect on other activities that depend on them.

Flowchart of Design and Development Phase

ISM session begins with identifying the variables of the issue at hand. This could be done by a survey or group problem solving technique. In this study, Nominal Group Technique (NGT) was used to identify the variables or elements relevant to the problem. This is followed by problem-solving session in a group of experts with the knowledge of the issue. Then, a contextual relation phrase is identified to best connect the variables based on the context of the issue. Next, a structural self-interaction matrix (SSIM) is developed based on pair-wise comparison of the varibles and transitive logic. The SSIM is then transformed into a reachability matrix with the aid of discrete mathematics. Then, the reachability matrix is partitioned into different levels. Depending on the partitioning of the variables, a structural model called Interpretive Structural Model (ISM) is produced. Finally, review the model to check for conceptual inconsistency and make the necessary modifications. Thus, the flow diagram of ISM is shown in Figure 3.6.

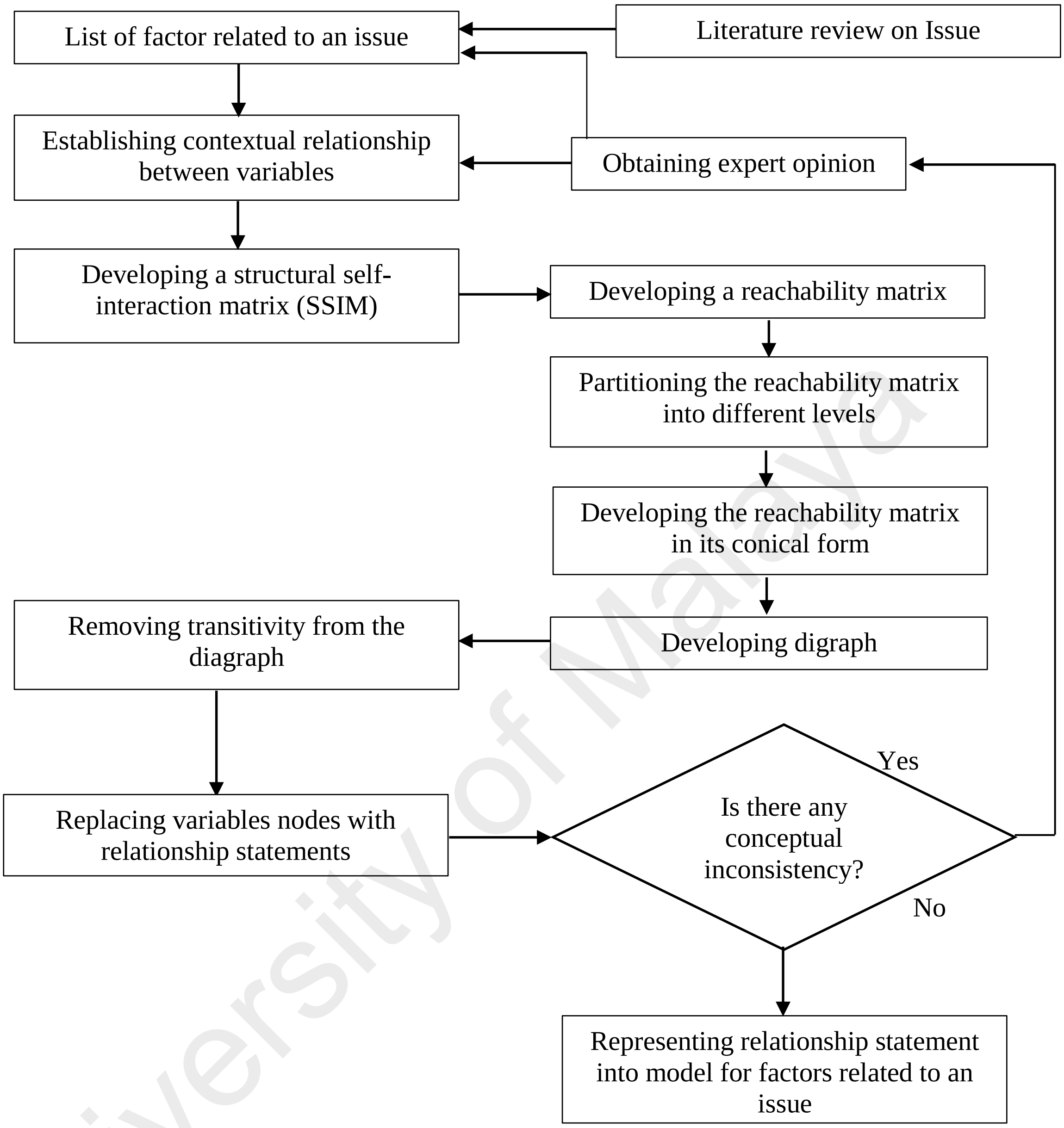


Figure 3.6 Flow Diagram for Preparing ISM Model.

Adapted from *Interpretive Structural Modelling (ISM) approach : An Overview*, by Attri, R., Dev, N., & Sharma, V. (2013), Research Journal of Management Sciences, 2(2), 3–8.

However, Figure 3.7 shows a flowchart of the steps involved in this design and development phase based on this study.

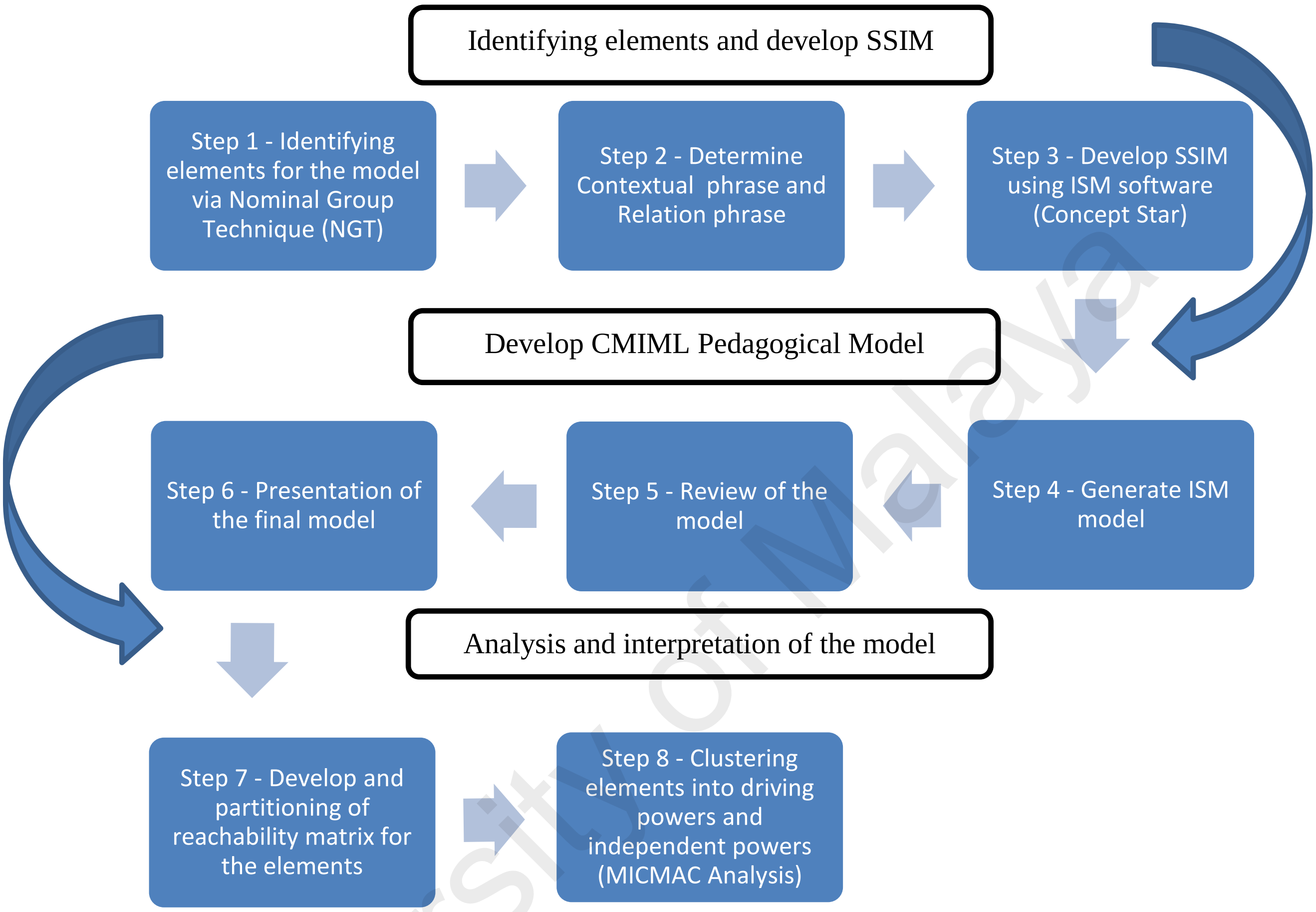


Figure 3.7 Flowchart of Development of CMIML Pedagogical Model

Phase 3: The Evaluation of Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical Model for Teacher Training

The section elaborates on the research methodology of the evaluation phase according to research design, population and sampling, instruments, data collection procedures, data analysis and flowchart of the procedures involved.

Research Design. The purpose of the third phase of this study is the evaluation of the model. This is to validate whether the CMIML Pedagogical model of the study could be suitable as a guide in implementing CMIML as learning support for lecturer in formal learning. This model was evaluated by selected experts based on several criteria. The evaluation was made in terms of their views on the suitability of the pedagogical activities as the elements in the model, the classification of pedagogical activities into domains, the categorization of pedagogical activities in the respective four clusters, the relationships among the pedagogical activities and the suitability of the model in the teaching and learning as designed in the following research questions:

1. What is the experts' consensus on the suitability of the pedagogical activities proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?
2. What the experts' consensus on the classification of the pedagogical activities is as proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?
3. What is the experts' consensus on the list of pedagogical activities in the respective four clusters (Independent, Linkage, Dependent, and Autonomous) as proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?
4. What the experts' consensus on the relationships among the pedagogical activities are as proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?

5. What are the experts' consensus on the suitability of the Collaborative Mobile Instant Messaging Learning Pedagogical model in the teaching and learning for teacher training?

Hence, in order to evaluate the model in this phase, this study adopted the fuzzy Delphi method to elicit experts' views in validating the model.

Fuzzy Delphi Method (FDM). Fuzzy Delphi is a combination between fuzzy set theory and Delphi technique (Murray, Pipino, & Van Gigch, 1985). It is an analytical method introduced by Kaufmann and Gupta (1988) for decision making which incorporates fuzzy theory in the traditional Delphi method. The traditional Delphi Method which was introduced by Dalkey and Helmer (1963), has been widely used to obtain a consistent flow of answers through the results of questionnaires (Hwang & Lin, 1987; Reza & Vassilis S., 1988).

According to Linstone and Turoff (2002), the Delphi technique is a method to make a decision that is made in several rounds of the questionnaire surveys to get experts' opinion on the issue or matter being investigated. This approach is also used to achieve consensus among the experts that have been selected. Meanwhile, Adler and Ziglio (1996) states that the Delphi method is a structured process for collecting and selecting the opinions of a group of experts made through several rounds of the survey, in which the feedback of opinion among them can be controlled. While, according to Delbecq et al., (1975), Delphi technique is a method to systematically seek consensus on a topic that is discussed, through a set of carefully designed questionnaires. Delphi method is also known as a forecast or projection method based on experts' judgment.

According to the RAND report 1953, this technique was originally intended to solve the problems of the military (Dalkey & Helmer, 1963). However, the technique has evolved into a variety of disciplines that can be found on various articles and journals. This method has been used in the field of education (Baggio, 2008), teacher training (Frazier & Sadera, 2011), management (Schmiedel & Brocke, 2013), sports (Eberman & Cleary, 2011), tourism (C. Lee & King, 2008), banking (Bradley & Stewart, 2002), and industry (Jung-Erceg, Pandza, & Armbruster, 2007).

This Delphi technique is an expert opinion survey method with three features: anonymous response, iteration and controlled feedback and finally statistical group response (Hsu et al., 2010). According to Saedah Siraj (2006), the method allows integration of opinions that is gained independently from each expert through multiple cycles of questionnaires for prediction outcomes. However, some weaknesses have been discovered where the process become more costly and time consuming as it needs repetitive surveys to allow forecasting values to converge (Hwang & Lin, 1987; Ishikawa et al., 1993). Furthermore, in many real situations, experts' judgments cannot be properly reflected in quantitative terms since people use linguistic terms, such as 'good' or 'very good' to reflect their preferences (Hsu et al., 2010). Due to the differences in the meanings and interpretations of the expert's opinions, some ambiguity might happen. Thus, to overcome this matter, the concept of combining fuzzy set theory and Delphi was proposed by Murray, Pipino and Gigch (1985) and was named the Fuzzy Delphi Method (FDM).

Fuzzy set theory was first being introduced in 1965 by an expert in Mathematics, Lotfi Zadeh (Navy, 1965). It is widespread used and has demonstrated a high ability to improve reliability in solving real problems in the form of fuzzy (Lin & Lee, 1996). It works as an extension of the theory of classical set where each element in a set are assessed based on Binary set (Yes or No). The fuzzy set theory of also enable a gradual assessment to every element studied. Ragin (2007) states that the value of fuzzy numbering is comprised from 0 to 1 or in the unit interval (0, 1).

Thus, the combination of fuzzy set theory and Delphi technique is able to provide the following (Chang, Huan, & Lin, 2000):

1. It processes ambiguity on predictive items and content of respondents' information.
2. The individual characteristics of the participants can be explained.

In short, this fuzzy Delphi method is used to obtain consensus of experts who act as respondents based on the use of quantitative methods.

Traditional Delphi Method vs Fuzzy Delphi Method. The purpose of Traditional Delphi methods is to achieve a consensus of experts. Various opinions can be obtained while maintaining an expert opinion. Among the shortcomings of this method is that more time is needed to gather the opinions of experts. Typically, it is carried out in three rounds. This long process will also result in high costs to be borne by the researchers. The questionnaire is to be administered repeatedly until a consensus is obtained. In the process repeated to achieve consensus, researchers are likely to misinterpret the opinion of experts. Approval of the expert opinion only applies to a certain range, while ambiguity is not taken into account.

Using Fuzzy Delphi Method mean minimize the time the study was done. It seeks to avoid the monotony of the researchers and other experts have been able to reduce the round of Delphi. Furthermore, the time reduction will reduce the travel costs of the researchers. Other than that, selected experts can fully express their opinions to ensure completeness and uniformity of opinion. Besides, it is able to prevent loss and leakage data collected by the researchers of the group of experts in the study. This method also takes into account the inevitable ambiguity during the review process applies. It does not misinterpret the original expert opinion and provide an overview of their real reactions.

In this study, a modified fuzzy Delphi method was employed to conduct the evaluation of the Collborative Mobile Instant Messaging (CMIML) pedagogical model. There were two main modifications made to this method:

1) In Delphi technique, experts are used for instance in decision making of product development using variables determined by them prior to the development. However, in this study, the evaluation does not require the experts to generate variables although the session involves decision-making. It takes into consideration collective views through consensus opinions of the participants involved on certain evaluation criteria of the model.

2) In conventional use of fuzzy Delphi method, the defuzzification process and rankings are used to determine the variables of the study. Instead, in the evaluation procedure of this study, the defuzzification process is used to determine the consensual agreement among experts on items tested in the model.

Thus, the procedure in conducting the modified fuzzy Delphi method is further elaborated in the next section.

Population and sampling. In this phase, as the study applies the modified Fuzzy Delphi method (FDM), a panel of experts was chosen through purposive sampling to evaluate the model. According to Hasson, Keeney and McKenna (2000), the technique of selecting the appropriate sample in the FDM is not a non-probability sampling. This technique was applied because the samples were not selected randomly since they were chosen based on their knowledge and experience in the field of the study. Linstone and Turoff (2002) suggested the panel of experts is between five to 10 experts in order for the study to reach the specific objectives. However, Gordon (2009) stated that the usual numbers of experts selected are between 15 to 35 experts to guarantee for comprehensive and reliable research findings. Whereas, Jones and Twiss (1978) proposed an appropriate number of experts in this method are 10 to 50 people. Thus, considering the related factors, the number of participants to form a panel of experts to evaluate and validate the model in this Fuzzy Delphi phase were 25 experts.

In the Delphi method, the selection of an appropriate panel of experts is the most important step as it affects the quality of the result of the study (Taylor, Judd, Witt, & Moutinho, 1989). According to Berliner (2004), lecturers who have experience of more than five years is classified as an experts in which they have experience in teaching and managing an ongoing basis. Other than that, Akbari and Yazdanmehr (2014), states that the term expert in the field of education refers to an individual who has more than five years based on their specific experience.

Instrument. The instrument used for this phase was a set of evaluation survey questionnaire (refer to Appendix M) consisted of 31 questions which divided into two parts: 1) Experts' personal details; and 2) Experts' views of the model. The first part consists of two sections: 1) Section A to elicit participants' background information; and 2) Section B to elicit participants' use of technologies. The second part served to elicit experts' view on the usability of the model using a 5-point linguistic scale as follows:

1 – Strongly Disagree
2 – Disagree
3 – Neutral
4 – Agree
5 – Strongly Disagree

Data collection procedures. The main aim of this phase is to evaluate the model developed in Phase 2 of this study. As the study employed fuzzy Delphi method to evaluate it, the procedure for this phase was as the following:

1. **Selection of experts to evaluate the model**

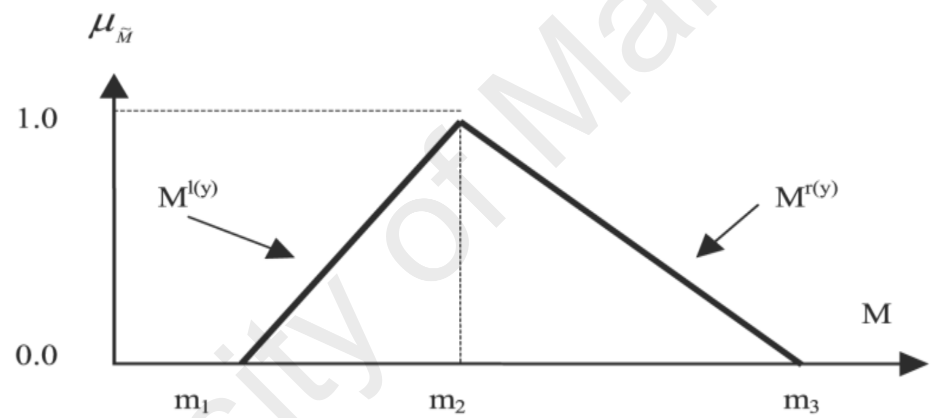
   The criteria of experts selected were elaborated in previous section. Thus, a total of 25 experts were chosen to evaluate the model. The process of obtaining information and data depending on the researcher's own initiative. According to Mohd Ridhuan Mohd Jamil (2017), among the methods that can be used by researchers are:

   i. Conducting seminars or workshops and invite experts involved.
   ii. Meet face to face with the experts who have been identified.
   iii. Through on-line medium such as via e-mail to the identified experts.

   However, in this phase, the researcher decided to meet face to face with selected experts to facilitate the evaluation questionnaire by giving explanation of the issues that may exist in the items, and so on.

2. **Determine the linguistic scale based on triangular fuzzy**

This is to address the issue of fuzziness among the experts' opinion based on their feedbacks. The linguistic scale is similar to a Likert scale with an additional of fuzzy numbers given to the scale of responses based on triangular fuzzy number as shown in Figure 3.8. For every response, three fuzzy values were given to consider the fuzziness of the experts' opinions. The three values as shown in Figure 3.8 consist of three levels of fuzzy value: minimum value (m_1), most plausible value (m_2), and maximum value (m_3).



m_1 = minimum value; m_2 = most plausible value; m_3 = maximum value

Figure 3.8 Triangular Fuzzy Number

Adapted from *Development of Activity-based mLearning Implementation Model for Undergraduate English Language Learning*, by Muhammad Ridhuan Tony Lim Abdullah. (2014).

The linguistic scale is used to convert the linguistic variable into fuzzy numbers. The level of agreement scale should be in odd numbers (3, 5, or 7 point linguistic scale). The higher the scale, the more accurate the response analysis could be. Table 3.8 and Table 3.9 show the fuzzy scale for a 5-point linguistic scale and 7-point linguistic scale respectively.

Table 3.8

5 Point Linguistic Scale

5 Point Linguistic Scale	**Fuzzy Scale**		
Strongly Agree	0.60	0.80	1.00
Agree	0.40	0.60	0.80
Moderately Agree/Neutral	0.20	0.40	0.60
Disagree	0.10	0.20	0.40
Strongly Disagree	0.00	0.10	0.20

Based on Table 3.8, the fuzzy numbers are in range of 0 to 1. In this study, this 5-point linguistic scale was used as the fuzzy numbers for the responses.

Table 3.9

7 Point Linguistic Scale

7 Point Linguistic Scale	**Fuzzy Scale**		
Strongly Agree	0.90	1.00	1.00
Agree	0.70	0.90	1.00
Moderately Agree	0.50	0.70	0.90
Slightly Agree	0.30	0.50	0.70
Slightly Disagree	0.10	0.03	0.50
Disagree	0.00	0.10	0.30
Strongly Disagree	0.00	0.00	0.10

3. **Calculating average for fuzzy responses of experts**

This procedure is known as identifying the average responses for each fuzzy number (Benitez, Martín, & Román, 2007). They were calculated using the following formula:

$$M = \frac{\sum_{i}^{n} = 1mi}{n}$$

The example of the experts' responses with the correspondent fuzzy number scales for each questionnaire item is shown in Table 3.10. The example given is based on 5-Point Linguistic scale since it was used in this study.

Table 3.10

Example of Fuzzy Delphi Experts' Responses

Respondents		**Item 1**	
R1	0.60	0.80	1.00
R2	0.40	0.60	0.80
R3	0.20	0.40	0.60
R4	0.40	0.60	0.80
R5	0.20	0.40	0.60
R6	0.60	0.80	1.00
R7	0.40	0.60	0.80
R8	0.60	0.80	1.00
R9	0.40	0.60	0.80
R10	0.60	0.80	1.00
Average	0.44	0.64	0.84
	m_1	m_2	m_3

4. **Identify the threshold value**

The difference between the experts' evaluation data and the average value for each item were calculated to identify the threshold value, 'd' using the following formula:

$$d(\tilde{m},\tilde{n}) = \sqrt{\frac{1}{3}\left[(m_1 - n_1)^2 + (m_2 - n_2)^2 + (m_3 - n_3)^2\right]}.$$

Table 3.11 shows an example of the threshold value (d) generated for 2 items surveyed by the views of 20 experts.

Table 3.11

Example of Threshold Value, d

Respondents	**Item 1**	**Item 2**
R1	0.0764	0.0611
R2	0.0764	0.0611
R3	0.0764	0.0611
R4	0.0764	0.0611
R5	**0.2291**	0.0611
R6	0.0764	0.0611
R7	0.0764	0.0611
R8	0.0764	**0.2444**
R9	0.0764	0.0611
R10	0.0764	0.0611
R11	**0.2291**	0.0611
R12	**0.2291**	**0.2444**
R13	0.0764	0.0611
R14	0.0764	0.0611
R15	0.0764	0.0764
R16	0.0764	0.0611
R17	**0.3819**	**0.3666**
R18	0.0764	0.0611

R19	0.0764	0.0611
R20	0.0764	**0.2444**

The threshold value is very important in determining the consensus level among experts. According to Cheng and Lin (2002), if the threshold value is less than or equal to 0.2, then all the experts are considered to have achieved a consensus. The threshold values which are in bold in the sample calculation in Table 3.11 indicate the individual experts' opinion that are not consensus with the other experts' view. However, what is more important to be considered is the overall consensus for all items. The overall group consensus should be more than 75%; otherwise a second round of fuzzy Delphi needs to be conducted.

5. **Determine the percentage agreement**

Based to the threshold value for each item, the overall consensus for all items is determined. According to Chu and Hwang (2008) and J. Murry and Hammons (1995), the percentage agreement of all experts must be equal to or greater than 75%. Table 3.12 shows the example of the percentage agreement for 2 items by the views of 20 experts based on Table 3.11.

Table 3.12

Examples of Calculation of Percentage of Experts' Agreement

	Items	
	1	2
No of items d ≤ 0.2	16	16
Percentage of each item d ≤ 0.2	80.0%	80.0%
Overall Percentage of Experts' Agreement	80%	

Based on Table 3.12, the overall percentage of experts' agreement has exceeded 75% which indicates that the experts have reached the required consensus in their views for all the questionnaires items.

6. **Defuzzification Process**

This is the final steps of the procedure in the evaluation phase. The data is analysed using the average of fuzzy numbers. In this analysis, it aims to get the fuzzy score (A). In order to reach consensus of all experts, the fuzzy scores (A) must be greater than or equal to the median value (the value of α - cut) of 0.5 (Bodjanova, 2006; Tang & Wu, 2010). The fuzzy score (A) for each questionnaire item was calculated using any of these following formula:

i. $A_{max} = 1/3 * (m1 + m2 + m3)$

ii. $A_{max} = 1/4 * (m1 + 2m2 + m3)$

iii. $A_{max} = 1/6 * (m1 + 4m2 + m3)$

Table 3.13 shows an example of the fuzzy scores (A) calculated using defuzzification analysis process based on Fuzzy Delphi method (FDM).

Table 3.13

Example of Fuzzy Scores (A)

Respondents	Item 1			Item 2		
R1	0.40	0.60	0.80	0.40	0.60	0.80
R2	0.60	0.80	1.00	0.40	0.60	0.80
R3	0.40	0.60	0.80	0.40	0.60	0.80
R4	0.40	0.60	0.80	0.40	0.60	0.80
R5	0.60	0.80	1.00	0.40	0.60	0.80
R6	0.40	0.60	0.80	0.40	0.60	0.80
R7	0.40	0.60	0.80	0.40	0.60	0.80
R8	0.40	0.60	0.80	0.60	0.80	1.00
R9	0.40	0.60	0.80	0.40	0.60	0.80
R10	0.40	0.60	0.80	0.60	0.80	1.00
R11	0.60	0.80	1.00	0.60	0.80	1.00
R12	0.60	0.80	1.00	0.60	0.80	1.00
R13	0.60	0.80	1.00	0.60	0.80	1.00
R14	0.60	0.80	1.00	0.60	0.80	1.00
R15	0.40	0.60	0.80	0.20	0.40	0.60
R16	0.40	0.60	0.80	0.40	0.60	0.80
R17	0.20	0.40	0.60	0.20	0.40	0.60
R18	0.40	0.60	0.80	0.20	0.40	0.60
R19	0.40	0.60	0.80	0.40	0.60	0.80
R20	0.40	0.60	0.80	0.60	0.80	1.00
Average	0.45	0.65	0.85	0.44	0.64	0.84
Fuzzy Score (A)	**0.65**			**0.64**		

Data analysis. Data from part 1 of the survey questionnaire were analyzed using descriptive statistics via SPSS version 22 software. The study proposed the analysis of frequency and percentage for this phase to investigate the experts' background information of their expertise that were relevant to the study. Data from Part two of the survey questionnaire were analyzed using fuzzy Delphi method from step 2 to 6 as discussed in the data collection procedure section for Phase III. The data were analyzed using Microsoft Excel.

Flowchart of Evaluation Phase

This phase employed Fuzzy Delphi Method (FDM) to evaluate the CMIML Pedagogical Model which was developed in phase 2. In order to obtain the data in the Evaluation phase, the evaluation survey instruments were used. The procedure to analyze the findings of this phase is shown in Figure 3.9 below.

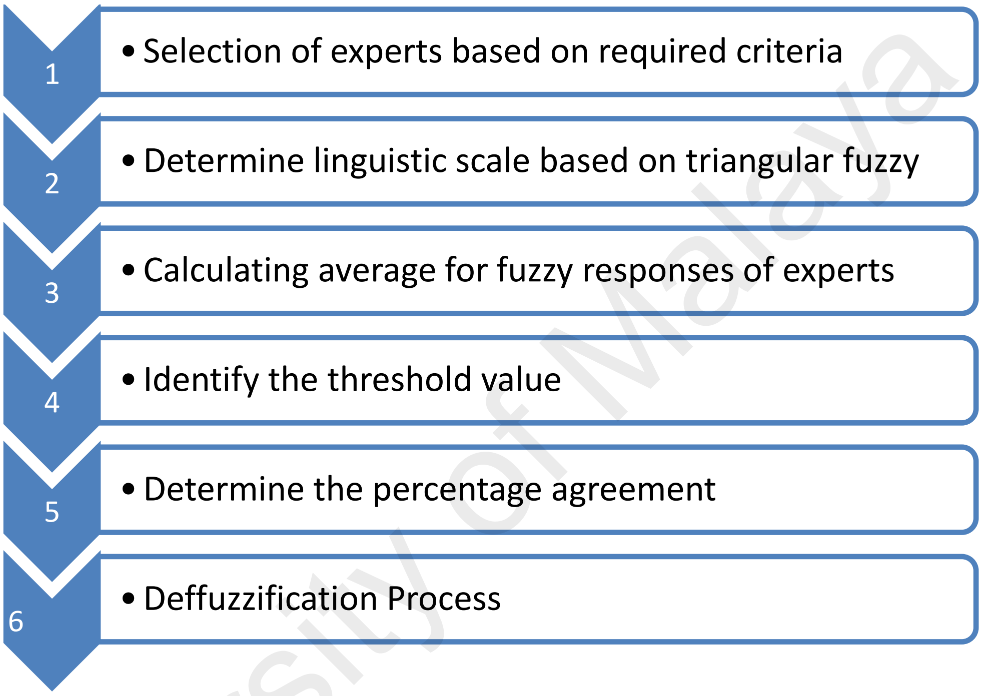


Figure 3.9 Flowchart of Fuzzy Delphi Method Procedure

Design and Development Research Matrix

The research design matrix summarizes every phase, method and technique used to answer the research questions and the respondents involved. The development of this matrix is intended to facilitate the researcher to see the details of each work being carried out. Table 3.14 shows the research design matrix in the development process of the CMIML pedagogical model.

Table 3.14

Design and Development Research Matrix

Needs Analysis Phase		
Research Questions	**Method/Technique**	**Respondent**
1. What are the lecturers' perceptions on their current ways of teaching and learning?	Survey questionnaires	268 lecturers
2. What are the lecturers' perceptions on implementing ICT in teaching and learning?		
3. What are the lecturers' access to mobile devices and the capability level of the devices?		
4. What are the lecturers' level of acceptance and intention to use collaborative mobile instant messaging learning if incorporated into the formal course?		

Development Phase		
Research Questions	**Method/Technique**	**Respondent**
1. What the experts' collective views on the pedagogical activities, which should be included in the development of the Collaborative Mobile Instant Messaging Learning pedagogical model?	Nominal Group Technique (NGT) Interpretive Structural Modelling (ISM)	10 experts involved in both NGT and ISM sessions.

2. What are the relationships among the pedagogical activities in the development of the Collaborative Mobile Instant Messaging Learning pedagogical model based on the experts' collective views?		
3. How is the structural pedagogical model of Collaborative Mobile Instant Messaging Learning based on the experts' collective views?		
4. How should the pedagogical activities be classified in the interpretation of the Collaborative Mobile Instant Messaging Learning pedagogical model based on the experts' collective views?		

Evaluation Phase		
Research Questions	**Method/Technique**	**Respondent**
1. What is the experts' consensus on the suitability of the pedagogical activities proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?	Fuzzy Delphi Method (FDM)	25 experts involved
2. What is the experts' consensus on the classification of the pedagogical activities as proposed in the Collaborative Mobile Instant		

Messaging Learning pedagogical model?

3. What is the experts' consensus on the list of pedagogical activities in the respective four clusters (Independent, Linkage, Dependent, and Autonomous) as proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?

4. What is the experts' consensus on the relationships among the pedagogical activities as proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?

5. What is the experts' consensus on the suitability of the Collaborative Mobile Instant Messaging Learning pedagogical model in the teaching and learning for teacher training?

Summary

The mainframe of the methodology in this study is constituted by the design and development research approach which was adopted to develop the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model. This research approach divided the conduct of the study into three phases: 1) The need analysis phase to seek the needs to develop the CMIML Pedagogical model; 2) The design and development of the CMIML pedagogical model; and 3) The evaluation of the model. Thus, this chapter elaborates on the research methodology of the each phases according to research design, population and sampling, instruments, data collection procedures, data analysis and flowchart of the procedures involved.

The needs analysis phase was conducted using survey questionnaires to seek the needs to develop the model based on the lecturers' views. The survey questionnaire was guided by a theory of technology acceptance which was Unified Theory of Acceptance and Use of Technology (UTAUT). The data then were analyzed using descriptive statistics via SPSS software.

In the second phase which is the design and development of the model, it was conducted in three stages: 1) identifying the elements for the model by experts' views using nominal group technique (NGT); 2) the development of the model by the panel of experts using Interpretive Structural Modeling (ISM) method and Concept Star software; and 3) refining the model for analysis and interpretation of the model.

Then, the model was evaluated by panel of experts in the third phase of the study using a modified Fuzzy Delphi Method (FDM), which is a powerful decision making tool. The instrument used in this phase was an evaluation survey questionnaire, based on a five-point Linguistic scale. Finally, the data of this phase was analyzed using descriptive statistics and Fuzzy Delphi technique.

Overall, the findings of all the phases will be presented in different chapters; i) Chapter 4 (The Need Analysis Stage); ii) Chapter 5 (The Design and Development Stage); and iii) Chapter 6 (The Evaluation Stage). Each chapter will elaborate according to the procedures of research involved in all stages.

CHAPTER 4

FINDINGS OF PHASE 1: NEEDS ANALYSIS

Introduction

The first phase is the Needs Analysis stage that aimed to identify a need to develope the Collaborative Mobile Instant Messaging Learning pedagogical model for teacher training. Hence, this survey was based on lecturers' perceptions and level of acceptance and intention to use mobile instant messaging application if incorporated in the formal course. Thus, the findings in this phase are presented according to the research questions as follows:

1. What are the lecturers' perceptions on their current ways of teaching and learning?
2. What are the lecturers' perceptions on implementing ICT in teaching and learning?
3. What are the lecturers' access to mobile devices and the capability level of the devices?
4. What are the lecturers' level of acceptance and intention to use collaborative mobile instant messaging learning if incorporated into the formal course?

Findings of the Need Analysis Phase

The discussion of the findings in this chapter is divided into two parts. The first part will present data analysis associated with respondent demographics. The second part will describe the analysis of data relating to the research objectives. The findings comprised of data with descriptive statistics through the analysis of mean, standard deviation, percentage, and frequency to determine the needs to develop the

CMIML pedagogical model based on the lecturers' view. Thus, the presentation of the findings are as the following sections.

Background of Participants. The survey was conducted using the needs analysis survey questionnaires that were distributed to the lecturers in five Institute of Teacher Education in the central zone. A total of 268 respondents participated in the study. The findings on the background of the respondents are summarized as shown in the table 4.1.

Table 4.1

Participants' Demography

Item		Frequency	Percentage
Gender	Male	102	38.1
	Female	166	61.9
Working experience	1 – 5 years	11	4.10
	6 – 10 years	62	23.1
	11 – 15 years	123	45.9
	16 – 20 years	56	20.9
	More than 20 years	16	6.0
Experience of using ICT	1 – 5 years	31	11.6
	6 – 10 years	94	35.1
	11 – 15 years	89	33.2
	16 – 20 years	48	17.9
	More than 20 years	6	2.2

Table 4.1 shows the demographics of survey respondents, comprising a total of 268 lecturers at the Institute of Teacher Education Malaysia on the campus of Central Zone. Based on Table 4.1, the total number of female respondent outnumber male respondent. A total of 166 (61.9%) female respondents involved in the study

compared to male respondents who are just a total of 102 (38.1%) lecturers. While in term of working experience, majority of respondents have been teaching for 11 to 15 years representing 45.9% of the total number of lecturers. Only 31 respondents have 1 to 5 years working experience representing 4.10% of the total respondents. Whereas, 16 (6.0%) respondents have been working for more than 20 years. In terms of the respondents' experience of using ICT, the findings revealed that most of the lecturers have experience of using ICT for 6 to10 years and 11 to15 years represent 35.1% and 33.2% respectively. Only six (2.2%) respondents have more than 20 years experience of using ICT in teaching and learning process.

Perceptions and intention to use Collaborative Mobile Instant Messaging Learning (CMIML). The following findings report on the lecturers' perception on their current ways of teaching, implementing ICT in teaching and learning, lecturers' access to mobile devices and the capability level of the devices, and finally their level of acceptance and intention to use collaborative mobile instant messaging learning (CMIML) if incorporated into the formal course. These findings justified the need to implement CMIML to ensure active implementation of ICT in teaching and learning. Thus, the following findings are discussed based on the objectives of the study as follows:

a) Lecturers' perception on their current ways of teaching and learning

This part is to elicit the lecturers' perception on their current ways of teaching and learning. The findings are shown in Table 4.2.

Table 4.2

Perception on the current ways of teaching and learning

Item	Descriptions	Mean	SD	Interpretation
1	I am comfortable with my current teaching using “chalk and talk” approach	2.79	.418	Moderate
2	My students enjoy learning with my “chalk and talk” approach	2.73	.398	Moderate
3	I intend to continue teaching using “chalk and talk” approach	2.24	.615	Moderate
4	I am interested to use ICT in teaching	4.56	.842	High
5	My students understand more easily when I integrate ICT in teaching	4.21	.768	High

Note : SD = Standard Deviation

Table 4.2 discusses the perception on the current ways of teaching by the lecturers. The finding shows that the lecturers perceived the use of ICT in education would make the students understand more easily. This is evidenced by a mean value of 4.21 (SD = .768). However, even though the findings revealed that the lecturers were interested to use ICT in teaching (mean = 4.56, SD = .842), a few of them would still continue using "chalk and talk" approach (mean = 2.24, SD = .615) as they perceived it was still relevant to use.

b) Lecturers' perceptions on implementing ICT in teaching and learning

This part is to investigate the lecturers' perceptions on implementing ICT in teaching and learning. The findings are shown in Table 4.3.

Table 4.3

Perception on implementing ICT in teaching and learning

Item	Descriptions	Mean	SD	Interpretation
1	ICT will increase quality of teaching	4.35	.765	High
2	ICT will make learning more interesting	4.56	.823	High
3	ICT facilitates collaborative work among students	4.26	.818	High
4	ICT makes students feel more autonomous in their learning	3.76	.685	High
5	ICT is essential in 21st century learning	4.59	.854	High

Note : SD = Standard Deviation

Table 4.3 shows the data analysis regarding the perception of lecturers on implementing ICT in teaching. Lecturers perceived that implementing ICT in teaching is essential in 21st century learning. This is evidenced by the mean value of 4.59 (SD = .854). The lecturers also believed that using ICT in teaching would promote student-centered learning as evidenced in item no 3 with the mean value of 3.76 (SD = .685). As a conclusion, the lecturers perceived that implementing ICT in teaching create many benefits in learning as majority of the mean value for each items is high.

c) Lecturers' access to mobile devices and the capability level of the devices

This part is to identify whether the lecturers' have the appropriate devices to implement mobile learning in formal classroom. The findings are shown in Table 4.4, Table 4.5, Table 4.6, Table 4.7.

Table 4.4

Owing a Mobile Device

	Frequency	Percentage (%)
Yes	268	100
No	0	0
Total	268	100

Table 4.4 shows that all respondents (100%, n = 268) owned mobile devices without considering the types of devices used by them. However, the type of devices owned by the lecturers is revealed in Table 4.5 below.

Table 4.5

Types of Mobile Devices Owned by lecturers

Mobile Devices	**Frequency**	**Percentage (%)**
Mobile Phone	106	96.4
Smartphone	108	98.2
PDA	23	21.0
AV portable player	47	42.7
Tablet PC	76	69.1

Table 4.5 shows the type of mobile devices owned by lecturers. The results revealed that mobile (96.4%, n=106) and smartphone (98.2%, n=108) were the types of mobile technology devices mostly owned by the respondent with PDA (21%, n=23) as the least device owned by them. This findings also indicate that the lecturers owns at least more than one mobile technology devices.

Table 4.6

Level of Capabilities of Mobile Devices

Level	Descriptions	Frequency	Percentage (%)
1	Basic services – voice calls & SMS, with/without camera	4	1.5
2	Level 1 + email, limited internet browsing, camera & video recording, MMS, video calls, and preloaded software	47	17.5
3	Level 2 + GPS + mobile apps downloadable	217	81.0

Table 4.6 shows the data analysis of level of capabilities of lecturers' mobile devices. A minimum Level 2 is suggested to enable incorporation of collaborative mobile instant messaging learning in their formal learning course. The results shows that most of the lecturers' mobile devices (81.0%, n=217) were at level 3. This findings revealed that the lecturers' devices have at least the minimum required mobile capabilities that could readily accommodate incorporation of collaborative mobile instant messaging learning.

Table 4.7

Supplementary Data Connection Capabilities

Data Connection	Frequency	Percentage (%)
WLAN WiFi	266	99.3
Bluetooth	200	74.6
USB	195	72.8
Others	17	6.3

Table 4.7 shows the data analysis of the connection capabilities of the devices owned by the lecturers. These supplementary data connections are essential to ensure the implementation of mobile learning is efficiently conducted. Thus, it is found that high percentage of supplementary data connections such as WLAN WiFi (99.3%), Bluetooth (74.6%), and USB (72.8%) were furnished in their mobile devices which were value added to mobile learning infrastructure.

d) Lecturers' level of acceptance and intention to use collaborative mobile instant messaging learning if incorporated into the formal course

The following findings are discussed based on every major construct in Unified Theory of Acceptance and use of Technology (UTAUT) which are Performance Expectancy, Effort Expectance, Social Influence, Facilitating Conditions, Attitude Towards using technology, Self-efficacy, Behavioral Intention to Use, and Anxiety. The findings reveal the lecturers' acceptance, readiness, and intent to use collaborative mobile instant messaging learning (CMIML) as support to formal learning.

Table 4.8

Acceptance and Intention to use Collaborative Mobile Instant Messaging Learning (Performance Expectancy)

Item	Descriptions	Mean	SD	Interpretation
1	I would find CMIML useful for my course	4.29	.688	High
2	Using CMIML would help me to accomplish my task more quickly	4.26	.719	High
3	Using CMIML would increase my productivity	4.26	.893	High
4	CMIML would increase my students' chance to get better grades	3.82	.658	High

Note : SD = Standard Deviation

Table 4.8 shows the result of lecturers' expectancy on performance of Collaborative Mobile Instant Messaging Learning (CMIML) to accommodate formal learning. The findings shows that all items received positive perception with the highest mean value of 4.29 (SD = .688) where they found CMIML is useful for their course. The lecturers also show positive perception that using CMIML would accomplish their task more quickly and would increase their productivity as evidence with the high mean value of 4.26 respectively. This is due to mobile tools offers a larger array of communication possibilities at greater speed and accessibility. The findings also show high mean value of 3.82 (SD = .658) which proved that the lecturers perceived using CMIML would increase their students' chance to get better grades as mobile instant messaging offers more opportunity for them to access assistance for their students' learning. Thus, these findings revealed that the respondents perceived high expectation on the performance of CMIML if it is incorporated in formal learning.

Table 4.9

Acceptance and Intention to use Collaborative Mobile Instant Messaging Learning (Effort Expectancy)

Item	Descriptions	Mean	SD	Interpretation
1	My interaction through CMIML would be clear	4.00	.838	High
2	It would be easy for me to become skilful at using CMIML	3.91	.970	High
3	I would find CMIML easy to use	4.32	.842	High

Note : SD = Standard Deviation

Table 4.9 shows the result of effort expectancy as the degree of ease in using a proposed approach which is Collaborative Mobile Instant Messaging Learning (CMIML). The findings show that the lecturers perceived the interaction through CMIML would be clear as mobile instant messaging offers synchronous interaction. This was evidenced with high mean value of 4.00. Besides, the findings also indicate that respondents would find CMIML easy to use as evidenced by the mean value of 4.32 (SD = .842). This was supported by item no 2 that they were positive to become skilful at using CMIML (mean = 3.91, SD = .970). Thus, these findings revealed that the lecturers perceived that CMIML was convenient and easy to be implemented.

Table 4.10

Acceptance and Intention to use Collaborative Mobile Instant Messaging Learning (Attitude towards using CMIML)

Item	Descriptions	Mean	SD	Interpretation
1	I prefer other teaching approach than CMIML	3.21	.605	High
2	CMIML would make teaching more interesting	4.15	.624	High
3	It would be fun teaching with CMIML	4.24	.730	High
4	Using CMIML would be a very good idea	4.18	1.05	High

Note : SD = Standard Deviation

Table 4.10 shows the data analysis of attitude of lecturers towards using Collaborative Mobile Instant Messaging Learning (CMIML). The results indicate that the lecturers were positive in their attitude towards using CMIML. However, they were not sure either CMIML was more interesting compared to other approach. This was evidenced by the moderate mean value of 3.21 (SD = .605) for item no 1 inquiring about their preference to use other approach than CMIML. The findings also indicate that the lecturers were confident that CMIML would make teaching more interesting (mean = 4.15, SD = .624) and they were convinced that teaching with CMIML could be more fun (mean = 4.24, SD = .730). As a conclusion, the lecturers showed their interest to use CMIML in their formal teaching course.

Table 4.11

Acceptance and Intention to use Collaborative Mobile Instant Messaging Learning (Social Influence)

Item	Descriptions	Mean	SD	Interpretation
1	People who influence my behaviour would think that I should use CMIML	3.60	.904	High
2	People who are important to me would think that I should use CMIML	3.70	.871	High
3	My colleagues would encouraged me to use CMIML	3.69	.867	High
4	In general, my university would support the use of CMIML	3.94	.746	High

Note : SD = Standard Deviation

Table 4.11 shows the data analysis of social influence as the degree at which the lecturers perceive how important others believe he or she should use technology in teaching. In other words, the lecturers' decisions to use Collaborative Mobile Instant Messaging Learning (CMIML) were being influenced by the parties that are important to them. In this aspect, the overall results show that people who have a critical influence on the lecturers have a significant impact on their motivation in deciding to use CMIML. The lecturers perceived that people have influence on their behaviour and people that were important to them thought that they should use CMIML in their formal teaching. These are evidenced by the high mean value of 3.60 (SD = .904) and 3.70 (SD = .871) respectively. Other than that, the lecturers also convinced that their colleagues would encourage them to use CMIML (mean = 3.69, SD = .867). In fact, the lecturers were confident that the university would support the use of CMIML in formal course (mean = 3.94, SD = .746). Therefore, the role of all the parties involved is important for the lecturers as it is the motivating factor in encouraging them to apply CMIML in teaching.

Table 4.12

Acceptance and Intention to use Collaborative Mobile Instant Messaging Learning (Facilitating Conditions)

Item	**Descriptions**	**Mean**	**SD**	**Interpretation**
1	I have necessary tools (e.g. smartphone, PDA, etc.) to use CMIML	4.32	.808	High
2	I have the knowledge necessary to use CMIML	3.82	.948	High
3	I have specific person to assist me with CMIML difficulties	3.63	1.05	High

Note : SD = Standard Deviation

Table 4.12 shows the data analysis of the extent to which individuals believe that the technical and organizational infrastructure exists to support the use of Collaborative Mobile Instant Messaging Learning (CMIML). In this aspect, the overall results show a positive decision on the perception of lecturers on organizational and technical support on the use of CMIML. For example, the lecturers have sufficient tools to run CMIML in teaching (mean = 4.32, SD = .808). They also perceived that they have the resources to help and knowledge needed to use CMIML (mean = 3.82, SD = .948). In addition, they also believed that they have a special person to help them to use the CMIML even though the mean value was slightly lower (mean = 3.63, SD = 1.05). These findings indicates that the lecturers were positive in using CMIML where they believed that the support and facilities needed were available.

Table 4.13

Acceptance and Intention to use Collaborative Mobile Instant Messaging Learning (Behavioural intention to use CMIML)

Item	Descriptions	Mean	SD	Interpretation
1	I intend to use CMIML for this course as soon as possible	3.68	.722	High
2	I plan to use CMIML for this course in the next semester	4.06	.564	High
3	I predict that I would use CMIML for this couse in the next semester	4.09	.640	High

Note : SD = Standard Deviation

Table 4.13 shows the data analysis of behavioral intention to use Collaborative Mobile Instant Messaging Learning (CMIML) in teaching. The results indicate that some of the lecturers had the intention to apply CMIML in teaching the soonest possible. It is evidenced by the mean value of 3.68 (SD = .722). The results show that some lecturers do intend to use mobile instant messaging learning in teaching as soon as possible. In addition, they also have high intention to apply CMIML where they planned (mean = 4.06, SD = .564) and expected (mean = 4.09, SD = .640) to apply it in their formal courses in the next semester. Thus, overall findings for this aspect revealed that the lecturers were significantly eagered and intended to apply CMIML in the near future.

Table 4.14

Acceptance and Intention to use Collaborative Mobile Instant Messaging Learning (Self-efficacy)

Item	Descriptions	Mean	SD	Interpretation
1	Could use CMIML without assistance	3.36	1.073	High
2	Could use CMIML with help when stuck	3.94	.765	High
3	Could use CMIML if having a lot of time	3.86	1.089	High
4	Could use CMIML if resources adequate	4.17	.845	High
5	Could use CMIML with Build-In Aid	4.06	.826	High

Note : SD = Standard Deviation

Table 4.14 shows the findings of the lecturers' self-efficacy to use Collaborative Mobile Instant Messaging Learning (CMIML) in their formal class. Self-efficacy refers to the lecturers' perceptions about their own ability and the skills to use CMIML. The findings indicate that lecturers perceived that they could use CMIML without assistance. This is evidenced by the mean value of 3.36 (SD = 1.073) even though it is slightly high. However, the lecturers also need help to cope with CMIML as they were certain to use CMIML provided they have assistance when they got stuck (mean = 3.94, SD = .765). The lecturers also perceived that they could use CMIML if having a lot of time and the resources were adequate. These are evidenced by the high mean value of 3.86 (SD = 1.089) and 4.17 (SD = .845) respectively. Thus, the overall findings indicate that the lecturers have high level of self-efficacy in using CMIML as every item shows of high mean value.

Table 4.15

Acceptance and Intention to use Collaborative Mobile Instant Messaging Learning (Anxiety)

Item	Descriptions	Mean	SD	Interpretation
1	I would feel apprehensive using CMIML for this course	2.48	1.007	Moderate
2	I would afraid I could lose a lot of CMIML information by hitting a wrong key	2.39	1.009	Moderate
3	Using CMIML would be somewhat intimidating for me	2.20	1.033	Moderate

Note : SD = Standard Deviation

Table 4.15 shows the findings of lecturers' anxiety in implementing Collaborative Mobile Instant Messaging Learning (CMIML) in their formal class. Anxiety refers to lecturers' concerns about the uncertainty of what is expected of them in using CMIML. The findings revealed that the lecturers were not apprehensive about using CMIML for their courses. This is evidenced by the moderate mean value of 2.48 (SD = 1.007). The lecturers were also not afraid of facing the risk of using CMIML such as the loss of important information if they press a wrong key (mean = 2.39, SD = 1.009). Furthermore, they were not feel intimidating of using CMIML as evidenced of the mean value of 2.20 (SD = 1.033). Thus, the overall findings revealed that the lecturers were slightly concerns about their uncertainty to use CMIML in their courses.

Summary of findings of Phase 1

This chapter discussed the findings of the Need Analysis phase which is the first phase in the development of Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model. Based on the research questions of the study, the findings have revealed the lecturers' perception on their current ways of teaching and implementing ICT in teaching and learning. Even though the findings revealed that the lecturers interested to use ICT in teaching, a few of them will still continue using "chalk and talk" approach as they perceived it is still relevant to use. Nevertheless, they perceived that implementing ICT in teaching create many benefits in learning.

Next, this chapter also reported on the lecturers' access to mobile devices and capabilities of the devices. This is important since using appropriate mobile devices to implement mobile learning in formal classroom is an essential criteria in technology based education. The findings also revealed that lecturers owns at least more than one mobile technology devices which the devices have at least the minimum required mobile capabilities that could readily accommodate incorporation of CMIML. Other than that, the devices owned by the lecturers were furnished with supplementary data connections which were value added to mobile learning infrastructure. This is important to be investigated to ensure the implementation of mobile learning is efficiently conducted.

Finally, this chapter reported on the level of lecturers' acceptance and intention to use collaborative mobile instant messaging learning (CMIML) if incorporated into the formal course. These findings justified the need to implement CMIML to ensure active implementation of ICT in teaching and learning. According to the findings on lecturers' acceptance and intention to use CMIML, the overall result on all the key constructs (based on UTAUT model) concluded that the lecturers highly accepted CMIML as intervention in their teaching and thus form a positive attitude towards the use of ICT in teaching and learning.

Hence, the overall findings revealed that CMIML is feasible to be incorporated in the formal learning as the mobile devices and technology are readily accessible by lecturers. Furthermore, the positive response from the lecturers on the acceptance and intention to use CMIML in their formal course would justify the need to develop the CMIML Pedagogical Model as suggested in this study. Thus, teacher training institution such as Institute of Teacher Education Malaysia (IPGM) and other parties involved are expected to benefit from the results of this study which could improve the delivery of teaching and learning methods that are more efficient through planning in shaping the framework of the course better.

CHAPTER 5

FINDINGS OF PHASE 2: DESIGN AND DEVELOPMENT OF THE MODEL

Introduction

The second phase of the study is design and development of the model. This phase is the most important part of the three phases where the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical Model was developed. The model was developed according to the findings of the needs analysis in phase one of this study based on the lecturers' views. The findings revealed that the lecturers highly accepted CMIML as it is feasible to be incorporated in the formal learning since the mobile devices and technology are readily accessible by the lecturers. However, in this phase, the findings of the study constitute the result of the experts' collective views on the pedagogical activities and the relationships among the activities, which would be incorporated in the model.

Thus, the findings in this phase are presented to achieve the following research objectives:

1. To identify the appropriate pedagogical activities, which should be included in the development of the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model;
2. To determine the relationships among the pedagogical activities in the development of Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model;
3. To propose a structural model of Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model; and

4. To classify the pedagogical activities in the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model into various categories.

Table 5.1 is a summary that shows every step in the procedure of data analysis that is carried out according to the research objectives.

Table 5.1

Steps for Data Analysis According to Research Objectives

Research Objectives	Steps	Activities
1. To identify the appropriate pedagogical activities which should be included in the development of the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model.	1	Identifying the elements that are relevant to the problem or issue
2. To determine the relationships among the pedagogical activities in the development of Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model.	2	Determine the contextual relationship and relation phrase
3. To propose a structural model of Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model.	3	Develop a Structural Self-interaction Matrix (SSIM)
	4	Generate the ISM model
	5	Review of the model
	6	Presentation of the final model
4. To classify the pedagogical activities in Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model into various categories.	7	Classifying activities into different levels (Reachability Matrix)
	8	Classification of activities according to clusters (MICMAC Analysis)

Findings of the Design and Development Phase

The findings of this phase are discussed according to the research objectives which constitute of experts' collective views:

1. *Identifying the appropriate pedagogical activities, which should be included in the development of the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model*

   This section reported the findings of Step 1 in the procedure of developing the model which is identifying the appropriate pedagogical activities as the elements to be included in the model.

Findings of Step 1: Identifying the elements that are relevant to the problem or issues.

The experts' views on the elements were collected through two sessions which were the interview session and the Nominal Group Technique (NGT) session.

Interview session

The interview was conducted over three chosen experts to obtain relevant information and recommendations to develop the Pedagogical Model for Collaborative Mobile Instant Messaging Learning (CMIML). All the experts have expertise in various education disciplines to develop this model. The background information of the experts is shown in Table 5.2.

Table 5.2

Experts for interview session

Experts	Academic Qualification	Field	Working experience
E1	Doctor of Philosophy (PhD)	Instructional Technology and mobile learning	15 years
E2	Doctor of Philosophy (PhD)	Curriculum and instructional technology	10 years
E3	Doctor of Philosophy (PhD)	Educational technology and Information system	18 years

The first expert (E1) is a doctor of philosophy who has expertise in the field of instructional technology and mobile learning with the working experience of 15 years in a public university. The second expert (E2) is a lecturer at Department of Curriculum and Instructional Technology who has served for 10 years in the field of educational technology. The third expert (P3) is a Head of Department of Educational Technology who has conducted studies of instructional technology at the Institute of Teacher Education and has served for 18 years as a lecturer. All the experts have expertise in the field of technology, pedagogy, curriculum and education.

The findings of the interview with the experts have improved and suggested appropriate elements to be included in the CMIML pedagogical model. The preliminary findings had guided the panel of experts in Interpretive Structural Modelling (ISM) session to develop the CMIML pedagogical model for teacher training.

The results obtained from the interviews have found that there were some elements that should be included in the model development process. In addition to the Salmon Five-Stage Scaffolding Model of online teaching and learning and FRAME model some elements have been added and revised as appropriate in the context of teaching in our country. Experts argued that the reflection activities should be included in the primary constructs of the model in addition to the five initial constructs contained in the Salmon Five-Stage Scaffolding Model. This was stated by an expert (E1) which said that;

> *"........reflection activity is essential for any learning process. Usually the reflection activities are carried out at the end of the learning process. This will help the lecturer to know whether the learning objectives are achieved or not…"*

This was supported by E3 which according to him;

> *"......the activity of reflection can also be held throughout the learning process to ensure students are able to follow the lessons being taught. The activities may be conducted individually, through peer review or in groups. With this, students will be able to understand more about the topic or theme they are studying…."*

Based on the experts' opinions, the reflection activities are included in the initial list of elements to develop the model. Besides reflection activities, experts pointed out that the maintenance of a system is necessary in any teaching and learning process that is conducted online. This was stated by E2 which according to him;

" .…….when you're doing online learning, maintenance of the system among other things, should be considered. This is to ensure the teaching and learning process will be conducted without any disruptions….."

Due to the technology's tool used in this study is mobile devices particularly mobile instant messaging application, which does not involved any learning management system (LMS), maintenance of the system is not included as one of the elements in developing the model. Thus, the expert agreed that the element was modified to the awareness of any upgrading of the mobile instant messaging application as one of the elements in the model.

The results of the interviews that were conducted on three experts were then summarized in a list of elements for the development of CMIML Pedagogical Model for teacher training. Results found that there are 27 elements (pedagogical activities) that are appropriate and necessary in the development of the model. The preliminary list was then submitted to the expert groups in the Modified Nominal Group Technique (NGT) for the development of CMIML Pedagogical model for teacher training.

Modified Nominal Group Technique (NGT). Modified Nominal Group Technique (NGT) session involved a panel of experts selected based on their expertise in the context of this study. There were 10 experts being identified to deliver their views and opinions in developing the CMIML pedagogical model. The experts in the NGT session were the same experts for Interpretive Structural Modelling (ISM) session.

The panel of experts in NGT session had determined the list of suitable pedagogical activities to be included in the model. The results from the NGT session found that experts had consensually agreed on the 27 elements found in the interview session as a final list of pedagogical activities (refer to Appendix L) to develop the CMIML pedagogical model. The list of elements and the elaborations of each pedagogical activities suggested by experts are shown in able 5.3.

Table 5.3

List of Elements (Pedagogical Activities)

	Elements (Pedagogical Activities)	**Elaboration of the elements**
1	Lecturer specifies the course objectives clearly and how to make it achievable.	It is important to clarify the course objectives to make sure that students understand of what they will achieve at the end of the lesson and how it benefits them. This includes building the understanding on how being online can contribute to learning.
2	Lecturer guides the students to participate in the CMIML by providing user manual on basic technical skills such as downloading application for IOS or Android users.	The user manual will help the students who are unfamiliar with the selected application because the mobile learning skills of students might be varied.
3	Lecturer encourages the students to participate by warmly welcoming them to CMIML.	Warmly welcoming the students to the CMIML will increase their comfort with the use of mobile instant messaging learning. This includes building their understanding about why they are learning in this way and as well as what they have to do to take part.

Table 5.3 (Continued)

List of Elements (Pedagogical Activities)

	Elements (Pedagogical Activities)	Elaboration of the elements
4	Lecturer informs students the criteria of evaluation to enable them to be more active in discussion and know how to get better grade.	Students who are aware of how they are being assessed will engage more in the discussion and eventually create a livelier informative discussion.
5	Lecturer provides guideline etiquettes of using mobile instant messaging learning.	This element is important to ensure that students follow the rules and aware of the restrictions should they intend not to be serious during discussions.
6	Lecturer identifies mobile learners behaviours (the active learners, social participant learners and passive learners) in order to create a productive CMIML environment.	This element is important since understanding the mobile learners' characteristics will help the lecturer to plan appropriate approaches to implement during the lesson.
7	Lecturer assigns tasks and requires students to explore any relevant information available to them.	Lecturer should assign tasks that show students' ability to explore relevant information and will further help the students to gather the information related to the tasks given.

Table 5.3 (Continued)

List of Elements (Pedagogical Activities)

	Elements (Pedagogical Activities)	Elaboration of the elements
8	Lecturer promotes independent critical thinking by encouraging students to reflect on what they have learned and achieved.	Promoting critical thinking is an undeniably skill that need to be exercised especially in doing reflection. Students will be able to obtain, understand and analyze what they have learned and achieved on a much more efficient scale. Simultaneously, lecturer able to identify new knowledge created by students in mobile learning environment.
9	Lecturer develops standard criteria for assessing the students based on appropriate rubrics.	Choosing appropriate rubrics is important as it will determine the successful of this learning. A few rubrics for assessing the students are suggested such as follows: a) Task b) Knowledge c) Performance d) Skills/competencies
10	Lecturer always awares of any upgrading on the application to ensure that CMIML is up to date.	The awareness of any upgrading of the application will help the learning to run smoothly and lecturer can create more tasks or improve the given task applying to the upgrading.
11	Lecturer encourages peer review where students are able to compare their own self-reflection on their work to their peers.	Giving students the opportunity to review each other will help students to gain different perspectives on how their peers accomplished certain tasks. By analyzing the work of their peers, students will get ideas to improve their own works.

Table 5.3 (Continued)

List of Elements (Pedagogical Activities)

	Elements (Pedagogical Activities)	Elaboration of the elements
12	Lecturer promotes reflection on how students are going to implement the knowledge to the new situation.	This element will help the students to look for more benefits from the learning to help them achieve personal goals and reflect on the learning process. Other than that, it will further promote the students to think critically in order to cope with problems and obstacles they may face in other situation.
13	Lecturer makes sure the information in the tasks should be specific to initiate action and interaction.	Lecturer should know on how to assign the tasks with specific information since some of the students might not interested to read lengthy instructions and eventually confusion among students may occur. Furthermore, it is an appropriate approach since short and concise information is enough to initiate interaction when using mobile instant messaging application.
14	Lecturer assigns co-created tasks that promote idea sharing and collaboration among students.	This element involves both lecturer and students' initiatives to create task for collaborative learning. Furthermore, it initiates collaborative learning through scaffolding where the students can continually receive help from their lecturer or more capable peers.

Table 5.3 (Continued)

List of Elements (Pedagogical Activities)

	Elements (Pedagogical Activities)	Elaboration of the elements
15	Lecturer conducts e-monitoring from time to time to ensure students continuing engaged with CMIML.	Lecturer constantly interacts with the students by encouraging them to contribute in the discussion in order to maintain the group discussion. Furthermore, e-monitoring the discussion will overcome the problem with oversharing of information that sometimes not related to the task.
16	Lecturer selects the most suitable mobile instant messaging application to suit the purpose.	This element is important since each application has its own capabilities. The suitability of the application is important to be considered to avoid any application tools problems as many people notice the complexity of the technology only when it goes wrong.
17	Lecturer explicitly informs of expected roles for lecturer and students.	The lecturer has to make it very clear to the students of the roles and the amount of time they should allocate to involve in the conference.
18	Lecturer assigns leaders among students in each group to be second admin.	Assigning leaders in each group will help the students to self-monitoring of their own discussions and at the same time will give the opportunity for the students to be responsible of their own learning. Moreover, students will be more open to discuss since it will be monitored by their own friends.

Table 5.3 (Continued)

List of Elements (Pedagogical Activities)

	Elements (Pedagogical Activities)	Elaboration of the elements
19	Lecturer facilitates the tasks and discussion by encouraging the students to collaborate in completing the tasks.	This element promotes student-centred learning since the role of lecturer is only to facilitate the task where it allows the students to collaboratively create their own way to complete the tasks.
20	Lecturer ensures that a compatible and achieving community of CMIML is built for the purpose that is intended.	This element is important since each student has their own learning styles and different level of socialization. Lecturer has to help the students to understand the value of working together despite of any differences they have in order to build a compatible community of CMIML.
21	Lecturer summarizes the discussion from time to time or according to themes.	Summarizing the discussion will deliberately make the students to be alert of what they have learnt. Furthermore, lecturer needs to give constant feedback on how their learning is progressing and suggest what changes they need to make.
22	Lecturer stimulates fresh strands of ideas by introducing new themes and suggesting alternative approaches when discussions go off track.	Lecturer builds students' knowledge by encouraging exploration and interpretation of wider issues that may challenge the students to a series of ideas in developing interesting discussions.

Table 5.3 (Continued)

List of Elements (Pedagogical Activities)

	Elements (Pedagogical Activities)	Elaboration of the elements
23	Lecturer conducts survey to know the availability and the accessibility of the application selected.	Conducting the survey will ensure that the learning run smoothly since some of the students might not have their own mobile data and they are relying solely on Wi-Fi to access the internet. Furthermore, each institution has different restriction in using public Wi-Fi for an instance; some institutions have applied limited bandwidth for each student to control the use of Wi-Fi.
24	Lecturer ensures that the tasks focus on exploring aspects of information familiar to students in order for them to easily retrieve it.	This element will help the students to productively explore the information since they are familiar with it and can be retrieved easily. This will eventually reduce the numbers of lurking members in the group since each student has their own experiences to explore.
25	Lecturer ensures that the social side of conferencing keeps on being available for any students who enjoy it.	In order to build trust among students, socialization is important as it is the way of exploring and understanding each other behaviours especially the ability to work together in a group. Nevertheless, lecturer has to monitor the discussions should they go over the limit.

Table 5.3 (Continued)

List of Elements (Pedagogical Activities)

	Elements (Pedagogical Activities)	Elaboration of the elements
26	Lecturer supports the use of learning materials both in digital or hardcopy by encouraging links sharing of information among students inside or outside closed conferences.	This element is to encourage the students to work collaboratively by sharing information and knowledge through other learning resources such as websites, videos and others. Sharing information can promote active collaboration activities as they build their trusts as group members.
27	Lecturer highlights or 'starred' the good point of any beneficial information or discussion to promote motivation.	This element is to acknowledge the students for their contributions and as an evident that their discussions are being thoroughly monitored. This will motivate them to contribute more in the discussion.

The elements or the pedagogical activities were then being ranked as it is one of the important procedures that must be conducted before the ISM session. Table 5.4 shows the ranking and prioritization of the pedagogical activities based on the experts' individual voting decision which was ranked based on experts' preference on the scale of 1 to 7 as the following:

1 = Least favourable　　5 = Very favourable

2 = Slightly favourable　　6 = Highly favourable

3 = Moderately favourable　　7 = Most favourable

4 = Favourable

Table 5.4

Ranking and Prioritization of Elements (Pedagogical Activities)

Elements (Pedagogical Activities)	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	Total	Ranking
1. Lecturer guides the students to participate in the CMIML by providing user manual on basic technical skills such as downloading application for IOS or Android users.	7	6	7	7	6	6	6	7	7	6	65	2
2. Lecturer encourages the students to participate by warmly welcoming them to CMIML.	7	6	5	6	7	7	7	7	7	6	65	3
3. Lecturer specifies the course objectives clearly and how to make it achievable.	7	7	7	6	7	7	7	7	6	6	67	1
4. Lecturer conducts survey to know the availability and the accessibility of the application selected.	5	5	4	6	7	5	5	7	7	4	55	23
5. Lecturer selects the most suitable mobile instant messaging application to suit the purpose.	5	7	7	7	6	7	6	3	6	5	59	16
6. Lecturer provides guideline etiquettes of using mobile instant messaging learning.	7	7	7	7	6	7	7	4	6	6	64	5

Table 5.4 (Continued)

Ranking and Prioritization of Elements (Pedagogical Activities)

Elements (Pedagogical Activities)	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	Total	Ranking
7. Lecturer explicitly informs of expected roles for lecturer and students.	7	7	7	7	6	4	7	3	7	4	59	17
8. Lecturer ensures that a compatible and achieving community of CMIML is built for the purpose that is intended.	7	5	5	6	5	7	5	7	6	4	57	20
9. Lecturer ensures that the social side of conferencing keeps on being available for any students who enjoy it.	6	5	4	7	5	3	5	6	6	6	53	25
10. Lecturer identifies mobile learners behaviours (the active learners, social participant learners and passive learners) in order to create a productive CMIML environment.	7	6	6	7	5	7	5	6	7	7	63	6
11. Lecturer assigns leaders among students in each group to be second admin.	7	7	4	7	7	4	7	6	6	4	59	18

Table 5.4 (Continued)

Ranking and Prioritization of Elements (Pedagogical Activities)

Elements (Pedagogical Activities)	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	Total	Ranking
12. Lecturer assigns tasks and requires students to explore any relevant information available to them.	7	6	4	7	6	7	7	6	7	6	63	7
13. Lecturer makes sure the information in the tasks should be specific to initiate action and interaction.	7	6	5	6	6	7	6	6	6	5	60	13
14. Lecturer assigns co-created tasks that promote idea sharing and collaboration among students.	7	6	4	6	6	7	7	7	5	5	60	14
15. Lecturer facilitates the tasks and discussion by encouraging the students to collaborate in completing the tasks.	7	6	5	6	6	7	7	6	5	4	59	19
16. Lecturer supports the use of learning materials both in digital or hardcopy by encouraging links sharing of information among students inside or outside closed conferences.	6	5	7	7	5	7	6	2	6	2	53	26

Table 5.4 (Continued)

Ranking and Prioritization of Elements (Pedagogical Activities)

Elements (Pedagogical Activities)	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	Total	Ranking
17. Lecturer ensures that the tasks focus on exploring aspects of information familiar to students in order for them to easily retrieve it.	7	6	5	7	5	7	5	6	5	2	55	24
18. Lecturer highlights or 'starred' the good point of any beneficial information or discussion to promote motivation.	6	6	6	6	5	6	5	6	5	2	53	27
19. Lecturer summarizes the discussion from time to time or according to themes.	6	5	7	7	4	7	5	7	5	4	57	21
20. Lecturer conducts e-monitoring from time to time to ensure students continuing engaged with CMIML.	7	6	7	6	5	7	6	7	5	4	60	15
21. Lecturer stimulates fresh strands of ideas by introducing new themes and suggesting alternative approaches when discussions go off track.	6	5	7	6	4	5	7	7	5	5	57	22

Table 5.4 (Continued)

Ranking and Prioritization of Elements (Pedagogical Activities)

Elements (Pedagogical Activities)	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	Total	Ranking
22. Lecturer encourages peer review where students are able to compare their own self-reflection on their work to their peers.	7	5	5	7	5	6	7	7	6	6	61	11
23. Lecturer promotes independent critical thinking by encouraging students to reflect on what they have learned and achieved.	7	6	7	6	4	6	7	7	7	6	63	8
24. Lecturer promotes reflection on how students are going to implement the knowledge to the new situation.	7	6	7	6	4	5	7	7	6	6	61	12
25. Lecturer develops standard criteria for assessing the students based on appropriate rubrics.	7	5	7	7	5	7	7	7	5	6	63	9
26. Lecturer informs students the criteria of evaluation to enable them to be more active and know how to get better grade.	6	6	7	7	6	7	7	7	6	6	65	4
27. Lecturer always awares of any upgrading on the application to ensure that CMIML is up to date.	7	6	6	6	5	6	7	7	6	6	62	10

The ranking numbers determined the priority value for the pedagogical activities. Based on the priority value shown in Table 5.4, the pedagogical activities were arranged as shown in Table 5.5.

Table 5.5

List of Pedagogical Activities Based on Ranking

Ranking	Elements / Pedagogical Activities
1	Lecturer specifies the course objectives clearly and how to make it achievable.
2	Lecturer guides the students to participate in the CMIML by providing user manual on basic technical skills such as downloading application for IOS or Android users.
3	Lecturer encourages the students to participate by warmly welcoming them to CMIML.
4	Lecturer informs students the criteria of evaluation to enable them to be more active in discussion and know how to get better grade.
5	Lecturer provides guideline etiquettes of using mobile instant messaging learning.
6	Lecturer identifies mobile learners behaviours (the active learners, social participant learners and passive learners) in order to create a productive CMIML environment.
7	Lecturer assigns tasks and requires students to explore any relevant information available to them.
8	Lecturer promotes independent critical thinking by encouraging students to reflect on what they have learned and achieved.
9	Lecturer develops standard criteria for assessing the students based on appropriate rubrics.
10	Lecturer always awares of any upgrading on the application to ensure that CMIML is up to date.
11	Lecturer encourages peer review where students are able to compare their own self-reflection on their work to their peers.

Table 5.5 (Continued)

List of Pedagogical Activities Based on Ranking

Ranking	Elements / Pedagogical Activities
12	Lecturer promotes reflection on how students are going to implement the knowledge to the new situation.
13	Lecturer makes sure the information in the tasks should be specific to initiate action and interaction.
14	Lecturer assigns co-created tasks that promote idea sharing and collaboration among students.
15	Lecturer conducts e-monitoring from time to time to ensure students continuing engaged with CMIML.
16	Lecturer selects the most suitable mobile instant messaging application to suit the purpose.
17	Lecturer explicitly informs of expected roles for lecturer and students.
18	Lecturer assigns leaders among students in each group to be second admin.
19	Lecturer facilitates the tasks and discussion by encouraging the students to collaborate in completing the tasks.
20	Lecturer ensures that a compatible and achieving community of CMIML is built for the purpose that is intended.
21	Lecturer summarizes the discussion from time to time or according to themes.
22	Lecturer stimulates fresh strands of ideas by introducing new themes and suggesting alternative approaches when discussions go off track.
23	Lecturer conducts survey to know the availability and the accessibility of the application selected.
24	Lecturer ensures that the tasks focus on exploring aspects of information familiar to students in order for them to easily retrieve it.
25	Lecturer ensures that the social side of conferencing keeps on being available for any students who enjoy it.

Table 5.5 (Continued)

List of Pedagogical Activities Based on Ranking

Ranking	Elements / Pedagogical Activities
26	Lecturer supports the use of learning materials both in digital or hardcopy by encouraging links sharing of information among students inside or outside closed conferences.
27	Lecturer highlights or 'starred' the good point of any beneficial information or discussion to promote motivation.

The pedagogical activities then were inserted in the ISM computer software (Concept Star) according to the above priority list. According to the list, 'Lecturer specifies the course objectives clearly and how to make it achievable' was in the top of the list whereas 'Lecturer highlights or 'starred' the good point of any beneficial information or discussion to promote motivation' were found to be at the bottom of the list. According to Janes (1988), the most important element should lead the pairing with other elements during the ISM session. Thus, the priority list was generated during the NGT session.

2. *Determine the relationships among the pedagogical activities*

This section reported the findings on the Step 2 of the procedure in this phase where the contextual relationship phrase and the relation phrase among the pedagogical activities were determined. The findings also answered to the second research objective in this phase which is to determine the relationships among the pedagogical activities in the development of Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model.

Findings from Step 2: Contextual Relationship Phrase and Relation Phrase

Referring to the pedagogical activities agreed during the NGT session, 'Priority Structural' were applied to build the contextual relationship among the activities to guide through the SSIM process. Therefore, the phrase 'In order to produce an appropriate collaborative mobile instant messaging learning, the pedagogical activity,…' was agreed as a contextual relationship phrase. Whereas, the experts agreed to the pedagogical activity 'i' MUST be conducted BEFORE pedagogical activity 'j' to be the relation phrase to relate the elements of the model.

3. *Structural model of Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical Model*

This section reported on the findings of development of the model through a few steps mentioned in the procedure in the methodology section. The findings in the steps answered to the third research objective of this phase which is to propose a structural model of Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical Model.

Findings from Step 3 and 4: Development of the model

These steps were the process of designing and developing the CMIML Pedagogical model based on experts' decisions during the NGT session. They were aided with the ISM computer software, 'Concept Star' as mentioned in the methodology. The model aimed to serve as a guide for the lecturers to implement mobile instant messaging in their teaching and learning. Although it could be used to deliver full course, this model was designed to complement the formal classroom learning.

The development of the model was designed based on the views of selected experts in order to produce an appropriate collaborative mobile instant messaging learning. Based on their collective decisions on selected elements during NGT sessions and the ‘relation phase’ and ‘contextual relationship phase’ from step 2, the ISM pedagogical model for CMIML was developed as shown in Figure 5.1. However, the model was not yet finalized and to be reviewed and modified if necessary by the experts. This process will be conducted in Steps 5 and 6 of this phase.

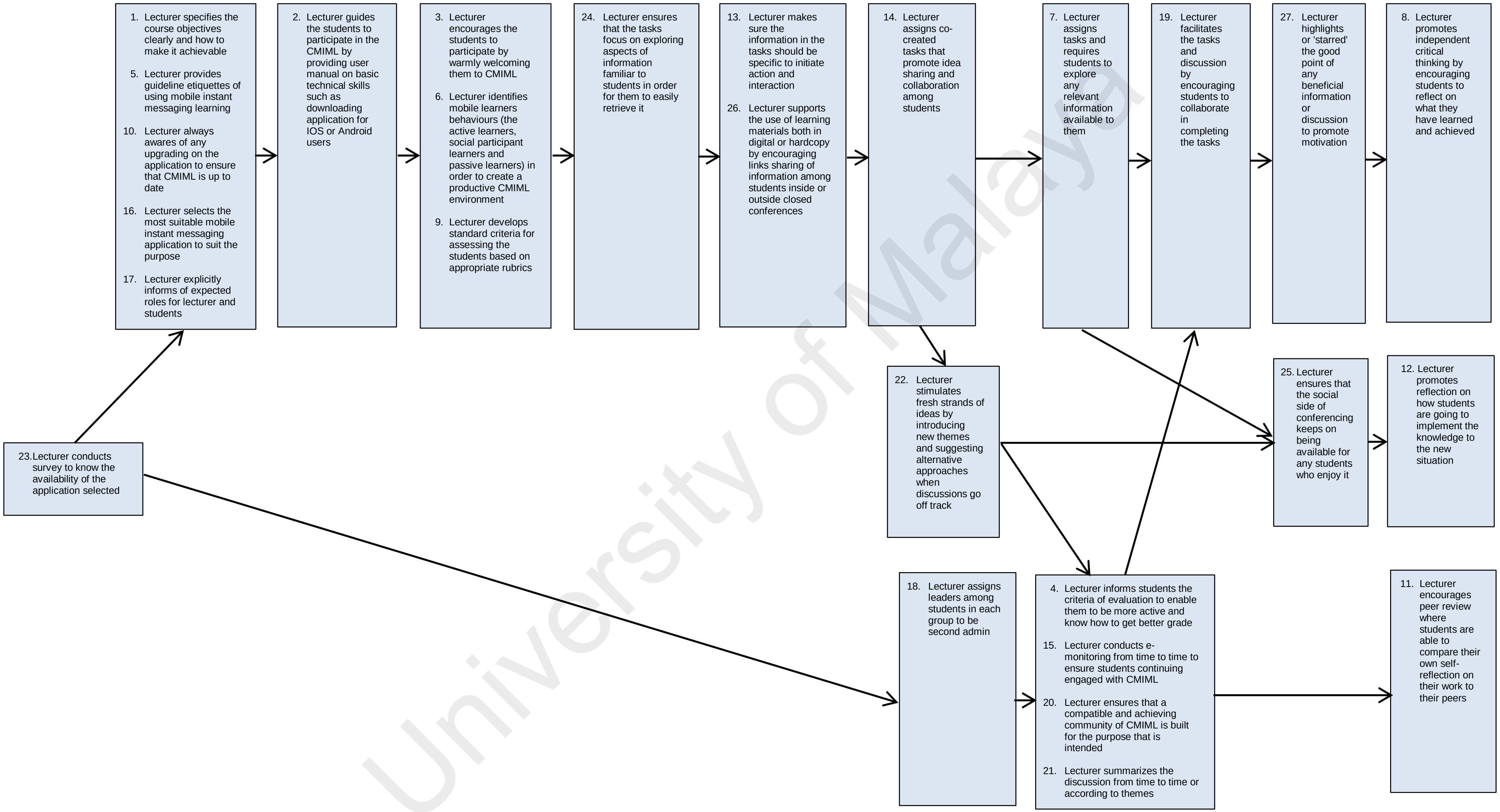


Figure 5.1 Interpretive Structural Modelling (ISM) based Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical Model for Teacher Training

Findings from Steps 5 and 6: Review and Presentation of the Model

These steps were the stage where the model was presented to go through the review process. During the presentation, experts were allowed to give their feedbacks and proposed amendments if necessary to the model.

Referring to Figure 5.1, a few experts proposed that pedagogical activity 18 (Lecturer assigns leaders among students in each group to be second admin) should be connected in the initial stage of the model and not as a separated element which linked directly from pedagogical activity 23 (Lecturer conducts survey to know the availability of the application selected). However, majority of the experts viewed that pedagogical activity 18 (Lecturer assigns leaders among students in each group to be second admin) can be conducted directly as it lead the other pedagogical activities to the end of the whole activities. Thus, pedagogical activity 18 remained its position as it is.

Experts also consensually agreed that the pedagogical activity 8 (Lecturer promotes independent critical thinking by encouraging students to reflect on what they have learned and achieved), pedagogical activity 11 (Lecturer encourage peer review where students are able to compare their own self-reflection on their work to their peers) and pedagogical activity 12 (Lecturer promotes reflection on how students are going to implement the knowledge to the new situation) can be conducted separately. Even though activities 8, 11 and 12 are belongs to the same criteria, which are reflection activities, experts believe that lecturer can choose to conduct any one of the activities at the end of the course.

After reviewing the relationships in each element in the model, the panel of experts agreed to maintain the model developed by the ISM software. Since there was no amendment needed, the process of regenerating the model using the ISM software was not conducted.

Finally, the experts proposed to divide the model into five pedagogical activities which are the Initial Pedagogical Activities, the Knowledge Construction Activities, the Collaborative Development Activities, the e-Monitoring Activities and the Reflection Activities. The Initial Pedagogical activities consists of pedagogical activities 1, 2, 3, 5, 6, 9, 10, 16, 17 and 23 that aid the lecturers on preparing the course. The Knowledge Construction activities that consist of pedagogical activities 13, 24 and 26 guide the lecturer to assign appropriate tasks. The Collaboration Development activities (Pedagogical activities 7, 14, 19 and 27) help the students to collaborate accordingly. The e-Monitoring activities comprise of pedagogical activities 4, 15, 18, 20, 21, 22, and 25 which helps the lecturers to monitor the students' activities in order to ensure that the CMIML is conducted smoothly. Finally, the reflection activities that consist of pedagogical activities 8, 11, and 12 conclude the learning through CMIML by offering the opportunity for the students to express themselves to the learning experienced by them. Table 5.6 shows the pedagogical activities according to the five domains.

Table 5.6

Pedagogical Activities According to Domains

Domain		Pedagogical Activities
Intitial Pedagogical Activities	1.	Lecturer specifies the course objectives clearly and how to make it achievable.
	2.	Lecturer guides the students to participate in the CMIML by providing user manual on basic technical skills such as downloading application for IOS or Android users.
	3.	Lecturer encourages the students to participate by warmly welcoming them to CMIML.
	5.	Lecturer provides guideline etiquettes of using mobile instant messaging learning.
	6.	Lecturer identifies mobile learners behaviours (the active learners, social participant learners and passive learners) in order to create a productive CMIML environment.
	9.	Lecturer develops standard criteria for assessing the students based on appropriate rubrics.
	10.	Lecturer always aware of any upgrading on the application to ensure that CMIML is up to date.
	16.	Lecturer selects the most suitable mobile instant messaging application to suit the purpose.
	17.	Lecturer explicitly informs of expected roles for lecturer and students.
	23.	Lecturer conducts survey to know the availability and the accessibility of the application selected.

Table 5.7 (Continued)

Pedagogical Activities According to Domains

Domain		Pedagogical Activities
Knowledge Construction Activities	13.	Lecturer makes sure the information in the tasks should be specific to initiate action and interaction.
	24.	Lecturer ensures that the tasks focus on exploring aspects of information familiar to students in order for them to easily retrieve it.
	26.	Lecturer supports the use of learning materials both in digital or hardcopy by encouraging links sharing of information among students inside or outside closed conferences.
Collaboration Development Activities	7.	Lecturer assigns tasks and requires students to explore any relevant information available to them.
	14.	Lecturer assigns co-created tasks that promote idea sharing and collaboration among students.
	19.	Lecturer facilitates the tasks and discussion by encouraging students to collaborate in completing the tasks.
	27.	Lecturer highlights or 'starred'the good point of any beneficial information or discussion to promote motivation.

Table 5.8 (Continued)

Pedagogical Activities According to Domains

Domain	Pedagogical Activities
E-Monitoring Activities	4. Lecturer informs students the criteria of evaluation to enable them to be more active in discussion and know how to get better grade.
	15. Lecturer conducts e-monitoring from time to time to ensure students continuing engaged with CMIML.
	18. Lecturer assigns leaders among students in each group to be second admin.
	20. Lecturer ensures that a compatible and achieving community of CMIML is built for the purpose that is intended.
	21. Lecturer summarizes the discussion from time to time or according to themes.
	22. Lecturer stimulates fresh strands of ideas by introducing new themes and suggesting alternative approaches when discussions go off track.
	25. Lecturer ensures that the social side of conferencing keeps on being available for any students who enjoy it.

Table 5.9 (Continued)

Pedagogical Activities According to Domains

Domain		Pedagogical Activities
Reflection Activities	8.	Lecturer promotes independent critical thinking by encouraging students to reflect on what they have learned and achieved.
	11.	Lecturer encourages peer review where students are able to compare their own self-reflection on their work to their peers.
	12.	Lecturer promotes reflection on how students are going to implement the knowledge to the new situation.

Therefore, based on the experts' decision to divide the pedagogical activities into the domains, the final CMIML Pedagogical model for teacher training is shown in Figure 5.2.

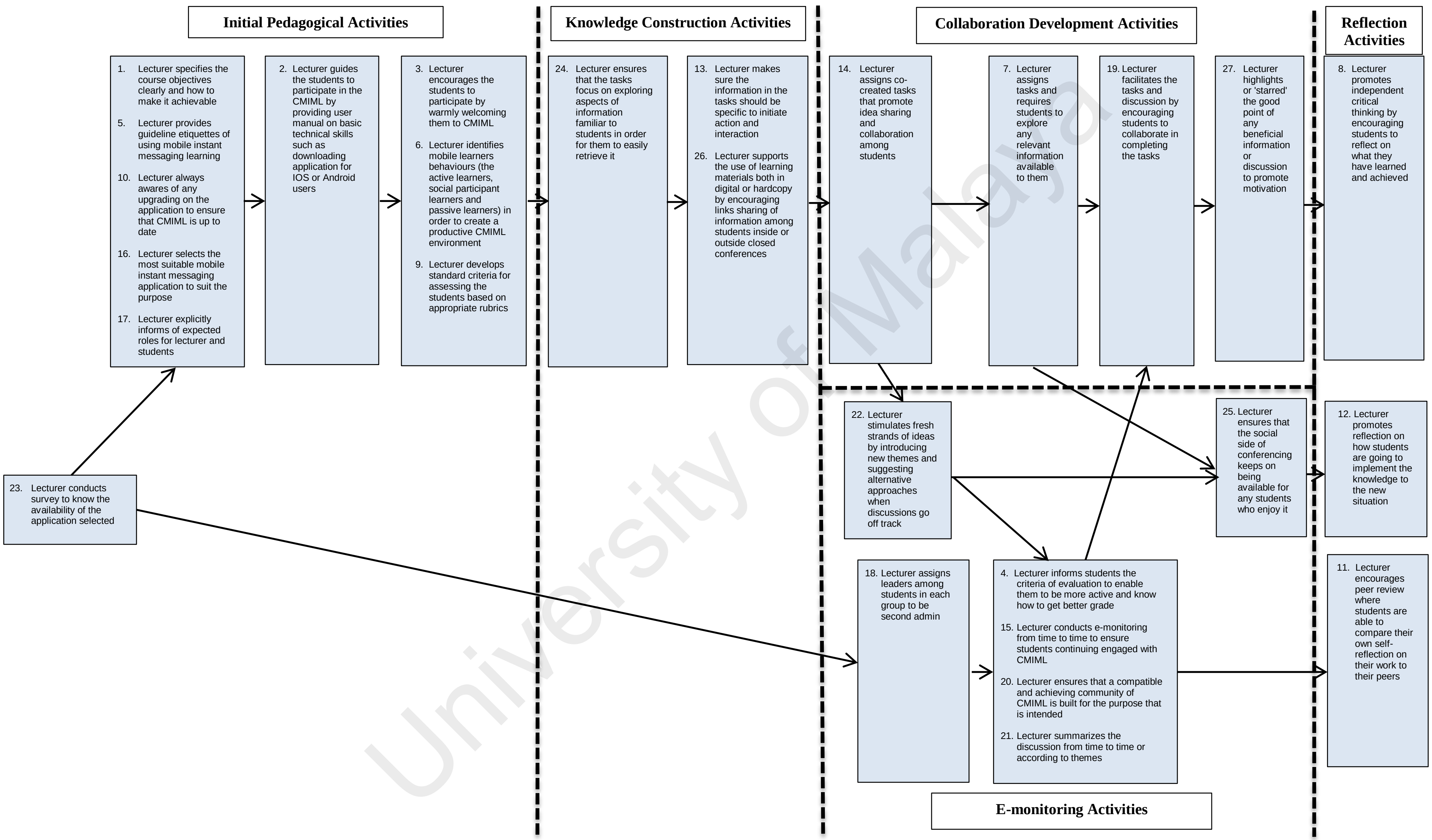


Figure 5.2 Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical Model for Teacher Training

Based on the contextual and the relation phrase as mentioned in findings of Step 2, the arrows in Figure 5.2 indicate the flow from one activity to another as groups of activities in sequence. However, the activities that share a single box such as pedagogical activities 1, 5, 10, 16, 17 and 3, 6, 9 indicate that the activities could be conducted in any sequence or concurrently as the activities complement each other.

10. Classifying the pedagogical activities in the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical Model into various categories

The findings in the steps onwards explain on how the CMIML Pedagogical model could be further interpreted. This section reports the findings for step 7, 8, and 9 of the procedures and to answer the fourth research objective which is to interpret the model by defining the driving power and dependence power of each activity in the model.

Findings from Step 7: Classifying the activities into different levels

The pedagogical activities were classified into different levels by defining the driving power and the dependence power of each activity. Driving power is the power driving elements or other activities in achieving the goals and objectives by itself (Mohd Ridhuan Tony, Saedah Siraj, & Zaharah Hussin, 2014). The dependence power is the power that depends on other powers to achieve certain goals and objectives. Thus, in order to explain the driving power and the dependence power of each element in the model, the reachability matrix for the pedagogical activities was developed as shown in Table 5.7.

Table 5.10.

Reachability Matrix

PA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	DP
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	25
2	0	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	0	0	1	1	1	1	0	1	1	1	1	20
3	0	0	1	1	0	1	1	1	1	0	1	1	1	1	1	0	0	0	1	1	1	1	0	1	1	1	1	19
4	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	1	8
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	25
6	0	0	1	1	0	1	1	1	1	0	1	1	1	1	1	0	0	0	1	1	1	1	0	1	1	1	1	19
7	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	6
8	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
9	0	0	1	1	0	1	1	1	1	0	1	1	1	1	1	0	0	0	1	1	1	1	0	1	1	1	1	19
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	25
11	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
12	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
13	0	0	0	1	0	0	1	1	0	0	1	1	1	1	1	0	0	0	1	1	1	1	0	0	1	1	1	15
14	0	0	0	1	0	0	1	1	0	0	1	1	0	1	1	0	0	0	1	1	1	1	0	0	1	0	1	13
15	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	1	8
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	25
17	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	25
18	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	0	1	1	1	1	0	0	0	0	0	1	9
19	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	3
20	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	1	8
21	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	1	8
22	0	0	0	1	0	0	0	1	0	0	1	1	0	0	1	0	0	0	1	1	1	1	0	0	1	0	1	11
23	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	27
24	0	0	0	1	0	0	1	1	0	0	1	1	1	1	1	0	0	0	1	1	1	1	0	1	1	1	1	16
25	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
26	0	0	0	1	0	0	1	1	0	0	1	1	1	1	1	0	0	0	1	1	1	1	0	0	1	1	1	15
27	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
DEP	6	7	10	20	6	10	15	24	10	6	21	18	13	14	20	6	6	2	22	20	20	15	1	11	17	13	23	

Note: PA – Pedagogy Activities; DP – Driving Power; DEP – Dependent Power

Based on the reachability matrix shown in Table 5.7, the total number shown at the end of the horizontal axis represents the driving power for each activity. It is the total number of all pedagogical activities that may help to achieve including itself. Whereas, in the vertical axis, the total number shown represents the dependence power of each activity. It is the total number of pedagogical activities (including itself), which may help achieve it. For example, the driving power for activity 23 is the highest which is 27. This means that this pedagogical activity must be conducted first before any other elements. Whereas the dependence power of activity 23 is very low which is 1. This means that activity 23 does not depend on other elements to achieve its goal and objective. In contrary, the driving power for each activity 8, 11, and 12 is only ‘1’. This indicates that those activities have the lowest driving power which means that the activities should be conducted last after other activities.

Based on the reachability matrix in Table 5.7, the pedagogical activities are partitioned according to levels of influence. The partitioning is based on the reachability and antecedent set for each pedagogical activity as shown in Table 5.8. The reachability set consist the element itself and the other elements, which it may help achieve, whereas the antecedent set consists of the element itself and the other elements that may help in achieving it. When ISM is conducted manually without the software, the partitioning of reachability matrix is essential to develop the model by the grouping the elements based on the levels. Even though the model in this study was developed with the aid of the ISM software, this partition level of pedagogical activities was still being used to guide in the mapping of the activities in the model.

Table 5.11

Partitioning of Reachability Matrix

Pedagogy Activity	Reachability Set	Antecedent Set	Intersection	Level
1	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,19,20,21,22,24,25,26,27	1,5,10,16,17,23	1,5,10,16,17	13
2	2,3,4,6,7,8,9,11,12,13,14,15,19,20,21,22,24,25,26,27	1,2,5,10,16,17,23	2	12
3	3,4,6,7,8,9,11,12,13,14,15,19,20,21,22,24,25,26,27	1,2,3,5,6,9,10,16,17,23	3,6,9	11
4	4,8,11,15,19,20,21,27	1,2,3,4,5,6,9,10,13,14,15,16,17,18,20,21,22,23,24,26	4,15,20,21	5
5	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,19,20,21,22,24,25,26,27	1,5,10,16,17,23	1,5,10,16,17	13
6	3,4,6,7,8,9,11,12,13,14,15,19,20,21,22,24,25,26,27	1,2,3,5,6,9,10,16,17,23	3,6,9	11
7	7,8,12,19,25,27	1,2,3,5,6,7,9,10,13,14,16,17,23,24,26	7	4
8	8	1,2,3,4,5,6,7,8,9,10,13,14,15,16,17,18,19,20,21,22,23,24,26,27	8	1
9	3,4,6,7,8,9,11,12,13,14,15,19,20,21,22,24,25,26,27	1,2,3,5,6,9,10,16,17,23	3,6,9	11
10	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,19,20,21,22,24,25,26,27	1,5,10,16,17,23	1,5,10,16,17	13
11	11	1,2,3,4,5,6,9,10,11,13,14,15,16,17,18,20,21,22,23,24,26	11	1
12	12	1,2,3,5,6,7,9,10,12,13,14,16,17,22,23,24,25,26	12	1
13	4,7,8,11,12,13,14,15,19,20,21,22,25,26,27	1,2,3,5,6,9,10,13,16,17,23,24,26	13	9
14	4,7,8,11,12,14,15,19,20,21,22,25,27	1,2,3,5,6,9,10,13,14,16,17,23,24,26	14	8
15	4,8,11,15,19,20,21,27	1,2,3,4,5,6,9,10,13,14,15,16,17,18,20,21,22,23,24,26	4,15,20,21	5
16	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,19,20,21,22,24,25,26,27	1,5,10,16,17,23	1,5,10,16,17	13
17	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,19,20,21,22,24,25,26,27	1,5,10,16,17,23	1,5,10,16,17	13

Table 5.8 (Continued)

Partitioning of Reachability Matrix

Pedagogy Activity	Reachability Set	Antecedent Set	Intersection	Level
18	4,8,11,15,18,19,20,21,27	18,23	18	6
19	8,19,27	1,2,3,4,5,6,7,9,10,13,14,15,16,17,18,19,20,21,22,23,24,26	19	3
20	4,8,11,15,19,20,21,27	1,2,3,4,5,6,9,10,13,14,15,16,17,18,20,21,22,23,24,26	4,15,20,21	5
21	4,8,11,15,19,20,21,27	1,2,3,4,5,6,9,10,13,14,15,16,17,18,20,21,22,23,24,26	4,15,20,21	5
22	4,8,11,12,15,19,20,21,22,25,27	1,2,3,5,6,9,10,13,14,16,17,22,23,24,26	22	7
23	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27	23	23	14
24	4,7,8,11,12,13,14,15,19,20,21,22,24,25,26,27	1,2,3,5,6,9,10,16,17,23,24	24	10
25	12,25	1,2,3,5,6,7,9,10,13,14,16,17,22,23,24,25,26	25	2
26	4,7,8,11,12,13,14,15,19,20,21,22,25,26,27	1,2,3,5,6,9,10,13,16,17,23,24,26	13	9
27	8,27	1,2,3,4,5,6,7,9,10,11,13,14,15,16,17,18,19,20,22,23,24,26,27	27	2

As indicated in Table 5.8, the influence level of each pedagogical activity is determined based on its reachability set and antecedent set. There are 14 levels of pedagogical activities with activities 8, 11 and 12 are at level 1 and the other end is activity 23 at level 14. Level 1 is the lowest level and level 14 is the highest level. In order to indicate the hierarchy of the pedagogical activities clearly based on the level partitions, the activities are rearranged based on the levels as shown in Table 5.9.

Table 5.12

Level Partition of Reachability Matrix

Activity	Pedagogy Activities	Level
8	Lecturer promotes independent critical thinking by encouraging students to reflect on what they have learned and achieved.	1
11	Lecturer encourages peer review where students are able to compare their own self-reflection on their work to their peers.	
12	Lecturer promotes reflection on how students are going to implement the knowledge to the new situation.	
25	Lecturer ensures that the social side of conferencing keeps on being available for any students who enjoy it.	2
27	Lecturer highlights or ‘starred’ the good point of any beneficial information or discussion to promote motivation.	
19	Lecturer facilitates the tasks and discussion by encouraging the students to collaborate in completing the tasks.	3
7	Lecturer assigns tasks and requires students to explore any relevant information available to them.	4
4	Lecturer informs students the criteria of evaluation to enable them to be more active in discussion and know how to get better grade.	5
15	Lecturer conducts e-monitoring from time to time to ensure students continuing engaged with CMIML.	
20	Lecturer ensures that a compatible and achieving community of CMIML is built for the purpose that is intended.	
21	Lecturer summarizes the discussion from time to time or according to themes.	

Table 5.9 (Continued)

Level Partition of Reachability Matrix

Activity	Pedagogy Activities	Level
18	Lecturer assigns leaders among students in each group to be second admin.	6
22	Lecturer stimulates fresh strands of ideas by introducing new themes and suggesting alternative approaches when discussions go off track.	7
14	Lecturer assigns co-created tasks that promote idea sharing and collaboration among students.	8
13	Lecturer makes sure the information in the tasks should be specific to initiate action and interaction.	9
26	Lecturer supports the use of learning materials both in digital or hardcopy by encouraging links sharing of information among students inside or outside closed conferences.	9
24	Lecturer ensures that the tasks focus on exploring aspects of information familiar to students in order for them to easily retrieve it.	10
3	Lecturer encourages the students to participate by warmly welcoming them to CMIML.	11
6	Lecturer identifies mobile learners behaviours (the active learners, social participant learners and passive learners) in order to create a productive CMIML environment.	11
9	Lecturer develops standard criteria for assessing the students based on appropriate rubrics.	11

Table 5.9 (Continued)

Level Partition of Reachability Matrix

Activity	Pedagogy Activities	Level
2	Lecturer guides the students to participate in the CMIML by providing user manual on basic technical skills such as downloading application for IOS or Android users.	12
1	Lecturer specifies the course objectives clearly and how to make it achievable.	13
5	Lecturer provides guideline etiquettes of using mobile instant messaging learning.	
10	Lecturer should be aware of any upgrading on the application to ensure that CMIML is up to date.	
16	Lecturer selects the most suitable mobile instant messaging application to suit the purpose.	
17	Lecturer explicitly informs of expected roles for lecturer and students.	
23	Lecturer conducts survey to know the availability and the accessibility of the application selected.	14

Based on Table 5.9, this level partition of reachability matrix is used to help in the mapping of the activities in the CMIML pedagogical model. Figure 5.3 indicates the hierarchy of the pedagogical activities based on the level partitions where the activities were arranged according to the levels.

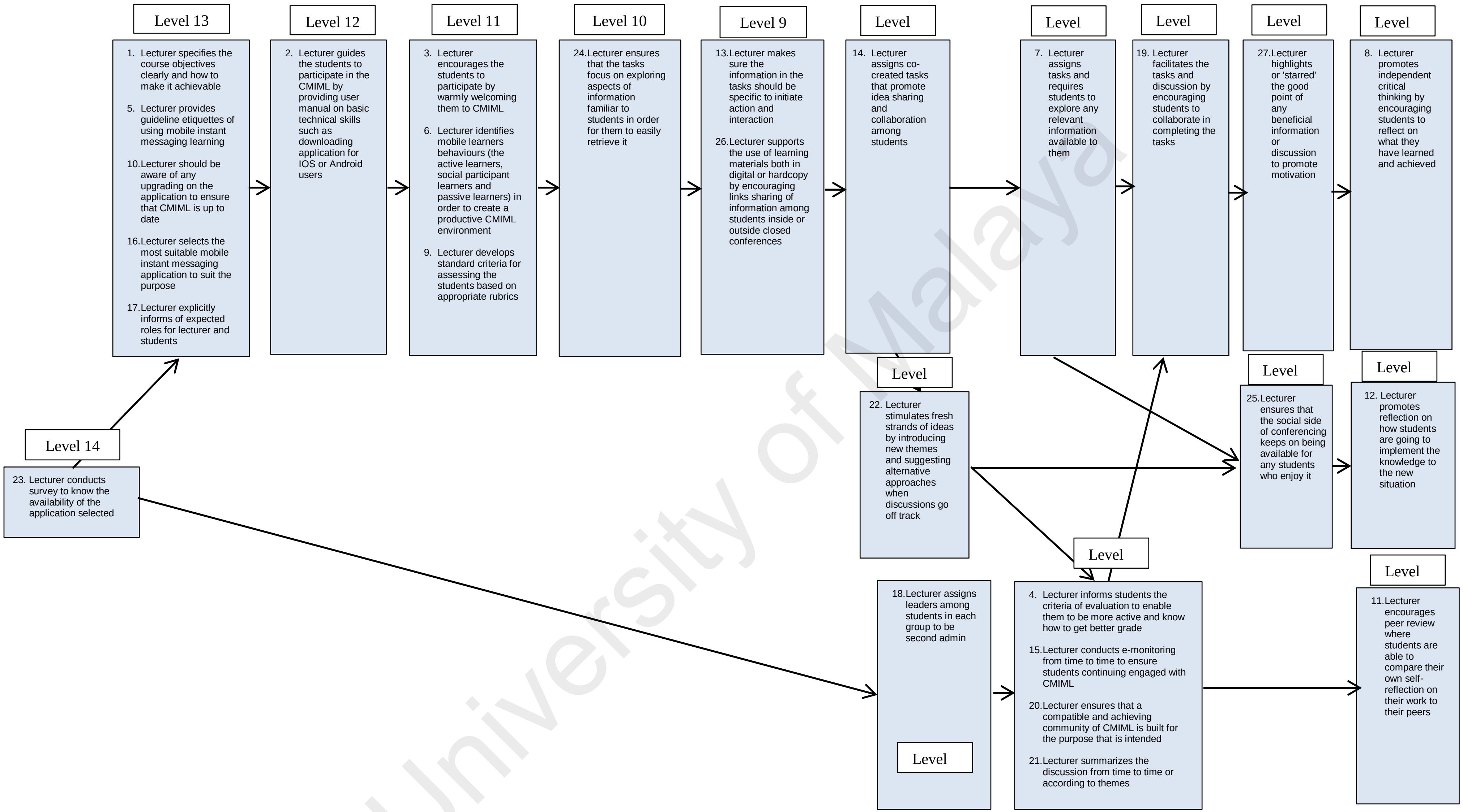


Figure 5.3 Partition of Pedagogical Activities According to Levels

Findings from Step 8: Classification of Activities According to Clusters

Finally, the pedagogical activities are further classified according to clusters based on their driving power and dependence power using MICMAC (Cross-impact multiplication applied to classification) analysis. The aim of this classification is to analyze the driving power and dependence power of each activity. The classification is divided into four clusters; a) Autonomous activities; b) Dependent activities; c) Linkage activities; and d) Independent activities.

The pedagogical activities which are categorized according to the clusters in MICMAC analysis are shown in Figure 5.4.

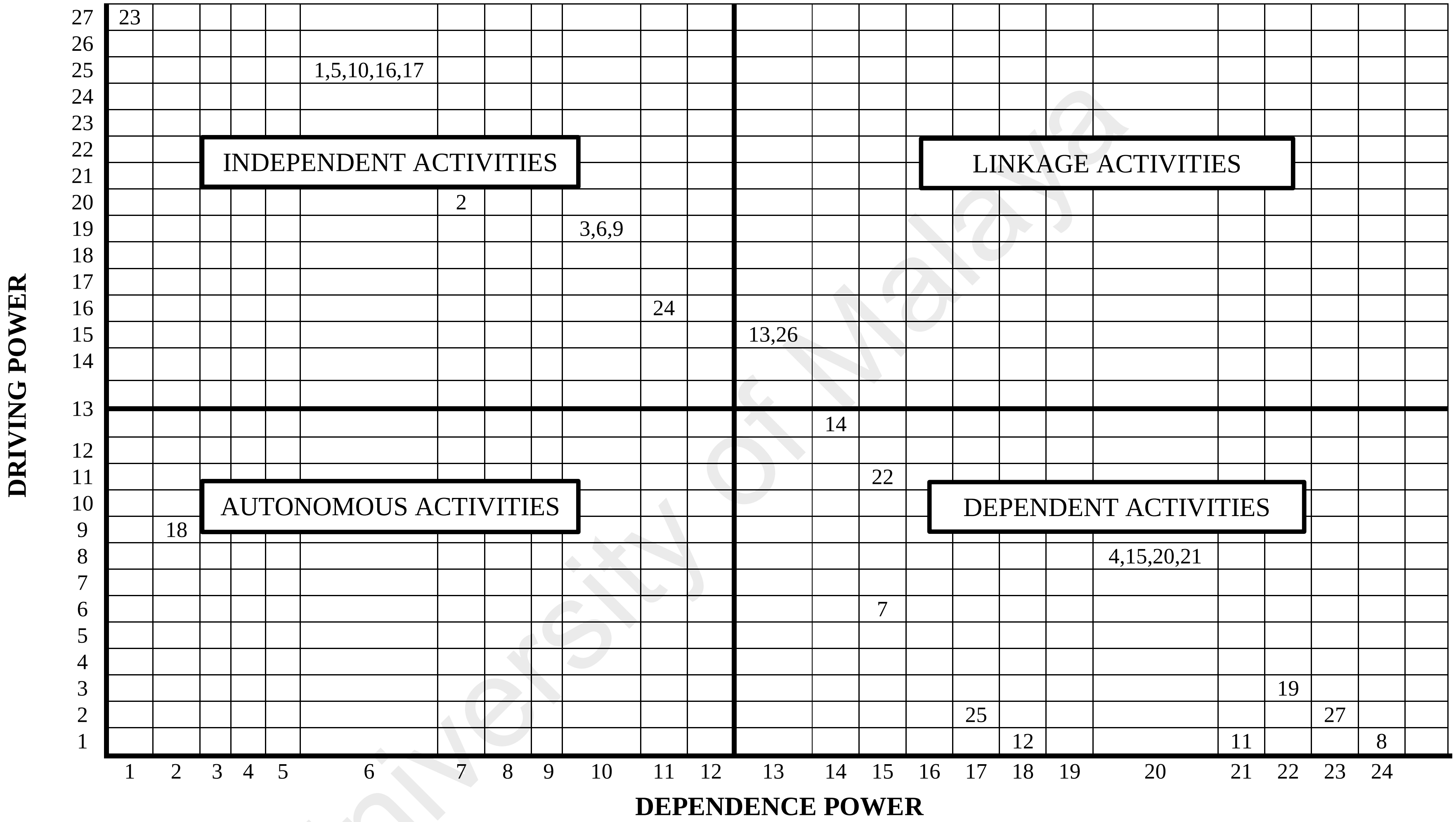


Figure 5.4. MICMAC Analysis for Collaborative Mobile Instant Messaging Learning Pedagogical Model for Teacher Training

Based on Figure 5.4, the first cluster which consists of the Autonomous activities has weak driving power and dependence power. Any activities that classified under this cluster can be disconnected from the system. Referring to Figure 5.4, pedagogical activity 18 (Lecturer assigns leaders among students in each group to be second admin) is classified under this cluster. This implies that pedagogical activity 18 does not affect any other activities should it being eliminated from the model. The second cluster is the Dependent activities. They have weak driving power and strong dependence power. In this study, 13 pedagogical activities (4, 7, 8, 11, 12, 14, 15, 19, 20, 21, 22, 25 and 27) are classified in this cluster.

The third cluster is the Linkage activities that consist of activities with strong driving and dependence power. Pedagogical activities 13 (Lecturer makes sure the information in the tasks should be specific to initiate action and interaction) and 26 (Lecturer supports the use of learning material both in digital or hardcopy by encouraging links sharing of information among students inside or outside closed conferences) are categorized in this cluster. These activities are being labeled as important links between the Dependent activities and Independent activities. The fourth cluster is the Independent activities that have strong driving power and weak dependence power. Thus, the activities that are categorized under this cluster need to be conducted before other activities. In this study, 11 pedagogical activities (1, 2, 3, 5, 6, 9, 10, 16, 17, 23 and 24) form cluster into this category.

Table 5.10 details the pedagogical activities according to clusters.

Table 5.13

Pedagogical Activities According to Clusters

Clusters		Elements / Pedagogical Activities
Autonomous	18	Lecturer assigns leaders among students in each group to be second admin.
Linkage	13	Lecturer makes sure the information in the tasks should be specific to initiate action and interaction.
	26	Lecturer supports the use of learning materials both in digital or hardcopy by encouraging links sharing of information among students inside or outside closed conferences.
Dependent	4	Lecturer informs students the criteria of evaluation to enable them to be more active in discussion and know how to get better grade.
	7	Lecturer assigns tasks and requires students to explore any relevant information available to them.
	8	Lecturer promotes independent critical thinking by encouraging students to reflect on what they have learned and achieved.
	11	Lecturer encourages peer review where students are able to compare their own self-reflection on their work to their peers.
	12	Lecturer promotes reflection on how students are going to implement the knowledge to the new situation.
	14	Lecturer assigns co-created tasks that promote idea sharing and collaboration among students.

Table 5.10 (Continued)

Pedagogical Activities According to Clusters

Clusters		Elements / Pedagogical Activities
Dependent	15	Lecturer conducts e-monitoring from time to time to ensure students continuing engaged with CMIML.
	19	Lecturer facilitates the tasks and discussion by encouraging the students to collaborate in completing the tasks.
	20	Lecturer ensures that a compatible and achieving community of CMIML is built for the purpose that is intended.
	21	Lecturer summarizes the discussion from time to time or according to themes.
	22	Lecturer stimulates fresh strands of ideas by introducing new themes and suggesting alternative approaches when discussions go off track.
	25	Lecturer ensures that the social side of conferencing keeps on being available for any students who enjoy it.
		Lecturer highlights or 'starred' the good point of any beneficial information or discussion to promote motivation.
Independent	1	Lecturer specifies the course objectives clearly and how to make it achievable.
	2	Lecturer guides the students to participate in the CMIML by providing user manual on basic technical skills such as downloading application for IOS or Android users.

Table 5.10 (Continued)

Pedagogical Activities According to Clusters

Clusters		Elements / Pedagogical Activities
	3	Lecturer encourages the students to participate by warmly welcoming them to CMIML.
	5	Lecturer provides guideline etiquettes of using mobile instant messaging learning.
	6	Lecturer identifies mobile learners behaviours (the active learners, social participant learners and passive learners) in order to create a productive CMIML environment.
	9	Lecturer develops standard criteria for assessing the students based on appropriate rubrics.
	10	Lecturer always awares of any upgrading on the application to ensure that CMIML is up to date.
	16	Lecturer selects the most suitable mobile instant messaging application to suit the purpose.
	17	Lecturer explicitly informs of expected roles for lecturer and students.
Independent	23	Lecturer conducts survey to know the availability and the accessibility of the application selected.
	24	Lecturer ensures that the tasks focus on exploring aspects of information familiar to students in order for them to easily retrieve it.

Summary of Findings of Phase 2

The finding of this phase is the interpretive structural Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model as shown in Figure 5.2. This model was developed based on the experts' opinions using the Interpretive Structural Modeling (ISM) technique, where it is an effective tool in making decisions especially in the economic and business sector (Warfield, 1974). However, it has become a popular technique in solving the issue in education. This is proved by various studies on education carried out using ISM technique as mentioned earlier. The purpose of this model is to provide a guideline for the lecturers in teacher training in implementing mobile instant messaging learning in their formal teaching. Indirectly, this will develop the interest of the teacher trainees towards the use of ICT in teaching and learning.

This model consists of 27 elements of the pedagogical activities that was determined by the panel of experts during the Nominal Group Technique (NGT) session. These elements were matched to each other using a hierarchical manner based on the pairing techniques with the aid of ISM software, Concept Star to develop the model. The model was divided into five pedagogical activities which are the Initial Pedagogical Activities, the Knowledge Construction Activities, the Collaborative Development Activities, the e-Monitoring Activities and the Reflection Activities.

The model was further being analyzed and interpreted by defining the driving power and dependence power of each activity in the model. Thus, the reachability matrix for the pedagogical activities was developed. Based on the reachability matrix, the pedagogical activities were partitioned according to levels of influence.

There are 14 levels of pedagogical activities that help in the mapping of the activities in the CMIML pedagogical model.

Finally, the model was interpreted using the MICMAC (Cross-impact multiplication applied to classification) analysis where the activities were categorized into four clusters; a) Autonomous cluster; b) Linkage cluster; c) Dependent cluster; d) Independent cluster. These clusters determine which activities to be carried out first before other activities. The finding of this phase is a proposed pedagogical model of CMIML that is developed through a series of pedagogical activities to improve the delivery of teaching and learning to be more efficient. Thus, this model is expected to benefit various parties in the education field especially for teacher training programs.

CHAPTER 6

FINDINGS OF PHASE 3: EVALUATION

Introduction

The aim of this final phase was to evaluate the Collaborative Mobile Instant Messaging Learning Pedagogical Model developed in Phase 2. This evaluation phase is essential to determine the suitability of the model as a guideline for the lecturers in implementing mobile instant messaging learning in formal classroom. According to Mohd Ridhuan (2016), the suitability evaluation phase is crucial to ensure that the designed and developed model achieved the objective of developing it. Thus, in order to evaluate the model, this phase employed the modified Fuzzy Delphi method (FDM) that involved contribution of experts' views and opinions of the feasibility of the model. The experts were chosen among the stakeholders from education field consisted of officers from Education Technology Division, Ministry of Education, Center for Research, Development and Innovation of Malaysia Institute of Teacher Education, Academic Development Center of Malaysia Institute of Teacher Education and Senior lecturers from public universities.

Thus, the findings in this phase are also presented based on the following research questions:

1. What is the experts' consensus on the suitability of the pedagogical activities proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model?

2. What is the experts' consensus on the classification of the pedagogical activities as proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model?
3. What is the experts' consensus on the list of pedagogical activities in the respective four clusters (Independent, Linkage, Dependent, and Autonomous) as proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model?
4. What is the experts' consensus on the relationships among the pedagogical activities as proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model?

Findings of the Evaluation Phase

The findings for this evaluation phase will be presented into two parts. The first part reveals the background information of the experts. This is to validate their expertise in evaluating the model. The second part presents the experts' views on the suitability of the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical Model as a guideline for the lecturers in implementing mobile instant messaging learning in formal classroom.

Background information of the Experts. A total of 25 experts were selected to evaluate the model which was developed in phase 2. The survey evaluation questionnaires were distributed to the experts through face to face. The findings of the experts' background information is shown in Table 6.1.

Table 6.1

Experts' Background Information

Item		Frequency	Percentage
Gender	Male	13	52.0
	Female	12	48.0
Working experience	1 – 5 years	0	0.0
	6 – 10 years	4	16.0
	11 – 15 years	5	20.0
	16 – 20 years	6	24.0
	More than 20 years	10	40.0
Academic qualifications	PhD	14	56.0
	Master	6	24.0
	Degree	5	20.0
Field of work/expertise	Education (Instructional/Educational Technology, etc)	17	68.0
	Education (Non Educational Technology)	8	32.0

Table 6.1 shows the findings of background information of the 25 experts involved in this phase. Based on Table 6.1, no significant differences in the total number of male and female experts participating in this study which represent 52% and 48% respectively. The findings also show that majority of experts (64%, n = 16) have more than 16 years of working experience with 40% (n = 10) of them were with more than 20 years of experience.

In terms of their academic qualification, Table 6.1 shows that majority of the experts (56%, n = 14) possessed the highest qualification (PhD), 24% (n = 6) with Masters, and 20% (n = 5) with basic degree. Whereas, in terms of experts' field of expertise, majority of the them (68%, n = 17) were from the instructional or educational technology background. Whereas, the rest of the experts (32%, n = 8) of them were from non-educational field of work.

Table 6.2

Experts' Computer or ICT Related Skills

	Frequency	Percentage (%)
Skillful	11	44.0
Moderate	14	56.0
Low Skilled	0	0
None	0	0
Total	25	100.0

Note: Skillful — Develop and managing website or/and blogs
Moderate — Able to communicate through social networks like Facebook, Twitter, Likendln, etc.
Low skilled — Use of office spreadsheets such as words, powerpoint; receive and sending emails; browse and search for informattion on the internet

Table 6.2 shows the findings in the aspect of experts' use of mobile technologies. The findings indicates that 56% (n = 14) of the experts were moderate in computer or ICT related skills, while 11% (n = 11) of them were skilful in ICT skills.

Table 6.3

Experts Mobile Technology Technical Skills

	Frequency	Percentage (%)
High	13	52.0
Average	12	48.0
Low	0	0
Total	25	100

Table 6.3 shows the findings in terms of experts' mobile technology technical skills. The findings reveals that most 52.0% (n = 13) claimed that they were highly skilled, while the remaining of the experts (48.0%, n = 12) indicated that they have average skill of mobile technical technology.

Based on the analysis shown in Table 6.1 to Table 6.3, the participants involved in this phase fit the description as experts in evaluating the model. In selecting experts for a specific Delphi study, Pawlowski, Suzanne D, Okoli, (2004) and stated that the experts should have some background or experience in the related field of study, to be able to contribute their opinions to the needs of the study, and willing to revise their initial judgement to reach consensus among experts. In terms of background experience and academic qualification in related field, the findings showed that majority of the participants were from either Instructional or Educational Technology field. Hence, they were suitable to evaluate the CMIML pedagogical model of the study. The experts also have some knowledge in using mobile technologies which is an added advantage in evaluating the model. Thus, based on the findings in this part, the selected respondents were qualify as experts in this phase.

Experts' views on the suitability of the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical Model. Based on the evaluation survey questionnaires (refer to Appendix E), the responses of experts were based on the five-points linguistic scale. To demonstrate the level of consensus among experts for each item, the threshold value, 'd' was calculated from the questionnaire and illustrated in Table 6.4. The process of calculating the threshold value, 'd' was based on the following formula:

$$d\left(\bar{m},\bar{n}\right) = \sqrt{\frac{1}{3}\left[(m_1 - n_1)^2 + (m_2 - n_2)^2 + (m_3 - n_3)^2\right]}.$$

Table 6.4

Threshold Value, d, for Evaluation Survey Questionnaire Items

E	Items																				
	1.1	2.1	2.2.	2.3	2.4	2.5	2.6	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	4.5	4.6	5.1	5.2	5.3	5.4	5.5
1	0.1222	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955	0.0122	0.0244	0.0611	0.0611	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100	0.1100	0.0122	0.0244	0.0244	0.0244
2	0.1833	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955	0.0122	0.0244	0.0611	**0.2444**	0.1833	0.0122	0.1344	0.0367	0.0244	0.1100	0.1955	0.0122	0.0244	0.0244	0.0244
3	0.1222	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100	0.0122	0.0244	0.0611	0.0611	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100	0.1100	**0.3177**	0.0244	0.0244	0.0244
4	0.1222	0.0122	0.0244	0.0244	0.0244	0.0367	**0.4155**	0.0122	0.0244	0.0611	0.0611	0.1833	**0.3177**	0.1344	0.0367	0.0244	0.1100	0.1100	0.0122	0.0244	0.0244	0.0244
5	0.1833	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955	**0.2933**	0.0244	**0.2444**	0.0611	0.1833	0.0122	0.1711	**0.2688**	0.0244	0.1955	0.1955	**0.2933**	**0.2811**	**0.2811**	**0.2811**
6	0.1222	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100	0.0122	0.0244	0.0611	0.0611	0.1222	**0.3177**	0.1344	0.0367	0.0244	0.1100	0.1100	0.0122	0.0244	0.0244	0.0244
7	0.1222	0.0122	0.0244	0.0244	0.0244	0.0367	**0.4155**	0.0122	0.0244	0.0611	**0.2444**	0.1222	0.0122	**0.4399**	0.0367	0.0244	0.1100	0.1100	0.0122	0.0244	0.0244	0.0244
8	0.1222	**0.2933**	**0.2811**	0.0244	0.0244	0.0367	0.1100	0.0122	0.0244	**0.2444**	0.0611	0.1833	0.0122	0.1711	0.0367	0.0244	0.1100	0.1955	0.0122	0.0244	0.0244	0.0244
9	0.1222	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100	0.0122	0.0244	0.0611	0.0611	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100	0.1100	0.0122	0.0244	0.0244	0.0244
10	0.1222	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100	0.0122	0.0244	0.0611	0.0611	0.1222	0.0122	0.1711	0.0367	0.0244	0.1100	0.1100	0.0122	0.0244	0.0244	0.0244
11	0.1833	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955	0.0122	0.0244	0.0611	0.0611	0.1833	0.0122	0.1711	0.0367	0.0244	0.1955	0.1955	0.0122	0.0244	0.0244	0.0244
12	0.1833	0.0122	0.0244	0.0244	0.0244	**0.2688**	0.1955	0.0122	0.0244	0.0611	0.0611	0.1833	0.0122	0.1711	0.0367	0.0244	0.1955	0.1955	0.0122	**0.2811**	**0.2811**	0.0244
13	0.1833	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100	0.0122	0.0244	0.0611	0.0611	0.1833	**0.2933**	0.1711	**0.2688**	**0.2811**	0.1955	0.1955	0.0122	0.0244	0.0244	0.0244
14	0.1833	0.0122	**0.2811**	**0.2811**	**0.2811**	**0.2688**	0.1955	**0.2933**	0.0244	**0.2444**	0.0611	0.1833	**0.2933**	0.1711	**0.2688**	**0.2811**	0.1955	0.1100	0.0122	0.0244	0.0244	0.0244
15	0.1222	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100	**0.3177**	0.0244	0.0611	**0.2444**	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100	**0.4155**	0.0122	0.0244	0.0244	0.0244
16	0.1222	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100	0.0122	0.0244	0.0611	0.0611	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100	0.1100	0.0122	0.0244	0.0244	0.0244
17	**0.4277**	**0.3177**	**0.3299**	**0.3299**	**0.3299**	**0.3422**	**0.4155**	**0.3177**	**0.3299**	0.0611	**0.2444**	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100	0.1100	**0.3177**	**0.3299**	**0.3299**	**0.3299**
18	0.1222	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100	0.0122	0.0244	0.0611	0.0611	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100	0.1100	0.0122	0.0244	0.0244	0.0244
19	0.1222	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100	0.0122	0.0244	0.0611	0.0611	0.1222	0.0122	0.1344	**0.3422**	0.0244	0.1100	**0.4155**	0.0122	0.0244	0.0244	0.0244
20	0.1222	0.0122	0.0244	**0.2811**	**0.2811**	**0.2688**	0.1955	0.0122	**0.2811**	0.0611	**0.2444**	0.1833	0.0122	0.1711	0.0367	**0.3299**	0.1100	0.1100	0.0122	0.0244	0.0244	0.0244

Table 6.4 (Continued)

Threshold Value, d, for Evaluation Survey Questionnaire Items

E	Items																					
	1.1	2.1	2.2.	2.3	2.4	2.5	2.6	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	4.5	4.6	5.1	5.2	5.3	5.4	5.5
21	0.1833	**0.2933**	**0.2811**	**0.2811**	**0.2811**	**0.2688**	0.1955	**0.2933**	**0.2811**	**0.2444**	0.0611	0.1833	**0.2933**	0.1711	**0.2688**	**0.2811**	0.1955	0.1955	**0.2933**	**0.2811**	**0.2811**	**0.2811**
22	0.1833	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955	0.0122	0.0244	0.0611	0.0611	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100	0.1955	0.0122	0.0244	0.0244	0.0244
23	0.1833	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955	0.0122	0.0244	0.0611	0.0611	0.1222	0.0122	0.1711	0.0367	0.0244	0.1955	0.1955	0.0122	0.0244	0.0244	0.0244
24	0.1833	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955	0.0122	**0.2811**	**0.2444**	0.0611	0.1222	0.0122	0.1711	0.0367	0.0244	0.1955	0.1955	0.0122	0.0244	0.0244	0.0244
25	0.1833	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955	0.0122	0.0244	0.0611	0.0611	0.1222	0.0122	0.1711	0.0367	0.0244	0.1955	0.1955	**0.2933**	0.0244	0.0244	**0.2811**

E = Experts

Table 6.4 shows the Threshold value, 'd' which determines the level of consensus among the experts for each item of the model. Any items that exceeded the threshold value 0.2 were marked black (bold). According to Chang, Hsu and Chang, (2011) and Cheng and Lin, (2002), the threshold value above 0.2 indicates that the individual experts' views that are not in consensus with the views of other experts on some items of the questionnaires. For example, for questionnaire item 2.1, experts number 8, 17, and 21 were not in consesus with the other experts in their agreement on the grouping of pedagogical activities into 5 domains; Initial Pedagogical Activities, Knowledge Construction Activities, Collaboration Development Activities, E-Monitoring Activities, and Reflection Activities as proposed in the model. However, the calculation of the threshold value is to find the threshold values for the overall questionnaire items. Thus, based on Table 6.4, the overall threshold value, 'd', was calculated as shown in Table 6.5.

Table 6.5

The Overall Threshold value 'd' for questionnaire items

	Items																					
	1.1	2.1	2.2	2.3	2.4	2.5	2.6	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	4.5	4.6	5.1	5.2	5.3	5.4	5.5
No of Items d ≤ 0.2	24	22	21	21	21	20	22	20	21	20	20	25	20	24	20	21	25	23	20	21	21	21
Percentage (%) of each items d ≤ 0.2	96	88	84	84	84	80	88	80	84	80	80	100	80	96	80	84	100	92	80	84	84	84
Percentage of overall items d ≤ 0.2	**86.00%**																					

Based on Table 6.5, the overall threshold value ‘d’ for questionnaire items is 86%. This means that the threshold value ‘d’, has exceeded 75% which indicates that the experts have reached the required consensus in their views for all questionnaire items of the evaluation survey questionnaire in evaluating the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical Model for teacher training course. A threshold value ‘d’, of less than 75% requires a second round of Fuzzy Delphi where the participants need to respond to the evaluation survey questionnaire again to reevaluate their views. Subsequent rounds may be needed until consensus is achieved.

Since a consensus among the participants had been achieved, the next step was to seek the findings for the participants’ collective opinions on the evaluation of the model in terms of their consensus on the following aspects:

1) The suitability of the elements (pedagogical activities);
2) The domain classification of the pedagogical activities;
3) The cluster calssification of the pedagogical activities;
4) The relationships among the pedagogical activities; and
5) The overall suitability of the model for teacher training course.

The aspects above are consistent to the research questions for this phase. Thus, the findings of this part were presented according to the research questions as follows:

1. What is the experts’ consensus on the suitability of the pedagogical activities proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model?

2. What is the experts' consensus on the classification of the pedagogical activities as proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model?
3. What is the experts' consensus on the list of pedagogical activities in the respective four clusters (Independent, Linkage, Dependent, and Autonomous) as proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model?
4. What is the experts' consensus on the relationships among the pedagogical activities as proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model?
5. What is the experts' consensus on the suitability of the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model in the teaching and learning for teacher training?

As discussed in Chapter 3, the analysis of the evaluation survey data for Fuzzy Delphi method (FDM) is based on the requirements contained in the triangular fuzzy number and deffuzification process. The terms of triangular fuzzy number is engaging the threshold value 'd' and the percentage of the experts' consensus where the threshold value 'd' for each item (components and elements) as measured must be less than or equal to 0.2 (Cheng & Lin, 2002). Whereas, the percentage of agreement of the experts must be more than or equal to 75.0% (H. C. Chu & Hwang, 2008; J. W. Murry & Hammons, 1995). The threshold value 'd' will be analyzed using Microsoft Excel based on the following formula:

$$d\left(\tilde{m},\tilde{n}\right)=\sqrt{\frac{1}{3}\left[(m_1-n_1)^2+(m_2-n_2)^2+(m_3-n_3)^2\right]}.$$

For the deffuzification process, there is only one condition which is the Fuzzy Score (A) must be greater than or equal to the value of α-cut of 0.5 (Bodjanova, 2006; Tang & Wu, 2010). The Fuzzy score (A) was analyzed using Microsoft Excel by using the following formula:

$$A_{max} = 1/3 * (m1 + m2 + m3)$$

Thus, the following findings are presented based on these two requirements contained in the triangular fuzzy number and deffuzification process.

1. *The suitability of the pedagogical activities proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model*

   In this item, experts had to respond to the following question: 'Do you agree with the pedagogical activities proposed in the model in order to produce appropriate collaborative mobile instant messaging learning? (Item 1.1).

Table 6.6

Experts' view on the pedagogical activities proposed in the model

Item	**Sub Item**	**Triangular Fuzzy Numbers**		**Defuzzification Process**			
		Threshold value each items	Percentage of experts' consensus	m1	m2	m3	Fuzzy Score (A)
1.1	Agreement of the pedagogical activities proposed in the model	0.1613	96%	0.480	0.680	0.880	0.680

Based on Table 6.6, the percentage of experts' consensus is 96% which is greater than 75%. In addition, the value of Fuzzy Score (A) is 0.68 which is greater than 0.5. Thus, this item has met the requirements contained in the triangular fuzzy number and deffuzification process which revealed that all experts consensually agreed with the pedagogical activities proposed.

2. *The classification of the pedagogical activities as proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model*

   In order to elicit the experts' agreement on the classification of the pedagogical activities into 5 domains of activities, the experts' were given the following questionnaire items to respond accordingly:

   2.1 Do you agree with the grouping of pedagogical activities into 5 domains as shown in the model: Initial Pedagogical Activities, Knowledge Construction Activities, Collaboration Development Activities, E-Monitoring Activities and Reflection Activities?

   2.2 Do you agree with the list of activities that is grouped under Initial Pedagogical Activities?

   2.3 Do you agree with the list of activities that is grouped under Knowledge Construction Activities?

   2.4 Do you agree with the list of activities that is grouped under Collaboration Development Activities?

   2.5 Do you agree with the list of activities that is grouped under E-Monitoring Activities?

   2.6 Do you agree with the list of activities that is grouped under Reflection Activities?

Thus, Table 6.7 shows the findings of Fuzzy Delphi analysis indicated threshold value 'd' for each item. Whereas, Table 6.8 shows the details of the findings of the experts' consensus agreement on the grouping of the pedagogical activities to their respective domains of activities.

Table 6.7

Fuzzy Delphi Analysis on Experts' Views on the Domain Classification of Pedagogical Activities

Experts	**Items**					
	2.1	**2.2**	**2.3**	**2.4**	**2.5**	**2.6**
1	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955
2	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955
3	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100
4	0.0122	0.0244	0.0244	0.0244	0.0367	0.4155
5	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955
6	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100
7	0.0122	0.0244	0.0244	0.0244	0.0367	0.4155
8	0.2933	0.2811	0.0244	0.0244	0.0367	0.1100
9	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100
10	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100
11	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955
12	0.0122	0.0244	0.0244	0.0244	0.2688	0.1955
13	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100
14	0.0122	0.2811	0.2811	0.2811	0.2688	0.1955
15	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100
16	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100
17	0.3177	0.3299	0.3299	0.3299	0.3422	0.4155
18	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100
19	0.0122	0.0244	0.0244	0.0244	0.0367	0.1100
20	0.0122	0.0244	0.2811	0.2811	0.2688	0.1955
21	0.2933	0.2811	0.2811	0.2811	0.2688	0.1955
22	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955
23	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955
24	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955
25	0.0122	0.0244	0.0244	0.0244	0.0367	0.1955
Threshold value (d)	0.0469	0.0675	0.0675	0.0675	0.0860	0.1877
% of experts' consensus	88	84	84	84	80	88
Fuzzy Score (A)	0.608	0.616	0.616	0.616	0.824	0.672

Table 6.8

Details Analysis of Experts' Views on the Domain Classification of Pedagogical Activities

Item	Sub item	Triangular Fuzzy Numbers: Threshold value each items	Triangular Fuzzy Numbers: Percentage of experts' consensus (%)	Defuzzification Process: m1	m2	m3	Fuzzy Score (A)
2.1	Agreement on the grouping of Pedagogical Activities into five domains	0.0469	88.0	0.408	0.608	0.808	0.608
2.2	Agreement on the list of activities that is grouped under Initial Pedagogical Activities	0.0675	84.0	0.416	0.616	0.816	0.616
2.3	Agreement on the list of activities that is grouped under Knowledge Construction Activities	0.0675	84.0	0.416	0.616	0.816	0.616
2.4	Agreement on the list of activities that is grouped under Collaboration Development Activities	0.0675	84.0	0.416	0.616	0.816	0.616
2.5	Agreement on the list of activities that is grouped under E-Monitoring Activities	0.0860	80.0	0.424	0.624	0.824	0.624
2.6	Agreement on the list of activities that is grouped under Reflection Activities	0.1877	88.0	0.472	0.672	0.872	0.672

Requirements:

a) Triangular Fuzzy Numbers
1) Threshold value (d) ≤ 0.2
2) Percentage of experts' consensus ≥ 75.0%

b) Defuzzification Process
3) Fuzzy score (A) ≥ value α – cut = 0.5

Based on Table 6.8, the percentage of experts' consensus for item 2.1 (Agreement on the grouping of Pedagogical Activities into five domains of activities) and item 2.6 (Agreement on the list of activities that is grouped under Reflection Activities) show the highest percentage of consensus which is 88.0% respectively. Meanwhile, item 2.2 (Agreement on the list of activities that is grouped under Initial Pedagogical Activities), 2.3 (Agreement on the list of activities that is grouped under Knowledge Construction Activities), and 2.4 (Agreement on the list of activities that is grouped under Collaboration Development Activities) received 84% of experts' consensus for each item which indicated that the items were in the range of requirement for triangular fuzzy number. Even though item 2.5 (Agreement on the list of activities that is grouped under E-Monitoring Activities) received the lowest percentage of consensus (80.0%), it is still met the requirement of triangular fuzzy number which is greater than 75%. In addition, this item shows the value of Fuzzy Score (A) is 0.624 which is greater than Alpha α – cut value of 0.5. In fact, all the items in this questionnaires showed the fuzzy score (A) more than 0.5. Hence, all the items have met the requirements contained in the triangular fuzzy number and deffuzification process which revealed that all experts consensually agreed with this questionnaire items.

Thus, conclusively, the experts consensually agreed with the proposed classification of pedagogical activities in the CMIML pedagogical model according to 5 domains of activities; Initial Pedagogical Activities, Knowledge Construction Activities, Collaboration Development Activities, E-Monitoring Activities and Reflection Activities.

3. *The list of pedagogical activities in the respective four clusters (Independent, Linkage, Dependent, and Autonomous) as proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model*

   In terms of the experts' views on the classification of pedagogical activities based on clusters, the experts' had to respond to the following questionnaire items:

   3.1. Do you agree with the classification of pedagogical activities in the Independent cluster?

   3.2. Do you agree with the classification of pedagogical activities in the Linkage cluster?

   3.3. Do you agree with the classification of pedagogical activities in the Dependent cluster?

   3.4. Do you agree with the classification of pedagogical activities in the Autonomous cluster?

Thus, Table 6.9 show the findings of Fuzzy Delphi analysis indicated threshold value 'd' for each item. Meanwhile, Table 6.10 shows the details of the findings indicated the experts' consensus agreement on the list of pedagogical activities in the respective four clusters (Independent, Linkage, Dependent, and Autonomous) as proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model.

Table 6.9

Fuzzy Delphi Analysis on Experts' Views on the Cluster Classification Pedagogical Activities

Experts	Items			
	3.1	**3.2**	**3.3**	**3.4**
1	0.0122	0.0244	0.0611	0.0611
2	0.0122	0.0244	0.0611	0.2444
3	0.0122	0.0244	0.0611	0.0611
4	0.0122	0.0244	0.0611	0.0611
5	0.2933	0.0244	0.2444	0.0611
6	0.0122	0.0244	0.0611	0.0611
7	0.0122	0.0244	0.0611	0.2444
8	0.0122	0.0244	0.2444	0.0611
9	0.0122	0.0244	0.0611	0.0611
10	0.0122	0.0244	0.0611	0.0611
11	0.0122	0.0244	0.0611	0.0611
12	0.0122	0.0244	0.0611	0.0611
13	0.0122	0.0244	0.0611	0.0611
14	0.2933	0.0244	0.2444	0.0611
15	0.3177	0.0244	0.0611	0.2444
16	0.0122	0.0244	0.0611	0.0611
17	0.3177	0.3299	0.0611	0.2444
18	0.0122	0.0244	0.0611	0.0611
19	0.0122	0.0244	0.0611	0.0611
20	0.0122	0.2811	0.0611	0.2444
21	0.2933	0.2811	0.2444	0.0611
22	0.0122	0.0244	0.0611	0.0611
23	0.0122	0.0244	0.0611	0.0611
24	0.0122	0.2811	0.2444	0.0611
25	0.0122	0.0244	0.0611	0.0611
Threshold value (d)	0.0704	0.0675	0.0978	0.0978
% of experts' consensus	80	84	80	80
Fuzzy Score (A)	0.608	0.616	0.640	0.560

Table 6.10

Detail Analysis of Experts' Views on the Cluster Classification of Pedagogical Activities

		Triangular Fuzzy Numbers		Defuzzification Process			
Item	**Sub item**	**Threshold value each items**	**Percentage of experts' consensus (%)**	**m1**	**m2**	**m3**	**Fuzzy Score (A)**
3.1	Agreement on the classification of the pedagogical activities in the Independent cluster	0.0704	80.0	0.408	0.608	0.808	0.608
3.2	Agreement on the classification of the pedagogical activities in the Linkage cluster	0.0675	84.0	0.416	0.616	0.816	0.616
3.3	Agreement on the classification of the pedagogical activities in the Dependent cluster	0.0978	80.0	0.440	0.640	0.840	0.640
3.4	Agreement on the classification of the pedagogical activities in the Autonomous cluster	0.0978	80.0	0.360	0.560	0.760	0.560

Requirements:

a) Triangular Fuzzy Numbers
1) Threshold value (d) ≤ 0.2
2) Percentage of experts' consensus $\geq 75.0\%$

b) Defuzzification Process
3) Fuzzy score (A) $\geq$ value α – cut = 0.5

Based on Table 6.10, the percentage of experts' consensus for item 3.2 (Agreement on the classification of the pedagogical activities in the Linkage cluster) show the highest percentage of consensus which is 84.0%. Meanwhile, the rest of the items which are item 3.1 (Agreement on the classification of the pedagogical activities in the Independent cluster), 3.3 (Agreement on the classification of the pedagogical activities in the Dependent cluster), and 3.4 (Agreement on the classification of the pedagogical activities in the Autonomous cluster) received 80% of experts' consensus for each item. This indicated that the items were in the range of requirement for triangular fuzzy number which is greater than 75%. Even though item 3.4 shows the value of fuzzy score (A) is 0.560, which is relatively low, it still met the requirement of the deffuzification process which is equal or greater than Alpha α - cut value of 0.5. In fact, all the items in this questionnaires showed the fuzzy score (A) more than 0.5. Hence, all the items have met the requirements contained in the triangular fuzzy number and deffuzification process which revealed that all experts consensually agreed with these questionnaire items.

Thus, conclusively, experts' consensually agreed on the list of pedagogical activities in the respective four clusters (Independent, Linkage, Dependent, and Autonomous) as proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model.

4. *The relationships among the pedagogical activities as proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model*

   In the development of the model, three important features should be considered which are the elements, the positioning of the elements, and the relationship among the elements in the development of the model. Thus, in evaluating the relationship of the pedagogical activities in the model, the experts were given the following questionnaire items to respond:

4.1. Do you agree with the relationships among the pedagogical activities in the Initial Pedagogical Activities?

4.2. Do you agree with the relationships among the pedagogical activities in the Knowledge Construction Activities?

4.3. Do you agree with the relationships among the pedagogical activities in the Collaboration Development Activities?

4.4. Do you agree with the relationships among the pedagogical activities in the E-Monitoring Activities?

4.5. Do you agree with the relationships among the pedagogical activities in the Reflection Activities?

4.6. Do you agree with the overall relationships among the pedagogical activities as shown in the model?

Thus, Table 6.11 show the findings of Fuzzy Delphi analysis indicated threshold value ‘d’ for each item. Meanwhile, Table 6.12 shows the details of the findings that indicates the experts’ consensus agreement on the relationships among the pedagogical activities in the five domains of activities (Intitial Pedagogical Activities, Knowledge Construction Activities, Collaboration Development Activities, E-Monitoring Activities, and Reflection Activities) as proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model.

Table 6.11

Fuzzy Delphi Analysis of Experts' Views on the Relationships among the Pedagogical Activities

Experts	**Items**					
	4.1	**4.2**	**4.3**	**4.4**	**4.5**	**4.6**
1	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100
2	0.1833	0.0122	0.1344	0.0367	0.0244	0.1100
3	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100
4	0.1833	0.3177	0.1344	0.0367	0.0244	0.1100
5	0.1833	0.0122	0.1711	0.2688	0.0244	0.1955
6	0.1222	0.3177	0.1344	0.0367	0.0244	0.1100
7	0.1222	0.0122	0.4399	0.0367	0.0244	0.1100
8	0.1833	0.0122	0.1711	0.0367	0.0244	0.1100
9	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100
10	0.1222	0.0122	0.1711	0.0367	0.0244	0.1100
11	0.1833	0.0122	0.1711	0.0367	0.0244	0.1955
12	0.1833	0.0122	0.1711	0.0367	0.0244	0.1955
13	0.1833	0.2933	0.1711	0.2688	0.2811	0.1955
14	0.1833	0.2933	0.1711	0.2688	0.2811	0.1955
15	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100
16	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100
17	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100
18	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100
19	0.1222	0.0122	0.1344	0.3422	0.0244	0.1100
20	0.1833	0.0122	0.1711	0.0367	0.3299	0.1100
21	0.1833	0.2933	0.1711	0.2688	0.2811	0.1955
22	0.1222	0.0122	0.1344	0.0367	0.0244	0.1100
23	0.1222	0.0122	0.1711	0.0367	0.0244	0.1955
24	0.1222	0.0122	0.1711	0.0367	0.0244	0.1955
25	0.1222	0.0122	0.1711	0.0367	0.0244	0.1955
Threshold value (d)	0.1466	0.0704	0.1642	0.0860	0.0675	0.1408
% of experts' consensus	100	80	96	80	84	100
Fuzzy Score (A)	0.680	0.608	0.688	0.624	0.616	0.672

Table 6.12

Detail Analysis of Experts' Views on the Relationships among the Pedagogical Activities

Item	Sub item	Triangular Fuzzy Numbers: Threshold value each items	Triangular Fuzzy Numbers: Percentage of experts' consensus (%)	Defuzzification Process: m1	Defuzzification Process: m2	Defuzzification Process: m3	Defuzzification Process: Fuzzy Score (A)
4.1	Agreement on the relationships among the pedagogical activities in the Initial Pedagogical Activities	0.1466	100.0	0.480	0.680	0.880	0.680
4.2	Agreement on the relationships among pedagogical activities in the Knowledge Construction Activities	0.0704	80.0	0.408	0.608	0.808	0.608
4.3	Agreement on the relationships among pedagogical activities in the Collaboration Development Activities	0.1642	96.0	0.488	0.688	0.888	0.688
4.4	Agreement on the relationships among pedagogical activities in the E-Monitoring Activities	0.0860	80.0	0.424	0.624	0.824	0.624
4.5	Agreement on the relationships among pedagogical activities in the Reflection Activities	0.0675	84.0	0.416	0.616	0.816	0.616
4.6	Agreement on the overall relationships among the pedagogical activities as shown in the model	0.1408	100.0	0.472	0.672	0.872	0.672

Requirements:

a) Triangular Fuzzy Numbers
1) Threshold value (d) ≤ 0.2
2) Percentage of experts' consensus ≥ 75.0%

b) Defuzzification Process
3) Fuzzy score (A) ≥ value α – cut = 0.5

Based on Table 6.12, both items 4.1 (Agreement on the relationships among the pedagogical activities in the Initial Pedagogical Activities), and 4.6 (Agreement on the overall relationships among the pedagogical activities as shown in the model) received 100.0% consensus among the experts. The experts also show strong agreement on item 4.3 (Agreement on the relationships among pedagogical activities in the Collaboration Development Activities) where the percentage of consensus is 96.0%. However, item 4.2 (Agreement on the relationships among pedagogical activities in the Knowledge Construction Activities) and 4.4 (Agreement on the relationships among pedagogical activities in the E-Monitoring Activities) received respectively 80.0% percentage of experts' consensus, which is slightly low compared to other questionnaire items. Meanwhile, item 4.5 (Agreement on the relationships among pedagogical activities in the Reflection Activities) received 84% of experts' consensus. This indicated that all the items were in the range of requirement for triangular fuzzy number which is the percentage of experts' consensus is greater than 75%. Other than that, all the items show the value of fuzzy score (A) more than the Alpha α - cut value of 0.5. Hence, all the items have met the requirements needed in the triangular fuzzy number and deffuzification process which revealed that all experts consensually agreed with these questionnaire items.

Thus, the experts consensually agreed on the relationships among the pedagogical activities in the five domain of activities (Intitial Pedagogical Activities, Knowledge Construction Activities, Collaboration Development Activities, E-Monitioring Activities, and Reflection Activities) as proposed in the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model.

5. *Views on the overall suitability of the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model in the teaching and learning for teacher training*

   Finally, the evaluation aspect was on the experts' views on the overall suitability of the model in the context of teaching and learning in guiding the lecturer to implement mobile instant messaging learning in their formal teaching. Thus, the experts were asked to respond to this aspect according to the following questionnaire items:

   5.1. The model shows a clear guide on how collaborative learning could be conducted using mobile instant messaging application in complementing the conventional classroom learning.

   5.2. The model shows clearly on how formal classroom learning activities could merge with informal learning activities to form a holistic learning experience for the students.

   5.3. The model shows clearly how one activity connects to other activities in aiding the students through collaborative learning in achieving the course objectives.

   5.4. The model could be used to assist planning of course unit lessons by the lecturer in facilitating students' in collaborative learning.

   5.5. The model could be used as an example to develop other curriculum implementation models for other courses.

Thus, Table 6.13 show the findings of Fuzzy Delphi analysis indicated threshold value 'd' for each item. Meanwhile, Table 6.14 shows the details of the findings indicates the experts' consensus agreement on the overall suitability of the model in the context of teaching and learning.

Table 6.13

Fuzzy Delphi Analysis on Experts' Views on the Suitability of the Model in Teaching and Learning

Experts	**Items**				
	5.1	**5.2**	**5.3**	**5.4**	**5.5**
1	0.1100	0.0122	0.0244	0.0244	0.0244
2	0.1955	0.0122	0.0244	0.0244	0.0244
3	0.1100	0.3177	0.0244	0.0244	0.0244
4	0.1100	0.0122	0.0244	0.0244	0.0244
5	0.1955	0.2933	0.2811	0.2811	0.2811
6	0.1100	0.0122	0.0244	0.0244	0.0244
7	0.1100	0.0122	0.0244	0.0244	0.0244
8	0.1955	0.0122	0.0244	0.0244	0.0244
9	0.1100	0.0122	0.0244	0.0244	0.0244
10	0.1100	0.0122	0.0244	0.0244	0.0244
11	0.1955	0.0122	0.0244	0.0244	0.0244
12	0.1955	0.0122	0.2811	0.2811	0.0244
13	0.1955	0.0122	0.0244	0.0244	0.0244
14	0.1100	0.0122	0.0244	0.0244	0.0244
15	0.4155	0.0122	0.0244	0.0244	0.0244
16	0.1100	0.0122	0.0244	0.0244	0.0244
17	0.1100	0.3177	0.3299	0.3299	0.3299
18	0.1100	0.0122	0.0244	0.0244	0.0244
19	0.4155	0.0122	0.0244	0.0244	0.0244
20	0.1100	0.0122	0.0244	0.0244	0.0244
21	0.1955	0.2933	0.2811	0.2811	0.2811
22	0.1955	0.0122	0.0244	0.0244	0.0244
23	0.1955	0.0122	0.0244	0.0244	0.0244
24	0.1955	0.0122	0.0244	0.0244	0.0244
25	0.1955	0.2933	0.0244	0.0244	0.2811
Threshold value (d)	0.1721	0.0704	0.0675	0.0675	0.0675
% of experts' consensus	92	80	84	84	84
Fuzzy Score (A)	0.672	0.608	0.616	0.616	0.616

Table 6.14

Detail Analysis of Experts' Views on the Suitability of the Model in Teaching and Learning

Item	Sub item	Triangular Fuzzy Numbers		Defuzzification Process			
		Threshold value each items	**Percentage of experts' consensus (%)**	**m1**	**m2**	**m3**	**Fuzzy Score (A)**
5.1	The model shows a clear guide on how collaborative learning could be conducted using mobile instant messaging application in complementing the conventional classroom learning.	0.1721	92.0	0.472	0.672	0.872	0.672
5.2	The model shows clearly on how formal classroom learning activities could merge with informal learning activities to form a holistic learning experience for the students.	0.0704	80.0	0.408	0.608	0.808	0.608
5.3	The model shows clearly how one activity connects to other activities in aiding the students through collaborative learning in achieving the course objectives	0.0675	84.0	0.416	0.616	0.816	0.616
5.4	The model could be used to assist planning of course unit lessons by the lecturer in facilitating students' in collaborative learning	0.0675	84.0	0.416	0.616	0.816	0.616
5.5	The model could be used as an example to develop other curriculum implementation models for other courses	0.0675	84.0	0.416	0.616	0.816	0.616

Requirements:

a) Triangular Fuzzy Numbers
1) Threshold value (d) ≤ 0.2
2) Percentage of experts' consensus ≥ 75.0%

b) Defuzzification Process
3) Fuzzy score (A) ≥ value α – cut = 0.5

Based on Table 6.14, the experts were consensually agreed (94%) that the model shows a clear guide on how collaborative learning could be conducted using mobile instant messaging application in complementing the conventional classroom learning. The experts also show consensually agreement on item 5.3 (The model shows clearly how one activity connects to other activities in aiding the students through collaborative learning in achieving the course objectives), 5.4 (The model could be used to assist planning of course unit lessons by the lecturer in facilitating students' in collaborative learning), and 5.5 (The model could be used as an example to develop other curriculum implementation models for other courses) where the items share the same percentage of consensus of 84.0% respectively. However, the percentage of experts' consensus is slightly low (80%) compared to other items in item 5.2 (The model shows clearly on how formal classroom learning activities could merge with informal learning activities to form a holistic learning experience for the students). Nevertheless, all the items were in the range of requirement for triangular fuzzy number which is the percentage of experts' consensus is greater than 75%. In fact, all the items show the value of fuzzy score (A) are more than the Alpha α - cut value of 0.5. Hence, all the items have met the requirements needed in the triangular fuzzy number and deffuzification process which revealed that all experts consensually agreed with these questionnaire items.

As a conclusion, the experts consensually agreed that Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model is suitable to be implemented as a guidance to employ mobile instant messaging learning for the lecturer in their formal teaching.

Summary of Findings of Phase 3

This evaluation phase is the final phase of the study where the developed model was evaluated using the Fuzzy Delphi Method (FDM). In order to determine the suitability of the model as a guideline for the lecturers in implementing mobile instant messaging learning in formal classroom, the experts were selected among the stakeholders from education field who have knowledge in the field of the study. The evaluation was made in terms of experts' views on the suitability of the pedagogical activities as the elements in the model, the classification of pedagogical activities into domains, the relationships among the pedagogical activities, and the overall suitability of the model in the context of teaching and learning.

The analysis of the evaluation survey data for Fuzzy Delphi Method (FDM) is based on the requirements contained in the triangular fuzzy number and deffuzification process. The triangular fuzzy number is engaging the threshold value 'd' and the percentage of the experts' consensus where the threshold value 'd' for each item measured must be less than or equal to 0.2. Whereas, the percentage of agreement of the experts must be more than or equal to 75.0%. For the deffuzification process, there is only one condition which is the Fuzzy Score (A) must be greater than or equal to the α-cut value of 0.5.

Based on the overall findings, all the items have met the requirements needed in the triangular fuzzy number and deffuzification process which revealed that all experts consensually agreed with all questionnaire items. Hence, according to the experts in the study, the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical Model is suitable to serve as a guideline for the lecturers in implementing mobile instant messaging application in the formal classroom.

CHAPTER 7

DISCUSSION OF FINDINGS, IMPLICATIONS AND RECOMMENDATIONS

Introduction

This final chapter is intended to discuss the presentation of the findings, implications and recommendations of the study carried out in three phases; The Needs Analysis phase (Phase 1), The Design and Development phase (Phase 2) and The Evaluation phase (Phase 3). Briefly, the needs analysis phase concluded the need to develop a pedagogical model applying mobile learning (mLearning) using mobile devices, especially mobile instant messaging application. While in phase 2, the focus is to design and develop the Mobile Instant Messaging Learning (CMIML) Pedagogical Model by adopting Nominal Group Technique (NGT) and Interpretive Structural Modeling (ISM) approaches. Finally, the evaluation phase has applied the Fuzzy Delphi Method (FDM) approach to evaluate the CMIML pedagogical model by selected experts to determine the suitability of the pedagogical model as support to formal learning for teacher training.

The following sections will present the summary of the study which recapture the procedures of research involved in all stages. It is then followed by the discussions of the findings for each phases. The implication of the study will be elaborated next in terms of the practical implications, theoretical implications and the methodology implications. Finally, the suggestions for future possible directions of the study are presented at the end of this chapter.

Summary of the study

The potential of mobile learning (mLearning) to be implemented in formal education has gained interest in Malaysian education system nowadays. However, regardless of the tremendous potential of mobile phones to promote active mlearning, Mobile Instant Messaging (MIM) application has increasingly being viewed as a tool to enhance learning delivery in the mlearning enviroment. Its potential to support collaborative learning has gain interest in education because of its compelling features such as speed, interactivity and less cost.

However, the implementation of mLearning in formal education is still in its infancy and can be accomplished if it is made in proper planning, in terms of its acceptance into formal education by all parties involved from the beginning. Thus, the exposure of applying mLearning specifically mobile instant messaging (MIM) learning should be applied at an earlier stage, namely in teacher training institutions. Thus, this study discusses the important relevant concepts and previous studies of mobile instant messaging (MIM) learning in supporting collaborative learning in classroom. This is to provide a better understanding on how it can be incorporated in formal learning. This paper also highlights an overview on how formal learning has been transformed in mobile learning environments, based on the past and existing ICT initiatives and implementation. As a result of this changing learning environment, MIM learning is expected to complement conventional ICT learning like Learning Management Systems (LMS) but in different ways. Furthermore, the main affordances of collaborative learning through MIM learning are providing just-in-time learning that happens anytime, anyplace and with learner-centred content. As a conclusion, Collaborative Mobile Instant Messaging Learning (CMIML) is expected not only to augment formal learning but to transform the lecturer's role to become a facilitator and mentor in providing guidance on demand.

Therefore, this study was carried out as an initiative to provide guidelines and considerations required in conducting CMIML by developing a structured pedagogical model. The structured pedagogical model is expected to improve the delivery of teaching and learning methods that are more efficient through planning in shaping the framework of the course better. Thus, in order to develop the model, this study has adopted the Design and Development Research (DDR) approach which was introduced by Richey and Klein (2007). Based on the approach, the study was conducted in three phases.

The first phase is the Needs Analysis phase which consists of four research objectives that aimed to identify a need to develop the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model for teacher training. This survey was based on lecturers' perceptions and level of acceptance and intention to use mobile instant messaging (MIM) application if incorporated in the formal course. This study involved 268 lecturers in Institute of Teacher Education in central zone. The instrument used for this phase is a set of need analysis survey questionnaire which is constructed based on The Unified Theory of Acceptance and Use of Technology (UTAUT). The data were analyzed using Statistical Package for Social Science (SPSS) that included the descriptive statistical methods like frequency, percentage, mean, and standard deviation. The findings indicated that the lecturers owned at least one mobile technology device with their devices have at least the minimum required mobile capabilities. This concluded that the lecturers have the necessary technology access for the incorporation of CMIML in their formal course.

They also showed high acceptance level and intend to use CMIML in their formal course. Thus, the findings necessitated the need for the study to develop the model.

The second phase of the study is the design and development stage which adopted Nominal Group Technique (NGT) and Interpretive Structural Modelling (ISM) techniques in order to develop the CMIML Pedagogical Model for teacher training. The model was developed based on the integrated views and opinions of panel of selected experts with the aid of Concept Star Software during the ISM session. The findings of the study constitute the result of the experts' collective views on the pedagogical activities and the relationships among the activities. Therefore, 27 pedagogical activities have been identified and determined to be incorporated in the model. From the model developed, the experts viewed that the pedagogical activities could be divided into five categories which are Initial Pedagogical Activities, Knowledge Construction Activities, Collaboration Development Activities, E-monitoring Activities and Reflection Activities. Thus, through this paper we contribute to identify the suitable pedagogical activities for collaborative mobile instant messaging learning and prioritize them.

The final phase of this study is the evaluation phase where it aimed to evaluate the CMIML pegagogical model designed and developed in the second phase. This phase consist of five research objectives in order to determine the suitability of the model as support to formal learning for teacher training. This evaluation phase has applied a modified Fuzzy Delphi Method (FDM) to determine the consensus' views and opinions from 25 selected panel of experts. The evaluation was based on their responses to a five-likert linguistic scale survey questionnaire. The threshold value 'd' was calculated to determine the experts' consensus for all questionnaire items while the defuzzification values for the items would determine the agreement of the experts. The findings showed that the percentage of experts' agreement has exceeded the required consensual agreement of 75% ($d \leq 0.2$). While in the defuzzification process, all the items showed the fuzzy scores (A) more than the value of Alpha α-cut of 0.5 which showed consensual agreement among the experts. Hence, the findings revealed that all experts consensually agreed with the suitability and feasibility of the pedagogical model for teacher training.

Therefore, the results of this study can be useful to policy makers, lecturers and instructors as it not only determines the feasibility of application of CMIML in teaching, but also to provide guidelines and considerations required in conducting mobile learning. Thus, the structured pedagogical model is expected to improve the delivery of teaching and learning methods that are more efficient through planning in shaping the framework of the course better.

Discussion of the Findings

This section discusess briefly the findings in three phases; the Needs Analysis phase, the Design and Development phase, and the Evaluation phase. The discussions are based on the findings elaborated in chapter four, five and six respectively.

Discussion of Findings from Phase 1: The Need Analysis Phase

Briefly, as discussed in Chapter 1, Mobile Instant Messaging Collaborative Learning (CMIML) Pedagogical Model has been proposed as a means of support to lecturers for teacher training programs. The pedagogical model proposed is intended to provide guidance to educators in particular lecturers in implementing mobile learning (mLearning) in teaching.

However, before the the proposed pedagogical model was developed, the lecturers' needs of using mobile devices in their formal teaching need to be identified beforehand. Therefore, the needs analysis phase was conducted using the need analysis survey questionnaire consisted of 46 items comprising of five aspects:

1. The Lecturers' demographic details
2. The lecturers' perceptions on their current ways of teaching and learning
3. The lecturers' perceptions on implementing ICT in teaching and learning
4. The lecturers' access to mobile devices and the capability level of the devices
5. The lecturers' level of acceptance and intention to use collaborative mobile instant messaging learning if incorporated into the formal course.

The survey questionnaires which were distributed to the lecturers, aimed to assess the level of acceptance and their intentions in applying mobile learning (mLearning) using mobile devices, spesifically, the use of mobile instant messaging (MIM) application. The survey questionnaire items were constructed based on the Unified Theory of Acceptance and Use of Technology (UTAUT) proposed by Venkatesh (2003) which has been modified to suit the study. The questionnaires were administered to 268 lecturers from five Institute of Teacher Training campuses. Data of this first phase were analyzed using descriptive statistics through Statistical Package for Social Science (SPSS). The analysis of frequency, percentage, standard deviation and the mean score were used to determine the needs of using mobile devices, especially the use of mobile instant messaging (MIM) application as a means of teaching support in teacher training. In identifying these needs, the lecturers' perceptions were taken into account in the needs analysis stage. So, this needs analysis aims to answer the following research questions:

1. What are the lecturers' perceptions on their current ways of teaching and learning?
2. What are the lecturers' perceptions on implementing ICT in teaching and learning?
3. What are the lecturers' access to mobile devices and the capability level of the devices?
4. What are the lecturers' level of acceptance and intention to use collaborative mobile instant messaging learning if incorporated into the formal course?

The findings of this needs analysis stage are discussed based on the research questions of the stage as follows:

1. The perception of lecturers on their current ways of teaching and learning

The findings regarding the perception of lecturers on teaching and learning found that some of them will continue to use the "chalk and talk" approach as they perceived it is still relevant to use. These findings are supported by research conducted by Zaidatun Tasir et al., (2008) which revealed that pre-service teachers in education institutions in Malaysia still requires the teacher-centered teaching methods which encouraged several lecturers continue to use the "chalk and talk " approach.

2. **The perception of lecturers on the implementation of ICT in teaching and learning**

   The findings regarding the perception of lecturers in implementing ICT in teaching have found that the lecturers perceived that the implementation of ICT in teaching creates many benefits in learning. This finding indicates that lecturers should implement the use ICT in teaching and learning process as to encourage the student (in this case, the teacher training students) according to a study conducted by Rahmat Sukor et al., (2008), trainee teachers should be given ample opportunity to increase the interest and skills in the field of ICT and thus form a positive attitude towards the use of ICT in teaching and learning.

3. **The lecturers' access to mobile devices and the capabilities level of the devices**

   In the process of the implementation of ICT in teaching and learning, the ICT equipment such as mobile devices owned by the lecturers should also be emphasized. This findings are important as the use of mobile technology is an essential criteria in technology based education (Quinn, 2011). According to Garrison and Anderson (2000), technology equipment can be used as a medium of instruction as it has a privilege not shared by other learning media. The study found that the lecturer has at least one mobile device technology where the devices they have are at least a minimum capacity needed to carry out mobile learning. This shows that the teaching process using MIM applications can be implemented in formal learning because it is easily accessible by the lecturer. This is not surprising considering the mobile phone penetration in this country is more than the country's population (Malaysian Communications and Multimedia Commission, 2017) as some of the mobile phone owners have more than one device.

4. The level of acceptance and intention of lecturers to use collaborative mobile instant messaging learning, if incorporated in teaching and learning

The findings about the ownership of mobile devices need to be followed by investigating the acceptance and the intention of the lecturers to apply the collaborative mobile instant messaging learning in the teaching and learning process. Therefore, this study was conducted to gain the lecturers' views on their intentions to apply it in their teaching process. The findings are discussed based on all the main constructs in the UTAUT model which are Performance Expectancy, Effort Expectance, Social Influence, Facilitating Conditions, Attitude Towards using technology, Self-efficacy, Behavioral Intention to Use, and Anxiety.

Based on the findings, the lecturers are very receptive to the use of MIM application in the teaching process and then develop a positive attitude towards the use of ICT in teaching and learning. These findings are important and support the opinion of Hartshorne and Ajjan (2009) who believe that this social network technology has the potential to enhance teaching and learning and interaction among students and teachers. According to the study conducted by Afendi Hamat, Mohamed Amin Embi, and Haslinda Abu Hassan (2013) on the readiness of the mobile learning implementation among lecturers in UKM, 79% of respondents have never used them for teaching and learning purposes even though they have smartphones. Therefore, the level of acceptance and readiness of using this mobile technology into the education field among all involved must be carefully viewed. Without the full reception of all parties, especially lecturers and teachers, the implementation of the mobile learning may not run smoothly. Therefore, this study is important because the acceptance factor is an aspect to be taken into account to support the teaching and learning process in an interesting and meaningful mobile learning environment.

Thus, the positive attitude of the lecturers was justifying the need to develop Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model as proposed in this study. Institute of Teacher Education Malaysia (IPGM) as the main organization and other teaching institutions are expected to benefit from the results of this study in which improvement to teaching and learning methods can be made more effective by establishing a framework for planning the course better.

The following section elaborates the discussion of the findings for the design and development of the model.

Discussion of Findings from Phase 2: Design and Development Phase

In order to develop the Collaborative Mobile Instant Messaging Learning (CMML) Pedagogical Model, the design dan development phase seeks to answer the following research questions:

1. What the experts' collective views on the pedagogical activities, which should be included in the development of the Collaborative Mobile Instant Messaging Learning pedagogical model?

2. What are the relationships among the pedagogical activities in the development of the Collaborative Mobile Instant Messaging Learning pedagogical model based on the experts' collective views?
3. How is the structural pedagogical model of Collaborative Mobile Instant Messaging Learning based on the experts' collective views?
4. How should the pedagogical activities be classified in the interpretation of the Collaborative Mobile Instant Messaging Learning pedagogical model based on the experts' collective views?

The findings of this design and development stage are discussed based on the following research questions:

1. **The experts' collective views on the pedagogical activities, which should be included in the development of the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model**

   The proposed pedagogical activities were identified and determined by a panel of experts through the Nominal Group Technique (NGT). There were 27 pedagogical activities which served as elements to develop a pedagogical model of Collaborative Mobile Instant Messaging Learning (CMIML).

   The initial draft list of activities that served as pedagogical elements that fit into the model was initially identified based on Five-Stage Scaffolding model introduced by Salmon (2004). In the model, there are five stages of online learning to be considered by a teacher or educator to structure and carry out teaching and learning activities. However, the list of these elements have been modified in accordance with the views of experts during the NGT session in which they are allowed to remove and add these elements if necessary.

The pedagogical activities which embraced the elements in the model were also representing effective features of mobile learning environment. According to a Framework for the Rational Analysis of Mobile Education (FRAME) introduced by Koole (2009), mobile learning is a learning process that takes into account a number of aspects; the mobile technology, the ability of human learning, and social interaction. The combination of these three aspects; aspects of the device, the learning aspect and the social aspect will create an ideal mobile learning environment. Thus, the list of pedagogical activities in the model that are categorized according to FRAME model are shown in Table 7.1.

Table 7.1

Pedagogical Activities based on FRAME

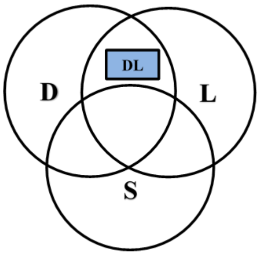
Aspect	Pedagogical Activities
Device Usability (DL)  **D** = *Device* **L** = *Learning* **S** = *Social*	2. Lecturer guides the students to participate in the CMIML by providing user manual on basic technical skills such as downloading application for IOS or Android users.
	5. Lecturer provides guideline etiquettes of using mobile instant messaging learning.
	10. Lecturer always awares of any upgrading on the application to ensure that CMIML is up to date.
	16. Lecturer selects the most suitable mobile instant messaging application to suit the purpose.
	23. Lecturer conducts survey to know the availability and the accessibility of the application selected.

Table 7.1 (Continued)

Pedagogical Activities based on FRAME

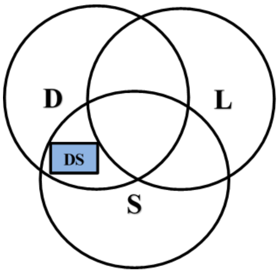
Aspect	Pedagogical Activities
Social Technology (DS)  **D** = *Device* **L** = *Learning* **S** = *Social*	3. Lecturer encourages the students to participate by warmly welcoming them to CMIML.
	6. Lecturer identifies mobile learners behaviours (the active learners, social participant learners and passive learners) in order to create a productive CMIML environment.
	13. Lecturer makes sure the information in the tasks should be specific to initiate action and interaction.
	15. Lecturer conducts e-monitoring from time to time to ensure students continuing engaged with CMIML.
	20. Lecturer ensures that a compatible and achieving community of CMIML is built for the purpose that is intended.
	24. Lecturer ensures that the tasks focus on exploring aspects of information familiar to students in order for them to easily retrieve it.
	26. Lecturer supports the use of learning materials both in digital or hardcopy by encouraging links sharing of information among students inside or outside closed conferences.

Table 7.1 (Continued)

Pedagogical Activities based on FRAME

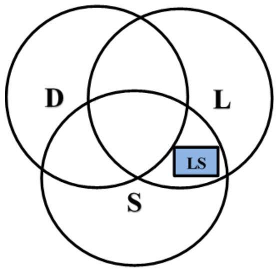
Aspect	Pedagogical Activities
Interaction Learning (LS)  **D** = *Device* **L** = *Learning* **S** = *Social*	1. Lecturer specifies the course objectives clearly and how to make it achievable. 4. Lecturer informs students the criteria of evaluation to enable them to be more active in discussion and know how to get better grade. 7. Lecturer assigns tasks and requires students to explore any relevant information available to them. 8. Lecturer promotes independent critical thinking by encouraging students to reflect on what they have learned and achieved. 9. Lecturer develops standard criteria for assessing the students based on appropriate rubrics. 11. Lecturer encourages peer review where students are able to compare their own self-reflection on their work to their peers. 12. Lecturer promotes reflection on how students are going to implement the knowledge to the new situation. 14. Lecturer assigns co-created tasks that promote idea sharing and collaboration among students.

Table 7.1 (Continued)

Pedagogical Activities based on FRAME

Aspect	Pedagogical Activities
	17. Lecturer explicitly informs of expected roles for lecturer and students. 18. Lecturer assigns leaders among students in each group to be second admin. 19. Lecturer facilitates the tasks and discussion by encouraging the students to collaborate in completing the tasks. 21. Lecturer summarizes the discussion from time to time or according to themes. 22. Lecturer stimulates fresh strands of ideas by introducing new themes and suggesting alternative approaches when discussions go off track. 25. Lecturer ensures that the social side of conferencing keeps on being available for any students who enjoy it. 27. Lecturer highlights or 'starred' the good point of any beneficial information or discussion to promote motivation.

Thus, the pedagogical activities which embraced the elements in the CMIML pedagogical model could promote in achieving an effective mobile learning environment as they fulfilled the Framework for the Rational Analysis of Mobile Education (FRAME).

2. The relationships among the pedagogical activities in the development of the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model based on the experts' collective views

In response to this research question, the relationships among the pedagogical activities were developed using experts' opinion with the aid of the Intepretive Structural Modeling (ISM) technique. ISM technique is a powerful decision-making tool widely used not only in the economic and business sector (Warfield, 1976) but in the education field (Mohd Paris Saleh, 2016 and Muhammad Ridhuan Tony Lim Abdullah, 2014) as well. Based on the findings, the elements for the model finally consisted of 27 pedagogical activities, which were connected to each other in a hierarchical manner determined by the experts based on pair wise technique with the aid of the Concept Star software.

3. The Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model.

In response to this research question, the result was the interpretive structural pedagogical model of collaborative mobile instant messaging learning for teacher training. This model consisted of 27 pedagogical activities determined by the selected panel of experts. The pedagogical activities were first being identified through the Nominal Group Technique (NGT) session with a panel consisted of 10 experts. The activities were then being inserted into the software for the Interpretive Structural Modeling (ISM) session. The result was the interpretive structural pedagogical model of collaborative mobile instant messaging learning for teacher training (Figure 5.1). The model was then being finalized by classifying the pedagogical activities into domains (Figure 5.2).

4. Classification of the identified pedagogical activities into various categories

The development of Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical Model is the result of a panel of experts' consensus using Interpretive Structural Modeling (ISM) as elaborated in Chapter 3. Based on the findings for this phase, the pedagogical activities have been classified into five domains to facilitate interpretation of the model; a) Initial pedagogical activities, b) Knowledge construction activities, c) Collaborative development activities, d) E-monitoring activities, and e) Reflection activities (Figure 5.2).

These five domains or categories of pedagogical activities in the model are in line with the five levels of online learning in Salmon Five-Stage Scaffolding model introduced by Salmon (2004). Briefly, five stages in Salmon Scaffolding Model provide an example of how an e-moderator (lecturers or teachers) need to do at each level to help students to benefit from e-learning. Therefore, based on the five-stage model of the Salmon Five-Stage Scaffolding, pedagogical model was developed to provide guidance to lecturers (e-moderator) to provide learning activities that are appropriate and effective to achieve the planned learning objectives. However, the level of pedagogical activities have been modified in accordance with the views of a panel of experts selected in accordance with the current situation because there is no term 'one size fits all' in the application of mobile learning (mLearning) (Mohamed Amin Embi & Norazah Mohd Nordin, 2013). This is due to this pedagogical model is based on mobile learning that there is a slight variation from Salmon Five-Stage Scaffolding Model which the learning activities proposed are based on e-Learning.

Additionally, Salmon Five-Stage Scaffolding model uses the concept of e-moderating in which the activities planned at all levels are categorized as monitoring activities. Whereas, the pedagogical model developed identified a number of pedagogical activities that are classified under the e-monitoring activities. However, the activities of the e-monitoring can be carried out at all times and at all levels of activities. Thus, Table 7.2 shows a comparison of levels of activities in both models.

Table 7.2

Comparing levels of activity in the CMIML Pedagogical Model with Salmon Five-Stage Scaffolding Model

Levels	Salmon Five-Stage Scaffolding Model	CMIML Pedagogical Model
1	**Access and motivation Stage** • E-moderator's role is to welcome students and encourage students to interact.	**Initial Pedagogical Activities** • Lecturer makes preparatory activities to ensure that students understand the lesson using the mobile instant messaging (MIM) application. This includes the preparation of technical and practical terms. (See Figure 5.2)
2	**Socialization** • E-moderator initiates activities to send and receive messages for the purpose of socializing online to build a reputation among participants of e-learning. • E-moderator builds relationships between the cultural, social and learning communities to ensure that e-learning can be compatible.	**Knowledge Construction Activities** • Lecturer selects learning activities that carry out the construction of knowledge through the provision of appropriate assignments to students and ensure that the information sought is readily available. • Lecturer also encourages the sharing of information among students. (See Figure 5.2)

Table 7.2 (Continued)

Comparing levels of activity in the CMIML Pedagogical Model with Salmon Five-Stage Scaffolding Model

Levels	Salmon Five-Stage Scaffolding Model	CMIML Pedagogical Model
3	**Information exchange** • E-moderator roles as facilitator in the given assignments and discussions as well as supporting the use of learning materials.	**Collaborative Development Activities** • The lecturer roles as facilitator in the discussions and promote collaborative activities among students in completing the assignment. (See Figure 5.2)
4	**Knowledge construction** • E-moderator roles as facilitator in the discussions for the construction of knowledge.	**E-monitoring Activities** • The lecturer roles as a watchdog to ensure that a compatible community of collaborative mobile instant messaging learning can be realized. (See Figure 5.2)
5	**Development** • E-moderator supports and encourages students to respond in critical thinking and self-reflection.	**Reflection Activities** • Lecturer encourages students to think critically and reflect on what they have learned. (See Figure 5.2)

Thus, these five domains are hoped to provide guidance to lecturers in providing appropriate pedagogical activities in order to achieve not only the planned learning objectives but also an effective mobile learning environment.

The pedagogical activities were also being classified into different levels by defining the driving power and the dependence power of each activity. Driving power is the power driving elements or other activities in achieving the goals and objectives by itself. Whereas, the dependence power is the power that depends on other powers to achieve certain goals and objectives. Thus, in order to explain the driving power and the dependence power of each element in the model, the reachability matrix for the pedagogical activities was developed. Based on the findings for this phase, there are 14 levels of pedagogical activities. These partition levels of pedagogical activities were used to guide in the mapping of the activities in the model (Figure 5.3).

The pedagogical activities were then being classified according to clusters based on their driving power and dependence power using Cross-impact multiplication applied to classification (MICMAC) analysis (Figure 5.4). The aim of this classification is to analyze the driving power and dependence power of each activities. The classification is divided into four clusters which are the autonomous cluster, dependent cluster, linkage cluster, and the independent cluster. The clusters indicated how the pedagogical activities were related among each other in terms of the flow and priority of acitivities in order to achieve the learning course objectives.

The following section elaborates on the discussion of the findings from Phase 3 which is the evaluation phase.

Discussion of Findings from Phase 3: Evaluation of the Model

The final phase of this study is the evaluation of the Collaborative Mobile Instant Messaging Learning (CMIML) Pedagogical model developed in phase 2. This evaluation phase aimed to answer the following research questions:

1. What is the experts' consensus on the suitability of the pedagogical activities proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?
2. What is the experts' consensus on the classification of the pedagogical activities as proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?
3. What is the experts' consensus on the list of pedagogical activities in the respective four clusters (Independent, Linkage, Dependent, and Autonomous) as proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?
4. What is the experts' consensus on the relationships among the pedagogical activities as proposed in the Collaborative Mobile Instant Messaging Learning pedagogical model?
5. What is the experts' consensus on the suitability of the Collaborative Mobile Instant Messaging Learning pedagogical model in the teaching and learning for teacher training?

Overall, the findings of this evaluation phase indicated the consensus agreement among the panel of experts to the evaluation of the usability of the CMIML pedagogical model that has been developed in phase two using the Interpretive Structural Modeling (ISM) approach. Based on the the research questions above, the pedagogical model was evaluated based on the following five aspects:

1. The suitability of the elements or pedagogical activities in the CMIML pedagogical model;
2. The classification of the pedagogical activities into 5 domains; Initial Pedagogical activities, Knowledge Construction activities, Collaboration Development activities, E-monitoring Activities, and Reflection activities;
3. The list of pedagogical activities in the respective clusters; Independent, Linkage, Dependent and Autonomous;
4. The relationships among the pedagogical activities; and
5. The suitability of the CMIML pedagogical model in teaching and learning for teacher training.

In evaluating the pedagogical model, the views of 25 experts were used. The evaluation of the pedagogical model adopted the modified Fuzzy Delphi method (FDM) which was elaborated in the methodology. The experts have responded to the evalution questionnaires consisting of 32 questions which were divided into 2 parts. The first part is to elicit the background information of the experts while the second part was to get their views on the pedagogical model developed in phase two. The second part of the questionnaires comprises of five aspects that need to be evaluated.

Based on the overall threshold value 'd' (Table 6.4), the percentage of experts' agreement which is 86% (Table 6.5) has exceeded the required consensual agreement of 75% ($d \leq 0.2$). In the defuzzification process, all the items showed the fuzzy scores (A) more than the value of Alpha α-cut of 0.5 which showed consensual agreement among the experts of the proposed pedagogical model.

For the suitability aspect of the pedagogical activities, the findings showed that they are suitable as elements in the CMIML pedagogical model based on the threshold value ‘d’, the percentage of experts’ agreement and the Fuzzy score (A) (Table 6.6). The next aspect being evaluated is related to the classification of the pedagogical activities into domains. The findings showed that the experts consensually agreed with all the items based on the threshold value ‘d’ ≤ 0.2, the percentage of experts’ consensus $\geq 75\%$ and the Fuzzy score (A) $\geq \alpha - \text{cut} = 0.5$ (Table 6.7). The findings also showed that the experts consensually agreed on the other aspect of the evaluation which is related to the classification of pedagogical activities into clusters as they fulfilled all the requirements of the threshold value ‘d’, the percentage of experts’ agreement and the Fuzzy score (A) (Table 6.8). The next evaluation is on the relationships among the pedagogical activities which considering the positioning of the elements in the five domains of activities. Based on the findings, all the items were in the range of the requirements for the threshold value ‘d’, the percentage of experts’ agreement and the Fuzzy score (A) (Table 6.9) which indicated that all experts consensually agreed with the relationships among the pedagogical activities in the five domains.

Finally, the last aspect was to evaluate the overall suitability of the CMIML pedagogical model in the teaching and learning for teacher training. Based on the findings (Table 6.10), the experts were consensually agreed that the model shows a clear guide on how collaborative mobile instant messaging learning could be conducted in complementing the conventional classroom learning. The model shows clearly on how formal classroom learning activities could merge with informal learning activities to form a holistic learning experience for the students. The experts also show consensually agreement that the model shows clearly how one activity connects to other activities in aiding the students through collaborative learning in achieving the course objectives. The experts also agreed that the model could be used to assist planning of course unit lessons by the lecturer in facilitating students' in collaborative learning, and the model could be used as an example to develop other curriculum implementation models for other courses. Hence, all the items have met the requirements needed in the triangular fuzzy number and deffuzification process which revealed that all experts consensually agreed that the pedagogical model is suitable to be used as a guide for the lecturers in teaching and learning process using mobile instant messaging application.

Overall, it can be concluded that the five aspects being viewed in the usability evaluation of the model are at the appropriate level based on the findings that have fulfilled all the requirements set out in the Fuzzy Delphi technique procedure. A good model development is a user-friendly model and easy-to-understand model as a developed model should guide and help the user to use it (Mohd Ridhuan, 2016). Therefore, the findings of the suitability of the CMIML pedagogical model showed that the development of this model is appropriate not only to create an ICT-based pedagogy according to current needs but to promote mobile learning as well.

Summary of Discussions of the Findings

Based on the needs analysis phase, the positive attitude of the lecturers was justifying the need to develop Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model as proposed in this study. Thus, the results are expected to benefit all the parties involved in which improvement to teaching and learning methods can be made more effective by establishing a framework for planning the course better.

In the proposed model, the five domains namely the initial pedagogical activities, knowledge construction activities, collaboration development activities, e-monitoring activities and reflection activities are hoped to provide guidance to lecturers in providing appropriate pedagogical activities in order to achieve not only the planned learning objectives but also an effective mobile learning environment.

The five aspects being viewed in the usability evaluation of the model is appropriate not only to create an ICT-based pedagogy according to current needs but to promote mobile learning as well. Thus, all the five domains in the model and the usability aspects being viewed have resulted in a robust pedagogical model and potentially being used as reference to all parties involved. In fact, the pedagogical model produced in this study is suitable to be adopted as the collaborative instant messaging learning implementation guidelines.

However, a few factors need to be taken into account in implementing this guideline such as the education policy of a country which is beyond the ability to be ignored. Other than that, the rapid development of mobile devices particularly the mobile instant messaging applications and the changing pedagogical practices would force the mobile instant messaging learning to be updated from time to time in order to cater the needs in the evolving world of the internet and technology.

Nevertheless, this pedagogical model that has been developed from experts' opinions and views is hoped to produce pre-service teachers with positive attitude towards the use of ICT and thus, create an active implementation of ICT in teaching and learning as described in Figure 7.1.

CONTEXTS

Government Policy/Malaysia Education Blueprint (PPPM)/Market Needs (Government Agency)/Information and Communication Technology (ICT)

INPUT

Lecturers in Teacher Training Institutions

PROCESS

CMIML PEDAGOGICAL MODEL

Intitial Pedagogical Activities

- Lecturer specifies the course objectives clearly and how to make it achievable.
- Lecture guides the students to participate in the CMIML by providing user manual on basic technical skills such as downloading application for IOS or Android users.
- Lecturer encourages the students to participate by warmly welcoming them to CMIML.
- Lecturer provides guideline etiquettes of using mobile instant messaging learning.
- Lecturer identifies mobile learners behaviours (the active learner, social participant learners and passive learners) in order to create a productive CMIML environment.
- Lecturer develops standard criteria for assessing the students based on appropriate rubrics.
- Lecturer always aware of any upgrading on the application to ensure that CMIML is up to date.
- Lecturer explicitly informs of experected roles for lecturer and students.
- Lecturer conducts survey to know the availability and the accessibility of the application selected.

Knowledge Construction Activities

- Lecturer makes sure the information in the taks should be specific to initiate action and interaction.
- Lecturer ensures that the tasks focus on exploring aspects of information familiar to students in order for them to easily retrieve it.
- Lecturer supports the use of learning materials both in digital or hardcopy by encouraging links sharing of information among students inside or outside closed conferences.

Collaboration Development Activities

- Lecturer assigns tasks and requires students to explore any relevant information available to them.
- Lecturer assigns co-created tasks that promote idea sharing and collaboration among students.
- Lecturer facilitates the tasks and discussion by encouraging students to collaborate in completing the tasks.
- Lecturer highlights or ‘starred’ the good point of any beneficial information or discussion to promote motivation.

E-monitoring Activities

- Lecturer informs students the criteria of evaluation to enable them to be more active in discussion and know how to get better grade.
- Lecturer conducts e-monitoring from time to time to ensure students continuing engaged with CMIML.
- Lecturer assigns leaders among students in each group to be second admin.
- Lectuere ensures that a compatible and achievingcommunity of CMIML is built for the poupose that is intended.
- Lecturer summarizes the discussion from time to time or according to themes.
- Lecturer stimulates fresh strands of ideas by introducing new themes and suggesting alternative approaches when discussions go off track.
- Lecturer ensures that the social side of conference keeps on being available for any students who enjoy it.

Reflection Activities

- Lecturer promotes independent critical thinking by encouraging students to reflect on what they have learned and achieved.
- Lecturer encourages peer review where students are able to compare their own self-reflection on their work to their peers.
- Lecturer promotes reflection on how students are going to implement the knowledge to the new situation.

OUTPUT

Teacher training students (Pre-service teachers) with ICT competence (positive attitude towards the use of ICT)

OUTCOME

21st century teaching and learning approach (Active implementation of mobile learning CMIML)

Figure 7.1 Collaborative Mobile Instant Messaging Learning Implementation Guideline

Implications of the Study

This section is a discussion of the implications of the study based on the findings discussed in previous sections. There are three main implications from the findings of the study; the practical implications, the theoretical implications, and the methodology implications. The practical implications are suggested steps taken action by stakeholders such as the Ministry of Education, policy makers and educational policy. While, the implications of the theory refers to the discussion to compare the theories used in this study. Finally the methodology implications contribute to the development of knowledge in the research methodology for curriculum and instruction technology field. Thus, this section presents the implications of the study based on the practical implications, theoretical implications, and the methodology implications.

Practical Implications of the Study

Mobile learning (mLearning) has clearly proven that it is increasingly being accepted as a form of teaching for the future. This is evidenced by the results of this study that found the needs to develop a model in particular the use of mobile instant messaging application for learning to assist lecturers in their teaching process. Through the model, the role of the lecturer as a facilitator, has allowed students and lecturers to interact with each other, explore new findings and build new knowledge through the incorporation of mobile devices in teaching and learning. Based on the findings of this model also shows the role of the teacher as a facilitator and motivator is very clear and visible during the teaching process, while the role of the students became increasingly active in the learning process. This is clearly seen through the collaborative development activities and e-monitoring activities. Similarly, during the reflection activites carried out in which lecturers could promote students to be more active in expressing their thoughts.

The results of this study will also be able to contribute to the implementation of teaching and learning using mobile technologies other than for teacher training course. This pedagogical model can also be used in formal classes in each school. Through the learning method uses a mobile instant messaging application, teachers can plan lessons that explore collaborative learning in a fast manner, and at save costs. Thus, the Ministry of Education should act proactively by providing infrastructure facilities in schools in terms of mobile technology equipment to be used in formal and informal classroom to encourage teachers and students to conduct various exploration activities using a mobile device. The Ministry of Education may need to collaborate with mobile technology providers in equipping schools with relevant mobile learning infrastructure for the teachers and students such as smart phones, tablets and iPad.

Through the study of model development, it will open a new era to the Ministry of Education and teacher training institutions in developing and planning the teaching process to be more recent and more significant as the use of mobile devices is the latest trend in information society. Without neglecting the traditional teaching in formal classroom that had so long practiced, this study focuses on aspects of teaching using mobile instant messaging learning approaches that can be used systematically to support teaching and learning. The key significance of employment of technology in education focus on its role to augment formal learning not as replacement of current practices.

Theoretical Implications of the Study

Theory is the fundamental in any study. For this study, there are a few theories and models referred to as the foundation for the study conducted. The implications of theory to the development of the CMIML model are based on these four learning theories which are the Social Constructivist Learning Theory (Vygotsky, 1978), The Scaffoding Theory (Bruner, 1970), The Situated Learning Theory (Lave and Wenger, 1991), and Connectivism Theory (Siemens, 2005). Whereas, the two main models involved are the Salmon Five-Stage Scaffolding Model (Salmon, 2004) and the Framework for the Rational Analysis of Mobile Education (FRAME) (Koole, 2009). In the development of the model, the elements identified are to be based on the stated theories. In describing how students could be assisted through interaction and collaboration with the course instructor, peers, and mobile devices, the study employed the social contructivist learning theory. This theory emphasis on the concept of scaffolding which is Zone of Proximal Development (ZPD) through interaction with more knowledgeable others (MKO) in pursuit of a learning goal. In the context of this study, during their early stage of using collaborative mobile instant messaging learning (CMIML), some of the students might need helps in downloading the mobile instant messaging (MIM) application and learning basic technical skills through their instructors or friends with more knowledge in it. Besides giving supports in technical part, this is the stage where the instructors welcoming the students by giving motivation to students help each other by giving motivation and encouraging each other to participate in the CMIML. By implementing MKO at the zone of proximal development, students should receive appropriate scaffolding to help them to the next stage of their study.

These activities can be found in every domain of activities proposed in the CMIML pedagogical model.

In CMIML, the role of the instructor has changed from the center of information dissemination to become the facilitator for acquiring new knowledge through online learning. Thus, the study employed the Connectivism theory, where Siemens (2005) pointed out that, learning in the digital age relies on the connected learning that occurs through interaction with various sources of knowledge including the Internet and learning management systems (LMS) and participation in communities of common interest, social networks, and group tasks. In the context of CMIML, the most significant is the facilitation of mobile instant messaging application in preparing the platform for collaborative activities where the students are expected to gather information through idea sharing among themselves. This information exchange has made the interaction becomes more collaborative and knowledge construction are developed throughout completing their group task which is in line with the activities in the knowledge construction and collaborative development domains in the model.

Furthermore, through CMIML, social relationships are created outside the physical confines of the course room through online discussion. This is on the ground that CMIML ables to create environment for students to initiate interaction that contributing to networks socialization. Thus, the study employed the Situated learning theory (Lave & Wenger, 1991) that promotes the development of competences through social learning activities occurring in context and culture as opposed to classroom learning activities. The role of instructors in employing CMIML is very important as the online activities have to be properly planned. The instructors have to encourage the students to participate in the group discussions and may as well requiring all assignments to be completed in any digital tools format. This is to allow the learners to indirectly absorb an online-mentality where they are comfortable with an online interaction (Wan Mohd Fauzy Wan Ismail, 2012). Thus, the combination of these theories to develop the CMIML pedagogical model has been proven appropriate to be used based on the evaluation of panel of experts' through Fuzzy Delphi technique.

The development of the CMIML pedagogical model for teacher training was driven by appropriate technology-based models. Thus, the model was developed with the integration of the Salmon Five-Stage Scaffolding Model (Salmon, 2004) and the Framework for the Rational Analysis of Mobile Education (FRAME) model (Koole, 2009). The employment of these models aims to identify appropriate pedagogical activities that are unique to mobile instant messaging learning. The Salmon Five-Stage Scaffolding Model has been used as the basis for the pedagogical constructs while the FRAME model is as a guide in identifying the appropriate elements for the model. The combination of these two models eventually resulted in a list of pedagogical activities as a guide to the lecturer for teacher training program to structure the teaching and learning activities in an effective mobile learning environment. A condusive mobile learning environment can indirectly promote active implementation of ICT in teaching and learning process.

Based on the discussion in this section, the CMIML pedagogical model implicates the theories by demonstrating how multiple learning theories, framework and model could be combined to develop an effective pedagogy strategy. Other than that, the study also showed that the past learning theory such as Vygotsky's Zone of Proximal Development (ZPD) and could still be relevant to describe the present learning application especially in this digital age.

Methodology Implications of the Study

There are some methodological approaches used in this study contribute to the development of knowledge in the field of research. Briefly, in developing the Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model, this study employed the design dan development research (DDR). This research involved three phases beginning with the Needs Analysis phase to investigate problems and justifications for developing a model. The next phase of design and development model involving a panel of experts in decision-making and evaluation phase that required the experts' views on the suitability of the developed model. In the Needs analysis phase, the mean score was used to interpret the views of respondents. However, in the design and development phase, a modified Nominal Group Technique (NGT) was employed to list, evaluate and validate identified elements based on experts' views. Meanwhile, the Interpretive Structural Modeling (ISM) approach which involving a panel of experts was employed to view the priority of the elements in the CMIML pedagogical model. For the evaluation phase, a modified Fuzzy Delphi method (FDM) was applied in evaluating the elements contained as well as the overall suitability of the model in teaching and learning process for teacher training program.

However, the research methodologies used in this study are not new. Eventhough ISM has been address as a powerful tool in decision making as it can address complex issues, it is uncommonly used in education field. Nevertheless, the integration of ISM with NGT has poven to generate appropriate elements for ISM as presented in this study. The use of Fuzzy Delphi technique also proved an effective strategy in evaluating the structured model eventhough it is scarcely used in educational research (Muhammad Ridhuan Tony Lim Abdullah, 2014). One of the similarity in these methods is the used of experts' opinion in designing and developing the model. The use of experts' opinion has a long established record of use in research methodology especially in new and undeveloped areas (Fowles, 1978). Since teaching is a conscious and carefully-planned procedure (Kordaki & Siempos, 2010), the use of experts' opinion is crucial in designing and developing effective pedagogical model.

Furthermore, the integration of ISM, NGT and Fuzzy Delphi technique in the development of CMIML pedagogical model here could serve as an example in using these methods for education strategies. The methodology used here in developing the model could be replicated or adapted to develop pedagogical models for other programs as well. The methodology could also be useful to develop other educational related model such as curriculum, management, planning and educational policy and others.

Recommendations for Further Research of the Study

The final product of the study is the interpretive structural pedagogical model of Collaborative Mobile Instant Messaging Learning (CMIML) for teacher training. Thus, this section will discuss a few recommendations for further research. As mentioned in chapter three, this study employed the design and development (DDR) research approach. Based on this model, it focused on using mobile instant messaging application in teaching and learning process. Therefore, there are some recommendations for further research that could be conducted based on the outcomes of this study.

The first recommendation is, in order to facilitate the use of this model, further studies should be done to develop this model in the form of a module so that it can be used by lecturers or educators. This module should then be conducted on the students to further evaluate the effectiveness of the model in supporting the formal teaching process. The model could be possibly further refined based on the findings of the evaluation through the modules.

The next recommendation is to develop another pedagogical model for other programs or courses other than the teacher training program. From the model, the pedagogical activities could be standardized to develop the model for general used. The pedagogical activities could be determined and listed based on the opinions from the selected panel of experts.

Another recommendation is to develop pedagogical model for primary and secondary school levels suitable with the limited mobile device facilities available or supplied at school because so far the use of mobile devices among school students is still under consideration by Ministry of Education.

Further research is also recommended in developing the CMIML pedagogical model at a full course. This model could be useful for the students in distance learning programs. The pedagogical activities could be different as the performance of the students will be fully evaluated based on their participations in the CMIML.

Finally, the CMIML pedagogical model could also be developed based on other factors identified such as culture, ethnicity, social and education background. The differences among the factors are normally happened across countries. Based on this, specific theories or models could be selected in order to generate appropriate activities or elements for the model. Besides that, perhaps, new theories or models could also be developed to define implementation of the models in general. Thus, research in technology-based intervention such as the application of newer technology in education need to be continued in catering for the evolving world of internet and technology.

Conclusion

In the world of internet and evolving technology, the use of better and advanced technology should be applied in the teaching and learning process. The increase of new and updated applications constantly found in smart phones make it even easier to be exploited in the field of education. Mobile instant messaging (MIM) application is a social media tool that is increasingly seen as a tool to enhance learning. Many studies have been conducted to understand how the MIM application can be implemented in learning other than its original function as a tool of social media alone. However, the use of MIM application that comes with the existing collaboration features is optimism can overcome the barriers that usually occur in the implementation of the use of ICT in the classroom. Furthermore, in the era of the 21st century, the role of teachers as 'knowledge providers' is changed to 'facilitator of learning' with a focus on student-oriented teaching. In line with current technology, mobile learning is seen to be realizing the present trend that emphasizes on student-oriented teaching. The use of mobile devices as the medium in mobile learning will demonstrate the ability of teachers to become effective facilitators in learning.

One of the obstacles to implementing technology in the classroom is due to the teacher is not quite ready for this teaching technique while they were undergoing teacher training in college. They may have a tendency to take the same approach to teaching because they are too familiar with the teaching style during lectures in colleges of their training college. Thus, exposure to the use of technology in teaching and learning process should be applied at an earlier stage, namely in teacher training institutions. If teachers or educators are introduced to the approach to teaching guidelines using better technology, they should not miss the opportunity to implement it. Therefore, the development of Collaborative Mobile Instant Messaging Learning (CMIML) pedagogical model is not only designed and developed to enhance formal learning but also as an alternative approach to enhance the normal teaching and learning methods specifically for teacher training program.

REFERENCES

Adler, M., & Ziglio, E. (1996). *Gazing into the oracle: The Delphi method and its application to social policy and public health*. Jessica Kingsley Publishers.

Afendi Hamat, Mohamed Amin Embi & Haslinda Abu Hassan. (2013). Preparing for Mobile Learning: A Readiness Study at Universiti Kebangsaan Malaysia. In *E-Learning in Malaysia Higher Education Institutions: Status, Trends & Challenges.* National University of Malaysia and Ministry of Higher Education.

Akbari, R., & Yazdanmehr, E. (2014). A critical analysis of the selection criteria of expert teachers in ELT. *Theory and Practice in Language Studies*, 4(8), 1653-1658.

Albadry, H. (2017). An Investigation into the Role of Tablet Devices in Facilitating Collaborative Learning in EFL Language Course. *International Journal of Emerging Technology*, 12(4), 39–52.

Ally, M., McGreal, R., Schafer, S., Tin, T., & Cheung, B. (2007). Use of mobile learning technology to train ESL adults. *Proceedings of the Sixth International Conference on Mobile Learning, Melbourne*.

Analisa Hamdan, Rosseni Din, Siti Zuraida Abdul Manaf. (2013). Penerimaan m-Pembelajaran dalam Sistem Pendidikan di Malaysia melalui The Unified Theory of Acceptance and Use of Technology (UTAUT): Satu Analisis Literatur. *1st International Conference on Mobile Learning, Applications, and Services (mobilcase2012)*, *1*(2), 93–97.

Ann Rosnida Mohd. Deni, Zainor Izat, & Malakolunthu, S. (2013). Improving teaching in higher education in Malaysia: Issues and challenges. *Journal of Further and Higher Education*, (Published online: 05 Sep 2013), 1 –18. http://doi.org/10.1080/0309877X.2013.831037

Attewell, G. (2007). Personal Learning Environments - the future of eLearning ? *Lifelong Learning*, 2(1), 1–8.

Attewell, G., & Hughes, J. (2010). Pedagogic approaches to using technology for learning: Literature review. *Lifelong Learning UK*, (September), 1–86.

Attewell, G., & Webster, T. (2005). Engaging and supporting mobile learners. Mobile learning anytime everywhere: *A Book of Papers from mLearn 2004*. 15-19.

Attri, R., Dev, N., & Sharma, V. (2013). Interpretive Structural Modelling (ISM) approach : An Overview. *Research Journal of Management Sciences*, *2*(2), 3–8. http://doi.org/10.1108/01443579410062086

Baggio, B. (2008). Integrating social software into blended-learning courses: A Delphi study of instructional-design processes. (Doctoral dissertation, Capella University). Retrieved from ProQuest Dissertations Publishing, 3297938

Beatty, B., & Ulasewicz, C. (2006). Faculty perspectives on moving from Blackboard to the Moodle learning management system. *TechTrends*, 50(4), 36-45.

Beetham, H., McGill, L., Littlejohn, A., & Mcbeth, O. (2009). Thriving in the 21st century: Learning literacies for the digital age (LLiDA project): Executive Summary, Conclusions and recommendations. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.423.2418

Benitez, J., Martín, J., & Román, C. (2007). Using fuzzy number for measuring quality of service in the hotel industry. *Tourism Management*, 28(2), 544-555.

Berliner, D. C. (2004). Describing the behavior and documenting the accomplishments of expert teachers. *Bulletin of Science, Technology & Society*, 24(3), 200-212.

Bodjanova, S. (2006). Median alpha-levels of a fuzzy number. *Fuzzy Sets and Systems*, *157*(7), 879–891. http://doi.org/10.1016/j.fss.2005.10.015

Bogdan, R., & Biklen, S. K. (2007). *Qualitative research for education : an introduction to theories and methods*. Pearson A & B.

Bollen, L., Eimler, S., & Hoppe, H. (2004). SMS-based discussions-technology enhanced collaboration for a literature course. *Proceedings of the The 2nd IEEE International Workshop on Wireless and Mobile Technologies in Education (WMTE'04)*. (209-210).

Bonner, P. (2001). *The influence of secondary science teachers' pedagogical content knowledge, educational beliefs and perceptions of the curriculum on implementation and science reform*. Retrieved from ProQuest Dissertations And Theses, AAI3038035

Bouhnik, D., Deshen, M., & Gan, R. (2014). WhatsApp goes to school: Mobile instant messaging between teachers and students. *Journal of Information Technology Education: Research*, *13*, 217–231.

Bradley, L., & Stewart, K. (2002). A Delphi study of the drivers and inhibitors of Internet banking. *International Journal of Bank Marketing*, 20(6), 250-260.

Brett, P. (2011). Students' experiences and engagement with SMS for learning in Higher Education. *Innovations in Education and Teaching International*, *48*(2), 137–147.

Brindley, J. E., Walti, C., & Blaschke, L. M. (2009). Creating effective collaborative learning groups in an online environment. *International Review of Research in Open and Distance Learning*, *10*(3), 1–18.

Broome, B., & Cromer, I. (1991). Strategic planning for tribal economic development: A culturally appropriate model for consensus building. *International Journal of Conflict Management*, 2(3), 217-233.

Brophy, J. (1991). Advances in Research on Teaching: A Research Annual, 1991: Teachers'Knowledge of Suject Matter As It Relates to Their Teaching Practice (Advances in Research on Teaching).

Brown, F. A. (2008). Collaborative learning in the EAP classroom: Students' Perceptions. *ESP World*, 17(1), 1-18.

Brown, T. H. (2005). Towards a model for m-learning in Africa. *International Journal on E-Learning*, *4*(3), 299–315.

Bruffee, K. (1999). *Collaborative learning: Higher education, interdependence, and the authority of knowledge*. Retrieved from http://eric.ed.gov/?id=ED430508

Bruner, J. (1970). The growth and structure of skill. In KJ Connolly (Ed.), Mechanisms of motor skill development, 63-94.

Bruner, J. (1999). Folk pedagogies. Learners and pedagogy, 1, 4-20.

Brush, T., & Saye, J. (2002). A summary of research exploring hard and soft scaffolding for teachers and students using a multimedia supported learning environment. *The Journal of Interactive Online*, 1(2), 1-12.

Çam, E., & Işbulan, O. (2012). A new addiction for teacher candidates: Social networks. *Turkish Online Journal of Educational Technology*, *11*(3), 14–19.

Cameron, A. F., & Webster, J. (2005). Unintended consequences of emerging communication technologies: Instant messaging in the workplace. *Computers in Human Behavior*, *21*, 85–103.

Chang, P.-L., Hsu, C.-W., & Chang, P.-C. (2011). Fuzzy Delphi method for evaluating hydrogen production technologies. *International Journal of Hydrogen Energy*, *36*(21), 14172–14179.

Chang, P. T., Huang, L. C., & Lin, H. J. (2000). The fuzzy Delphi method via fuzzy statistics and membership function fitting and an application to the human resources. *Fuzzy Sets and Systems*, *112*(3), 511-520.

Chapple, M., & Murphy, R. (1996). The nominal group technique: extending the evaluation of students' teaching and learning experiences. *Assessment & Evaluation in Higher Education*, 21(2), 147-160.

Charan, P., Shankar, R., & Baisya, R. (2008). Analysis of interactions among the variables of supply chain performance measurement system implementation. *Business Process Management Journal*, 14(4), 512-529.

Chen, C. (2012). The application of interpretive structural modeling method to develop verity design solution of case host preference-based products: a case study of Razor. *Journal of Theoretical and Applied Information,* 35(1), 92-99.

Chen, Y., Handy-Bosma, J., & Walker, K. (2005). Method and system for automatic/dynamic instant messaging location switch. *US Patent App*. No. 11/260,577.

Chen, Y., Kao, T., & Sheu, J. (2003). A mobile learning system for scaffolding bird watching learning. *Journal of Computer Assisted Learning*, 19(3), 347-359.

Cheng, C., & Lin, Y. (2002). Evaluating the best main battle tank using fuzzy decision theory.pdf, *142*, 174–186.

Chigona, A. (2015). Pedagogical shift in the twenty-first century: Preparing teachers to teach with new technologies. *Africa Education Review*, *12*(3), 478–492.

Chipunza, P. (2013). Using mobile devices to leverage student access to collaboratively-generated resources: A case of WhatsApp instant messaging at a South African University. *International Conference on Advanced Information and Communication Technology for Education (ICAICTE 2013).*

Chu, H. C., & Hwang, G. J. (2008). A Delphi-based approach to developing expert systems with the cooperation of multiple experts. *Expert Systems with Applications*, *34*(4), 2826–2840.

Clark, D. (2012). Social Media: Why this matters to everyone in Education. The International HETL Review, 2(8), 1. Retrieved from https://www.hetl.org/wp-content/uploads/2013/09/HETLReviewVolume2Article8.pdf

Cochran-Smith, M., & Lytle, S. (1993). *Inside/outside: Teacher research and knowledge*. Teachers College Press.

Cohen, L., Manion, L., & Morrison, K. (2007). *Research Methods in Education*. *Education* (Vol. 55). http://doi.org/10.1111/j.1467-8527.2007.00388_4.x

Colley, J., & Stead, G. (2004). Take a bite: producing accessibble learning materials for mobile devices. Learning with mobile devices. In J. Attewell & S.-S. Carol (Eds.), *Learning with Mobile Devices: Research and Development* (pp. 43–46). Learning and Skills Development Agency.

Collis, B., & Jung, I. (2003). Uses of information and communication technologies in teacher education. *Teacher Education through Open and Distance*, 171–192.

Conole, G. (2010). Review of Pedagogical Models and their use in e-learning. *Milton Keynes: Open University*.

Contreras-Castillo, J., & Pérez-Fragoso, C. (2006). Assessing the use of instant messaging in online learning environments. *Interactive Learning Environments,* 14(3), 205-218.

Cook, J., Pachler, N., & Bradley, C. (2008). Bridging the gap? Mobile phones at the interface between informal and formal learning. *Journal of the Research Center for Educational Technology*, 4(1), 3-18.

Corbin, J., & Strauss, A. (2008). Basics of qualitative research: Techniques and procedures for developing grounded theory. *Thousand Oaks: California, CA, USA.*

Creswell, J. (2007). *Qualitative enquiry and research design: Choosing among five approaches* (2nd ed.). Thousand Oaks, CA:SAGE.

Dalkey, N. (1972). *Studies in the quality of life; Delphi and Decision-making*. Lexington Books.

Dalkey, N., & Helmer, O. (1963). An experimental application of the Delphi method to the use of experts. *Management Science*, 9(3), 458-467.

Deip, P., Thesen, a, Motiwalla, J., & Seshardi, N. (1977). Nominal Group Technique. *Systems Tools for Project Planning*, 14–18.

Delbecq, A., Ven, A. Van de, & Gustafson, D. (1975). Group techniques for program planning: A guide to nominal group and Delphi processes. Scott Foresman.

Devinder, S. & Zaitun Abu Bakar. (2006). Mobile learning in wireless classrooms. *Malaysian Online Journal of Instructional Technology (MOJIT)*, *3*(2), 26–42.

DeWitt, D., Saedah Siraj, & Norlidah Alias. (2013). Collaborative mlearning: A module for learning secondary school science. *Educational Technology and Society*, *17*(1), 89–101.

DeWitt, D., Saedah Siraj, Mohd Nazri Abdul Rahman, Zaharah Hussin, & Norlidah Alias. (2013). *Design and Developmental Research: Emergent Trends in Educational Research*. (pp. 2–15). Pearson, Malaysia.

Dillenbourg, P. (1999). *Collaborative Learning: Cognitive and Computational Approaches*. Elsevier Science & Technology Books. Retrieved from https://books.google.com/books?id=Zq4wQgAACAAJ&pgis=1

Dourando, D., Parker, M. B., & De la Harpe, R. (2007). Investigation into the usage of mobile instant messaging in tertiary education. *Proceedings of Annual Conference of World Wide Web Application*.

Driscoll, K. (2007). Collaboration in today's classrooms: New web tools change the game. *Multimedia and Internet@ Schools*, 14(3), 9.

Dukes, S. (1984). Phenomenological methodology in the human sciences. *Journal of Religion and Health*, 23(3), 197-203.

Eberman, L., & Cleary, M. (2011). Development of a heat-illness screening instrument using the Delphi panel technique. *Journal of Athletic Training*, 46(2), 176-184.

Echeverría, A., Nussbaum, M., Calderón, J. F., Bravo, C., Infante, C., & Vásquez, A. (2011). Face-to-face collaborative learning supported by mobile phones. *Interactive Learning Environments*, 19(4), 351-363.

El-Hussein, M., & Cronje, J. (2010). Defining mobile learning in the higher education landscape. *Journal of Educational Technology & Society*, 13(3), 12.

Ellis, B. R. K. (2009). Field Guide to Learning Management Systems. Learning Circuits, 8. Retrieved from http://www.astd.org/NR/rdonlyres/12ECDB99-3B91-403E-9B15-7E597444645D/23395/LMS_fieldguide_20091.pdf

EMarketer. (2015). *Mobile Messaging to Reach 1.4 Billion Worldwide in 2015*. Retrieved from https://www.emarketer.com/Article/Mobile-Messaging-Reach-14-Billion-Worldwide-2015/1013215

Enochsson, A., & Rizza, C. (2009). ICT in initial teacher training. *Research Review*. *OECD Education Working Papers*, (38), 0_1.

Farahizan Zaihan Azizan. (2010). Blended Learning in Higher Education Institution in Malaysia. *Proceedings of Regional Conference on Knowledge Integration in ICT 2010* (pp. 454–466).

Farmer, R. (2005). Instant Messaging: IM Online! RU?. *Educause Review*. Retrieved from http://eric.ed.gov/?id=EJ745799

Ferguson, C., & Keengwe, J. (2007). Pedagogical paradigm shift: A shift from traditional to E-learning education. *E-Learn: World Conference on E-Learning. in Corporate, Government, Healthcare, and Higher Education* (pp. 2022-2024). Association for the Advancement of Computing in Education (AACE).

Fowles, J. (1978). *Handbook of futures research*. Greenwood Press: Connecticut.

Fraenkel, J. R., & Wallen, N. E. (2006). *How to design and evaluate research in education* (4th ed.). New York: McGraw-Hill.

Franklin, T., & Harmelen, M. V. (2007). Web 2.0 for content for learning and teaching in higher education.

Frazier, L. C., & Sadera, W. A. (2013). Distance Education in Teacher Preparation Programs: A National Study. I*nternational Journal of Technology in Teaching & Learning*, 9(2).

Garrison, D., & Anderson, T. (2000). *Transforming and enhancing university teaching: Stronger and weaker technological influences*. London, Eng.: Kogan Page.

Gay, L. R., & Airasian, P. (2000). *Educational research: Competencies for. Analysis and application* (6th ed.). Ohio: Prentice Hall.

Geddes, S. (2004). Mobile learning in the 21st century: benefit for learners. *Knowledge Tree E-Journal*, 30(3), 214-228.

Georgakopoulos, A. (2009). Teacher effectiveness examined as a system: Interpretive structural modeling and facilitation sessions with US and Japanese students. *International Education Studies*, 2(3), 60.

George, D., & Mallery, P. (2003*). SPSS for Windows step by step: A simple guide and reference 11.0 update (4th ed.)*. Boston: Allyn & Bacon

Goldsborough, R. (2001). Instant messaging becomes big business. *Philadelphia News*. Retrieved from: https://www.newspapers.com

Google Survey Report. (2014). *Google: Malaysians use more smartphone than computers*. Retrieved from https://www.malaysianwireless.com/2014/11/google-malaysians-use-smartphone-computers/

Gordon, T. J. (2009). The Delphi Method. *Futures Research Methodology v3.0 [CD-ROM]*, 1–29.

Haleem, A., Sushil, undefined, & Qadri, M. (2012). Analysis of critical success factors of world-class manufacturing practices: an application of interpretative structural modelling and interpretative ranking process. *Production Planning* & Control, 23(10-11), 722-734.

Hansen, J., McKell, L., & Heitger, L. (1979). ISMS: computer-aided analysis for design of decision-support systems. *Management Science*, 25(11), 1069-1081.

Hartshorne, R., & Ajjan, H. (2009). Examining student decisions to adopt Web 2.0 technologies: theory and empirical tests. *Journal of Computing in Higher Education*, 21(3), 183.

Hasson, F., Keeney, S., & McKenna, H. (2000). Research guidelines for the Delphi survey technique. *Journal of Advanced Nursing*, 32(4), 1008-1015.

Haythornthwaite, C., Kazmer, M., Robins, J., & Shoemaker, S. (2000). Making connections: Community among computer-supported distance learners. *Association for Library and Information Science Education 2000 Conference. San Antonio, Texas. July (Vol. 3, p. 2003).*

Hill, R. (1998). What sample size is “enough” in internet survey research. *Interpersonal Computing and Technology: An Electronic Journal for the 21st Century*, *6*(3–4).

Hmelo-Silver, C. (2006). Analyzing collaborative learning: Multiple approaches to understanding processes and outcomes. *Proceedings of the 7th international conference on learning sciences*. (pp. 1059-1065). International Society of the Learning Sciences.

Holley, D., & Dobson, C. (2008). Encouraging student engagement in a blended learning environment: The use of contemporary learning spaces. *Learning, Media and Technology*, 33(2), 139-150.

Holton, D., & Clarke, D. (2006). Scaffolding and metacognition. *Journal of Mathematical Education in Science and Technology*, 37(2), 127-143.

Holton, D., & Thomas, G. (2001). Mathematical interactions and their influence on learning. In *Perspectives on practice and meaning in mathematics and science classrooms* (pp. 75-104). Springer, Dordrecht.

Hosseini, Z., & Kamal, A. (2013). A survey on pre-service and in-service teachers' perceptions of technological pedagogical content knowledge (TPCK). *Malaysian Online Journal of Educational Technology*, *1*, 1–7.

Hou, H., Chang, K., & Sung, Y. (2007). An analysis of peer assessment online discussions within a course that uses project-based learning. *Interactive Learning Environments*, 15(3), 237-251.

Hsu, Y.-L., Lee, C.-H., & Kreng, V. B. (2010). The application of Fuzzy Delphi Method and Fuzzy AHP in lubricant regenerative technology selection. *Expert Systems with Applications*, *37*(1), 419–425.

Hull, K., & Dodd, J. E. (2017). Faculty use of Twitter in higher education teaching Faculty use of Twitter in higher education teaching. *Journal of Applied Research in Higher Education Journal of Applied Research in Higher Education*, *9*(1), 91–104.

Hwang, C., & Lin, M. (1987). Decision Making under Multiple Criteria. *Berlin: SpringerVerlag*.

Hwang, G., & Tsai, C. (2011). Research trends in mobile and ubiquitous learning: A review of publications in selected journals from 2001 to 2010. *British Journal of Educational Technology*, *42*(4), 65–70.

Hwang, W.-Y., Huang, Y.-M., & Wu, S.-Y. (2011). The effect of an MSN agent on learning community and achievement. *Interactive Learning Environments, 19*(4), 413–432.

Informa Telecoms & Media. (2012). *OTT pressure not major threat to SMS*. Retrieved from http://telecoms.com/44976/ott-pressure-not-major-threat-to-sms/

Ioannou, A., & Georgiou, A. (2009). Fostering online collaborative learning using wikis: A pilot study. In *Proceedings of the 9th International Conference on Computer Supported Collaborative Learning* (pp. 115–117).

Ishikawa, A., Amagasa, M., Shiga, T., Tomizawa, G., Tatsuta, R., & Mieno, H. (1993). The max-min Delphi method and fuzzy Delphi method via fuzzy integration. *Fuzzy Sets and Systems*, 241–253.

Issac, S., & Michael, W. (1995). Handbook in research and evaluation: A collection of principles, methods, and strategies useful in the planning, design, and evaluation of studies in. *San Diego, CA: Edits Pub*.

Jacobs, G. (2006). Fast times and digital literacy: Participation roles and portfolio construction within instant messaging. *Journal of Literacy Research*, 38(2), 171-196.

Janes, F. R. (1988). Interpretive structural modelling: a methodology for structuring complex issues. *Transactions of the Institute of Measurement and Control*, *10*(3), 145–154.

Jeong, W. (2007). Instant messaging in on-site and online classes in higher education. *Educause Quarterly*, 30(1), 30.

Johnson, D., & Johnson, R. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher*, 38(5), 365-379.

Jonassen, D. H. (2000). *Computers As Mindtools For Schools: Engaging Critical Thinking* (2nd ed.). New Jersey: Merrill Prentice Hall.

Jones, H., & Twiss, B. (1978). Forecasting technology for planning decisions. (No. 658.4 J6).

Judd, T., Kennedy, G., & Cropper, S. (2010). Using wikis for collaborative learning: Assessing collaboration through contribution. *Australasian Journal of Educational Technology*, *26*(3), 341–354.

Jung-Erceg, P., Pandza, K., & Armbruster, H. (2007). Absorptive capacity in European manufacturing: a Delphi study. *Management & Data Systems*, 107(1), 37-51.

Jung, I. (2005). ICT-Pedagogy Integration in Teacher Training Application Cases.pdf. *Educational Technology & Society*, *8*(2), 94–101.

Kannan, G., & Haq, A. (2007). Analysis of interactions of criteria and sub-criteria for the selection of supplier in the built-in-order supply chain environment. *International Journal of Production Research*, 45(17), 3831-3852.

Kaplan, L. (1999). *The Cost of Networked Learning*. Sheffield, UK: Sheffield Hallam University.

Kaufmann, A., & Gupta, M. M. (1988). *Fuzzy Mathematical Models in Engineering and Management Science*. Elsevier Science Inc. New York, NY, USA.

Kaye, A. (1992). Learning together apart. *Collaborative Learning through Computer Conferencing*, (1-24). Springer, Berlin, Heidelberg.

Keegan, D. (2002). The Future of Learning: From eLearning to mLearning. Retrieved from https://eric.ed.gov/?id=ED472435

Kennedy, G., Dalgarno, B., Bennett, S., Gray, K., Waycott, J., Judd, T., … Chang, R. (2009). Educating the Net Generation: A Handbook of Findings for Practice and Policy. *Higher Education*, 1–82.

Kim, H., Lee, M., & Kim, M. (2014). Effects of Mobile Instant Messaging on Collaborative Learning Processes and Outcomes : The Case of South Korea. *Educational Technology & Society*, *17*(2), 31–42.

Kirschner, P., Strijbos, J.-W., Kreijns, K., & Beers, P. J. (2004). Designing electronic collaborative learning environments. *Educational Technology Research and Development*, 52(3), 47.

Knouzi, I., Swain, M., & Lapkin, S. (2010). Self-scaffolding mediated by languaging: microgenetic analysis of high and low performers. *International Journal of. Applied Linguistics*, 20(1), 23-49.

Koole, M. L. (2009). A Model for Framing Mobile Learning. In *Mobile Learning: Transforming the Delivery of Education and Training* (p. 39).

Kop, R., & Hill, A. (2008). Connectivism: Learning theory of the future or vestige of the past? *International Review of Research in Open and Distance Learning*, *9*(3), 1–7.

Kordaki, M., & Siempos, H. (2010). The Jigsaw collaborative method within the online computer science classroom. In *CSEDU 2010 - 2nd International Conference on Computer Supported Education, Proceedings* (Vol. 2, pp. 65–72).

Koschmann, T. (1996). *CSCL, theory and practice of an emerging paradigm*. New York, Routledge.

Kreber, C. (2012). Developing the scholarship of teaching through transformative learning. *Journal of the Scholarship of Teaching and Learning*, 6(1), 88-109.

Krejcie, R. V, & Morgan, D. W. (1970). Determining Sample Size for Research Activities, *38*, 607–610.

Krueger, R., & Casey, M. (2001). Designing and conducting focus group. In *Social analysis: selected tools and techniques* (pp. 4–23).

Kukulska-Hulme, A., & Traxler, J. (2002). Cognitive, ergonomic and affective aspects of PDA use for learning. *Proceedings of the European Workshop on Mobile and Contextual Learning*

Kukulska-Hulme, A., & Traxler, J. (2005). *Mobile learning: A handbook for educators and trainers*. Psychology Press.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge university press.

Lee, C., & King, B. (2008). Using the Delphi method to assess the potential of Taiwan's hot springs tourism sector. *International Journal of Tourism Research*, 10(4), 341-352.

Lee, M., & McLoughlin, C. (2010). Beyond distance and time constraints: Applying social networking tools and Web 2.0 approaches to distance learning. In *Emerging technologies in distance education* (pp. 61–87). Edmonton, AB: Athabasca University Press.

Leedy, P., & Ormrod, J. (2001). Practical research: Planning and design . New Jersey: Prentice-Hall.

Lenhart, A., & Shiu, E. (2004). How Americans use instant messaging. *Pew Internet and American Life Project, Washington*. Retrieved from http://scholar.google.com/scholar?q=Shiu+%2526+Lenhart%252C+2004&btnG=&hl=en&as_sdt=0%252C5#2

Lin, C., & Lee, C. (1996). Neural fuzzy systems. *PTR Prentice Hall*.

Linstone, H. a, & Turoff, M. (2002). The Delphi Method - Techniques and applications. *The Delphi Method - Techniques and Applications*, 1–616. http://doi.org/10.2307/1268751

Liu, N., & Gorvett, R. (2006). 2006 Enterprise Risk Management Symposium: Interpretive Structural Modeling of Interactive Risks. Retrieved from http://jvvnz.x.incapdns.net/library/monographs/other-monographs/2006/july/m-as06-1_X.pdf

Lloyd-Jones, G., Fowell, S., & Bligh, J. (1999). The use of the nominal group technique as an evaluative tool in medical undergraduate education. Medical Education-Oxford, 33(1), 8-13.

Malaysian Communications and Multimedia Commission. (2017). Communications & Multimedia Pocket Book of Statistics Q1 2017. Retrieved from http://www.mcmc.gov.my/Mobile/About-Us/Our-Responsibility.aspx

Markett, C., Sánchez, I., Weber, S., & Tangney, B. (2006). Using short message service to encourage interactivity in the classroom. *Computers & Education*, 46(3), 280-293.

Marshall, C., & Rossman, G. (2014). *Designing qualitative research*. Sage publications.

Mayes, T., & Freitas, S. De. (2004). Review of e-learning theories, frameworks and models. JISC e-learning models study report. Retrieved from http://researchrepository.murdoch.edu.au/id/eprint/32662/

McKillip, J. (1987). *Need Analysis: Tools for the Human Services and Education*. Sage Publications, Inc.

Merriam, S. (2009). What is Qualitative Research? *Qualitative Research: A Guide to Design and Implementation*, 3–20.

Mifsud, L. (2002). Alternative learning arenas-pedagogical challenges to mobile learning technology in education. *Mobile Technologies in Education, 2002 Proceedings. IEEE International Workshop (pp. 112-116).*

Milrad, M. (2003). Mobile learning: challenges, perspectives, and reality. *In K Nyiri (Ed) Learning Essays on Philosophy, Psychology and Education*, 151–164.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017.

Miyazoe, T., & Anderson, T. (2010). Learning outcomes and students' perceptions of online writing: Simultaneous implementation of a forum, blog, and wiki in an EFL blended learning setting. *System*, *38*(2), 185–199.

Mohamed Amin Embi (2011a). *E-Learning in Malaysia Higher Education Institutions: Status, Trends & Challenges*. Retrieved from http://www.ukm.my/ctlt/wp-content/uploads/2014/08/e-learning-in-Malaysian-Higher-Education-Institutions.pdf

Mohamed Amin Embi (2011b). e-Learning in Malaysian Institutions of Higher Learning: Status, Trends and Challenges Mohamed Amin Embi Universiti Kebangsaan Malaysia, (November), 14–15.

Mohamed Amin Embi & Norazah Nordin. (2013). *Mobile Learning : Malaysian Initiatives & Research Findings*. Embi, M. A., & Nordin, N. M. (2013). Mobile learning: Malaysian initiatives and research findings. Malaysia: Centre for Academic Advancement, Universiti Kebangsaan Malaysia, 1-131.

Mohd Nazri Abdul Rahman. (2014). *Pembangunan Model Homeschooling Berasaskan Nilai dan Amalan Masyarakat bagi Kanak-Kanak Orang Asli*. (Doctoral dissertation, University of Malaya)

Mohd Nazri Abdul Rahman, Rosman Ishak, Juhara Ayob, Saedah Siraj, Norlidah Alias, Rohani Abdul Aziz, Ruslina Ibrahim. (2014). Transformasi bentuk pentaksiran dan penilaian dalam buku teks: Aplikasi Interpretive Structural Modelling (ISM). *Jurnal Kurikulum dan Pengajaran Asia Pasifik,* 2(2)

Mohd Nishat Faisal. (2010). Analysing the barriers to corporate social responsibility in supply chains: an interpretive structural modelling approach. *International Journal of Logistics: Research and Applications*, 13(3), 179-195.

Mohd Paris Saleh. (2016). *Reka bentuk model pengajaran m-pembelajaran berasaskan kaedah inkuari untuk mata pelajaran sejarah peringkat menengah*. (Doctoral dissertation) Retrieved from: studentsrepo.um.edu.my.

Mohd Ridhuan Mohd Jamil, Saedah Siraj, Zaharah Hussin, Nurulrabihah Mat Noh, & Ahmad Arifin Sapar. (2017). *Pengenalan asas kaedah Fuzzy Delphi dalam penyelidikan rekabentuk dan pembangunan.* Minda Intelek Agency.

Moore, C. M. (1994). *Group techniques for idea building*. Sage Publications.

Moore, M., & Richardson, P. (2002). Overcoming the Limitations of Traditional Web-Based Activities by Using Web-Compatible Applications. University of New Bruswick. Available at: http://www. unb. ca/naweb/proceedings/1998/richardson/richardson. html.

Morrison, G., Ross, S., Kemp, J., & Kalman, H. (2010). *Designing effective instruction*. John Wiley & Sons.

Muhammad Ridhuan Tony Lim Abdullah. (2014). *Development of Activity-based mLearning Implementation Model for Undergraduate English Language Learning*. (Doctoral dissertation). Retrieved from: studentsrepo.um.edu.my

Muhammad Ridhuan Tony Lim Abdullah, Saedah Siraj, & Zaharah Hussin. (2014). Interpretive structural modeling of mlearning curriculum implementation model of English language communication skills for undergraduates. *TOJET: The Turkish Online Journal of Educational Technology*, 13(1), 151–161.

Murray, T. J., Pipino, L., & Van Gigch, J. P. (1985). A Pilot Study of Fuzzy Set Modification of Delphi. *Human Systems Management*, 6–80.

Murry, J., & Hammons, J. (1995). Delphi: A versatile methodology for conducting qualitative research. *The Review of Higher Education*, 18(4), 423-436.

Narayanansamy, M., & Issham Ismail. (2011). Introducing mobile technology as a tool for teaching. *Malaysian Journal of Distance*, 13(2), 9-18.

Nardi, B., Whittaker, S., & Bradner, E. (2000). Interaction and outeraction: instant messaging in action. *Proceedings of the 2000 ACM Conference on Computer Supported Cooperative Work.* 79–88.

Ng'ambi, D. (2011). Enhancing student interaction in didactic teaching approaches: the right to text during class. In *Proceedings of the 6th International Conference on e-Learning* (pp. 249–257). University of British Columbia, Kelowna.

Nicholson, S. (2002). Socialization in the "virtual hallway": instant messaging in the asynchronous web-based distance education classroom. *The Internet and Higher Education*, 5(4), 363-372.

Norlidah Alias, Mohd Nazri Abdul Rahman, Saedah Siraj, & Ruslina Ibrahim. (2013). A Model of Homeschooling Based on Technology in Malaysia. *The Malaysian Online Journal of Educational Technology*, 1(3), 10–16.

Norlidah Alias, Saedah Siraj, Mohd Nazri Abdul Rahman, & DeWitt, D. (2013). *Design and Developmental Research: Emergent Trends in Educational Research.* Pearson, Malaysia.

O'Malley, C., Vavoula, G., Glew, J., Taylor, J., & Sharples, M. (2003). Guidelines for learning/teaching/tutoring in a mobile environment. Mobilearn project deliverable.

O'Neil, M., & Jackson, L. (1983). Nominal group technique: a process for initiating curriculum development in higher education. *Studies in Higher Education*, 8(2), 129-138.

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.

Oghuma, A. P., Chang, Y., Libaque-Saenz, C. F., Park, M.-C., & Rho, J. J. (2015). Benefit-confirmation model for post-adoption behavior of mobile instant messaging applications: A comparative analysis of KakaoTalk and Joyn in Korea. *Telecommunications Policy*, *39*(8), 658–677.

Oshima, J., Scardamalia, M., & Bereiter, C. (1996). Collaborative learning processes associated with high and low conceptual progress. *Instructional Science*, 24(2), 125-155.

Pallant, J. (2007). *SPSS survival manual : a step by step guide to data analysis using SPSS for Windows*.

Palloff, R. M., & Pratt, K. (2005). Collaborating Online: Learning Together in Community. *Distance Education Report*, 9, 2.

Palloff, R. M., & Pratt, K. (2009). *Assessing the online learner: resources and strategies for faculty*. *Jossey-Bass guides to online teaching and learning* (Vol. 1).

Panitz, T. (1999). Collaborative Versus Cooperative Learning-a Comparison of the Two Concepts Which Will Help Us Understand the Underlying Nature of Interactive Learning.

Parente, R. J., Hiob, T. N., Silver, R. A., Jenkins, C., Poe, M. P., & Mullins, R. J. (2005). The Delphi method, impeachment and terrorism: Accuracies of short-range forecasts for volatile world events. *Technological Forecasting and Social Change*, *72*(4), 401–411.

Pawlowski, Suzanne D, Okoli, C. (2004). The Delphi Method as a Research Tool : An Example , Design Considerations and Applications 1 Introduction 2 Overview of the Delphi method. *Information & Management*, *42*(1), 15–29.

Porter, A. L., Rossini, F., Carpenter, S. R., Roper, A. T., Larson, R. W., & Tiller, J. S. (1980). *Guidebook for technology assessment and impact analysis*. New York: North Holland.

Proctor, N., & Burton, J. (2004). Tate modern multimedia tour pilots 2002-2003. In *Learning with Mobile Devices: Research and Development* (pp. 127–130).

PSPTN. (2013). Official portal higher education sector. Retrieved from http://www.mohe.gov.my/protal/en/psptn-faq.html

Quan-Haase, A., Cothrel, J., & Wellman, B. (2005). Instant messaging for collaboration: a case study of a high-tech firm. *Journal of Computer-Mediated Communication*, 10(4), 00-00.

Quinn, C. (2011). *Designing mLearning: tapping into the mobile revolution for organizational performance*. San Francisco, CA: John Wiley & Sons.

Ragin, C. (2007). Fuzzy sets: calibration versus measurement. *Methodology Volume of Oxford Handbooks of Political Science 2*.

Ragus, M. (2006). M-learning: a future of learning. *Knowledge Tree eJournal, Edition*, 9.

Rahmad Sukor Ab Samad, Shahril Jamaludin, Zainudin Abu Bakar, & Mohd Ali Ibrahim. (2008). Model Kemahiran ICT Guru Pelatih IPTA di Malaysia. In *Kemahiran ICT di Kalangan Guru Pelatih IPTA Malaysia* (pp. 151–161).

Raja Maznah Raja Hussain. (2004). eLearning in Higher Education Institutions in Malaysia. *E-Mentor*, *5*(7), 1–6.

Rajendran, N. (2001). Amalan berdaya fikir pengajaran pembelajaran Bahasa Melayu dalam bilik darjah. *Anjuran Institut Bahasa Melayu, Malaysia*. Retrieved from http://nsrajendran.tripod.com/Papers/dayafikir2001.pdf

Rambe, P., & Bere, A. (2012). An M-Learning strategy for leveraging learner participation: using WhatsApp mobile messaging at a South African University of Technology. In *Proceedings of the Southern African Computer Science Lecturers' Association Conference (SACLA)* (pp. 29–36).

Rambe, P., & Bere, A. (2013). Using mobile instant messaging to leverage learner participation and transform pedagogy at a South African University of Technology. *British Journal of Educational Technology*, 44(4), 544-561.

Rau, P., Gao, Q., & Wu, L. (2008). Using mobile communication technology in high school education: Motivation, pressure, and learning performance. *Computers & Education*, 50(1), 1-22.

Redecker, C., Ala-Mutka, K., & Punie, Y. (2010). Learning 2.0-The impact of social media on learning in Europe. Policy brief. JRC Scientific and Technical Report. EUR JRC56958 EN, available from: http://bit. ly/cljlpq.

Reeves, T. C., Herrington, J., & Oliver, R. (2004). A development research agenda for online collaborative learning. *Educational Technology Research and Development*, *52*(4), 53–65.

Repman, J., Zinskie, C., & Carlson, R. (2005). Effective use of CMC tools in interactive online learning. *Computers in the Schools*, 22(1-2), 57-69.

Resta, P., & Laferrière, T. (2007). Technology in support of collaborative learning. *Educational Psychology Review*, 19(1), 65-83.

Reza, K., & Vassilis S., M. (1988). Delphic hierarchy process (DHP): A methodology for priority setting derived from the Delphi method and analytical hierarchy process. *European Journal of Operational Research*, 37(3), 347–354.

Richey, R. C., & Klein, J. D. (2007). *Design and Development Research: Methods, Strategies, and Issues*. Lawrence Erlbaum Associates Publishers.

Roibás, A., & Sánchez, I. (2002). Design scenarios for m-learning. *Proceedings of the European Workshop on Mobile and Contextual Learning* (pp. 53-56).

Ryu, H., & Parsons, D. (2012). Risky Business or Sharing the Load?--Social Flow in Collaborative Mobile Learning. *Computers & Education*, *v58*(n2), p707-720.

Sabitha, M. (2005). *Kaedah Penyelidikan Sains Sosial*. Malaysia Pearson Prentice Hall.

Saedah Siraj. (2006). Projection of the future curriculum. In *Second International Conference on Principalship and School of Management*. University of Malaya, Kuala Lumpur.

Saedah Siraj. (2004). mPembelajaran untuk kurikulum masa depan (mlearning for future curriculum). In *Masalah Pendidikan (Issues in Education)* (pp. 115–29). University of Malaya Press.

Saedah Siraj & Muhammad Helmi Norman. (2012). Current Trends and Future Prospects of mLearning. In Saedah Siraj, Fadzilah Siraj, & Muhammad Helmi Norman (Eds.), *mLearning: A New Dimension of Curriculum Advancement* (pp. 3–16). University of Malaya Press.

Sage, A. (1977). Interpretive structural modeling: methodology for large-scale systems, 91–164.

Sahney, S., Banwet, D., & Karunes, S. (2006). An integrated framework for quality in education: Application of quality function deployment, interpretive structural modelling and path analysis. *Total Quality Management &* Business Excellence, 17(2), 265-285.

Salimifard, K., Abbaszadeh, M. A., & Ghorbanpur, A. (2010). Interpretive structural modeling of critical success factors in banking process re-engineering. *International Review of Business Research Papers*, *6*(2), 95-103.

Salmon, G. (2004). *E-moderating: The Key to Teaching and Learning Online.* London and New York: Routledge Falmer.

Savill-Smith, C., Attewell, J., & Stead, G. (2006). *Mobile learning in practice*. *London: Learning and Skills Network*. Retrieved from http://www.talpalink.co.uk/resources/Mobile+learning+in+practice.pdf

Schempp, P., & Manross, D. (1998). Subject expertise and teachers' knowledge. *Of Teaching in Physical Education*, 17(3), 342-356.

Schmiedel, T., & Brocke, J. vom. (2013). Which cultural values matter to business process management? Results from a global Delphi study. *Business Process Management Journal*, 19(2), 292-317.

Seels, B., & Richey, R. (1994). Instructional technology: The definition and domains of the field. Bloomington, IN: Association for Educational Communication and Technology

Shih, J., Chuang, C., & Hwang, G. (2010). An inquiry-based mobile learning approach to enhancing social science learning effectiveness. *Journal of Educational Technology & Society*, 13(4).

Shulman, L. S., (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 135-143.

Siemens, G. (2002). Instructional design in elearning. *Elearnspace: Everything Elearning*.

Siemens, G. (2005). Connectivism: Learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, *2*(1).

Singh, H., & Khamba, J. (2011). An Interpretive Structural Modelling (ISM) Approach for advanced manufacturing technologies (AMTs) utilisation barriers. *International Journal of Mechatronics and Manufacturing Systems*, 4(1), 35-48.

Singh, M., & Kant, R. (2008). Knowledge management barriers: An interpretive structural modeling approach. *International Journal of Management Science and Engineering Management*, 3(2), 141-150.

Skulmoski, G., Hartman, F., & Krahn, J. (2007). The Delphi method for graduate research. *Journal of Information Technology Education*, *6*, 21.

So, H.-J., & Bonk, C. J. (2010). Examining the Roles of Blended Learning Approaches in Computer- Supported Collaborative Learning (CSCL) Environments : A Delphi Study. *Educational Technology & Society*, *13*, 189–200.

Stahl, G., Koschmann, T., & Suthers, D. (2006). Computer-supported collaborative learning: An historical perspective. *Cambridge Handbook of the Learning Sciences*, 409–426.

Stanciu, A., & Aleca, O. (2012). Social networking as an alternative environment for education. *Accounting and Management Information Systems*, 11(1), 56.

Stockwell, G., & Hubbard, P. (2013). Some emerging principles for mobile-assisted language learning. *Monterey, CA: The International Research Foundation for English Language Education*, 1–15.

Stone, A. (2004). Mobile scaffolding: An experiment in using SMS text messaging to support first year university students. In *Proceedings - IEEE International Conference on Advanced Learning Technologies, ICALT 2004* (pp. 405–409).

Surina Nayan, Latisha Asmaak Shafie, & Mahani Mansor. (2010). The practice of collaborative learning among lecturers in Malaysia. *Management Science and Engineering*, *4*(1), 62–70.

Suthers, D. D. (2006). Technology affordances for intersubjective meaning making: A research agenda for CSCL. In *International Journal of Computer-Supported Collaborative Learning* (Vol. 1, pp. 315–337).

Syed Ardi Kamal, & Zaidatun Tasir. (2008). Pembelajaran Masa Depan Mobile Learning (mlearning) di Malaysia. In *Pembelajaran Masa Depan Mobile Learning (mlearning) di Malaysia* (pp. 122–129). Seminar Edupress Universiti Teknologi Malaysia.

Tang, C. W., & Wu, C. T. (2010). Obtaining a picture of undergraduate education quality: A voice from inside the university. *Higher Education*, *60*(3), 269–286.

Taylor, R., Judd, L., Witt, S., & Moutinho, L. (1989). Delphi method applied to tourism. *Tourism Marketing and Management Handbook*, 95–98.

Tsai, C. (2010). Do students need teacher's initiation in online collaborative learning? *Computers & Education*, 54(4), 1137-1144.

Upadhyay, R., Gaur, S., & Agrawal, V. (2007). ISM-CMAP-Combine (ICMC) for hierarchical knowledge scenario in quality engineering education. *European Journal of Engineering Education*, 32(1), 21-33.

Vavoula, G., Sharples, M., Rudman, P., Meek, J., & Lonsdale, P. (2009). Myartspace: Design and evaluation of support for learning with multimedia phones between classrooms and museums. *Computers & Education*, *53*(2), 286–299.

Veletsianos, G., & Navarrete, C. (2012). Online social networks as formal learning environments: Learner experiences and activities. *The International Review of Research in Open and Distance Learning*, 13(1), 144-166.

Venkatesh, V., Morris, M., Davis, G., & Davis, F. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 425-478.

Vrasidas, C., & McIsaac, M. (2001). Integrating technology in teaching and teacher education: Implications for policy and curriculum reform. *Educational Media International*, 38(2-3), 127-132.

Vygotsky, L. S. (1978). Mind in Society. *Memory, Mind in So*, 381–381. http://doi.org/(Original manuscripts [ca. 1930-1934])

Wan Mohd Fauzy Wan Ismail. (2012). Roles of Instructor and Learner in mLearning. In *mLearning: A New Dimension of Curriculum Advancement* (pp. 49–57). Kuala Lumpur: University of Malaya Press.

Warfield, J. (1974). Developing subsystem matrices in structural modeling. *Systems, Man and Cybernetics, IEEE Transactions on* Systems, Man, and Cybernetics, (1), 74-80.

Warfield, J., & Jr, G. P. (1999). The problematique: Evolution of an idea. *Systems Research and Behavioral Science*, 16(3), 221.

Watkins, C., & Mortimore, P. (1999). Pedagogy: What do we know. *Pedagogy and Its Impact on Learning*, 1-19.

Waycott, J., Scanlon, E., & Jones, A. (2002). Evaluating the use of PDAs as learning and workplace tools: an activity theory perspective. *Proceedings of the European Workshop on Mobile and Contextual Learning* (No. 6, pp. 34-35).

Wei, F., & Chen, G. (2006). Collaborative mentor support in a learning context using a ubiquitous discussion forum to facilitate knowledge sharing for lifelong learning. *British Journal of Educational Technology*, 37(6), 917-935.

Wexler, S., Brown, J., Rogers, D., Metcalf, E., & Wagner, E. (2008). *eLearning guild research 360 report: Mobile learning. Santa Rosa, CA: eLearning Guild.*

Witkin, B. . (1997). Needs assessment kits, models, and tools. *Educational Technology*, *17*(11), 5–18.

Wood, D., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry, 17(2), 89-100.*

Yelland, N., & Masters, J. (2007). Rethinking scaffolding in the information age. *Computers and Education, 48*(3), 362–382.

Yengin, I., Karahoca, A., Karahoca, D., & Uzunboylu, H. (2011). Deciding which technology is the best for distance education: Issues in media/technology comparisons studies. *Procedia Computer Science, 3, 1388-1395.*

Zaidatun Tasir, Norah Mohd Noor, Jamalludin Harun, & Nurul Syazwani Ismail. (2008). A survey on online teaching preference among pre-service teachers in Malaysia: Andragogy vs pedagogy. *Proceedings ascilite Melbourne 2008* (1022–1027).

Zamani-Miandashti, N., & Ataei, P. (2015). College students' perceptions of short message service-supported collaborative learning. *Innovations in Education and Teaching International*, *52*(4), 426–436.

Zamri Mahamod & Mohamed Amin Embi. (2008). *Teknologi maklumat dan komunikasi dalam pengajaran dan pembelajaran bahasa melayu: Teori dan praktis.* Shah Alam: Karisma Publications Sdn. Bhd.

LIST OF PUBLICATIONS AND PAPERS PRESENTED

JOURNAL

- Khairah @ Asma'a Baharun, Muhammad Faizal A.Ghani, Saedah Siraj (2017). Penerimaan M-Pembelajaran Dalam Kalangan Pensyarah Institut Pendidikan Guru Malaysia Melalui The Unified Theory of Acceptance and Use of Technology (UTAUT): Satu Kajian Awal. *Jurnal Kepimpinan Pendidikan (JuPiDi) Bil.4, Isu 2, April 2017*

- Khairah @ Asma'a Baharun, Muhammad Faizal A.Ghani, Saedah Siraj (2017). Aplikasi Pesanan Segera Mudah Alih (Mobile Instant Messaging) dalam Pembelajaran Kolaboratif: Satu Kajian Analisis Keperluan. *Jurnal Kepimpinan Pendidikan (JuPiDi) Bil.4, Isu 1, Januari 2017*

PRESENTATION

- Application of Fuzzy Delphi Method For Evaluating Suitability of Pedagogical Activities for Mobile Instant Messaging Learning. *Seminar of Future Education 2017. Faculty of Education, Universiti Malaya, Kuala Lumpur, 3rd – 4th August 2017*

- Application of Interpretive Structural Modelling in Development of Collaborative Mobile Instant Messaging Learning Model. *5th Asia Pacific Conference on Advanced Research. Melbourne, Australia, 28th – 29th April 2017*

- Implementation of Collaborative Mobile Instant Messaging Learning in Formal Education. *Persidangan Kebangsaan Kurikulum Masa Depan 2016. Pusat Pengajian Siswazah, Universiti Malaya, Kuala Lumpur, 31 Mei 2016*

- Collaborative Mobile Instant Messaging (MIM) Learning Implementation Model: A Needs Analysis Survey. *2016 International Symposium on Teaching, Education, and Learning - ISTEL 2016 Winter. Bali, Indonesia, 2nd – 4th February 2016*