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Exploring the Development of Metacognitive Strategies in Learning Technologies among Pre-service Teacher Trainees through an E-space Community Framework

By

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DECLARATION

I hereby declare that this thesis is a product of my own work, which has not, whether in the same of different form, been presented to this or any other university in support of an application for any degree other than that of which I am now a candidate.

SIGNED: ……

MOHD SHUKRI NORDIN

2015

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DEDICATION

I would like to dedicate this thesis most and foremost to my family. To my beloved wife, Majdah, who has supported and stood by me through the thick and thin of my PhD journey with utmost understanding. To all my five children, Muaz Adri, Mueez Adri, Muqri Adri, Mariam Adri and Mariah Adri (from fully understanding the nature of the study to having no idea whatsoever of what the father is doing for the past four years), let this be the encouragement to things that can be accomplished once a mind is set to it.

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ABBREVIATIONS

e-space	Electronic space
CMS	Course Management System
CoP	Community of Practice
ICT	Information and Communication Technologies
IIUM	International Islamic University Malaysia
iTa'LeEM	Innovative Teaching and Learning Environment System
KoED	Kulliyyah of Education
LMS	Learning Management System
MAI	Metacognitive Awareness Inventory
MOODLE	Modular, Object-Oriented Dynamic Learning Environment
OCoP	Online Community of Practice
VCoP	Virtual Community of Practice
VLE	Virtual Learning Environment
ZPD	Zone of Proximal Development

ABSTRACT

The purpose of this study was to explore the extent of e-space community framework in developing metacognitive strategies of pre-service teacher trainees towards ICT competency in contemporary learning technologies. The e-space community framework used in this study created a virtual community of practice (VCoP) that has the possibilities of developing the trainees' metacognitive strategies in learning technologies. The framework looks at extending Vygotsky's concept of Zone of Proximal Development (ZPD) upon the VCoP. Evidence has shown that ZPD has the potential of helping a learner learn better by seeking guidance from surrounding peers. It is argued that the combination of ZPD and VCoP has the advantages of making teaching and learning more engaging and effective. The study proposed the use of an e-space community as the mediator to develop metacognitive strategies in learning technologies. The concept of e-space community is congruent with Wenger's concept of Communities of Practice (CoPs), where people of the same interest do and learn better via regular interaction. It is also parallel with the earlier mentioned concept of ZPD as discussed by Vygotsky. The research used an explanatory mixed-method approach on 38 pre-service teacher trainees, where a pre-test, a mid-test and a post-test with a treatment intervention were supported by interviews. The quantitative findings of this study revealed that e-space community in this study gave very little impact on the development of the pre-service teacher trainees' metacognitive strategies towards ICT competency in contemporary learning technologies. This was supported by the qualitative findings that concur with the fact that the participants did not prefer the official e-space platform chosen for this study and were more drawn to more convenient external platforms. The study has implications on how any official e-space platform of an institution should be designed and deployed in order to create more appeal and attract the targeted CoP to use and gain benefits from the intended objectives towards ICT competency.

Chapter One:Introduction and background of the study

1.0 Chapter overview

In this introductory chapter, I describe my background and details the motivational factors for this study. I explain about the pre-service teacher trainees in International Islamic University Malaysia and ICT competencies which serve as the context of my study. I also clarify the rationale behind the focus on metacognitive strategies and its relevance to the context of my study.

1.1 Research background

In 1999, I graduated from the International Islamic University Malaysia with a bachelor's degree in English Language and Literature. Right after, I started teaching English language proficiency in a college in Kelantan, a state in the east coast of Malaysia. Students of the college are of 18 to 20 years old, undertaking preparatory study in biology and physics as well accountancy. Even though I was teaching language proficiency, my interest in information and communication technology (ICT) is already very strong. My late father started as a teacher and retired as a lecturer from a teacher training college in my home state, Terengganu. Since I was young, I have observed him using computers to prepare and enhance his lessons. That intrigued me at first into taking interest in computer technology and began exploring. Most of my ICT skills are self-taught and I am always looking at new technologies that can be used to enhance my teaching. Since the beginning of my teaching, I always try to find ways to integrate my passion for ICT into making the lessons more fun

and interactive. I started to read and explore more into the integration of ICT into teaching and learning. Colleagues acknowledged my interest in this field and made me the reference point for anything ICT related. The English department of the college later took notice of this and decided to assign to me several tasks involving computer technologies expertise. I was assigned two tasks specifically needing computer skills. The first was to design the website for the English department and the second was as the graphic editor for the department's weekly newsletter, The Wednesday Tribune.

In 2003, after four years in the college, I return to my alma matter for a lecturing position at the Centre for Language and Pre-University Academic Development (CELPAD). By this time, computer technologies were growing very rapidly and with it my continuous passion for integrating ICT into teaching and learning. Just like the previous workplace, I continued with my interest and explored more into using ICT, inside and outside of the classroom. Likewise, other than teaching English language proficiency, I was also assigned several tasks that requires computer skills. One of the tasks was also as the graphic editor of the English department's weekly tribune, The Chronicles. At the same time, I was appointed the coordinator of the resource centre for the English department. My task here involved, among others, managing, cataloguing and tagging the available resources for the lecturers. Here I incorporated the use of computer technology to make my tasks faster and more efficient in handling the resources. I also made the resource centre more ICT friendly by making it a one stop centre for lecturers to seek advice and assistance in regards to technologies for teaching and learning.

It was during this period that I came to realise that a lot more can be explored with technologies for education and decided to pursue my master's degree from the same university in the field of instructional technology. In 2005, I started my study part time and obtained a master's degree in 2008 from the Kulliyyah of Education (then Institute of Education) of IIUM. Upon finishing my master's study, I was appointed a new administrative position as the coordinator for the Educational and Computer Assisted Language Learning/Information Technology (EDUCALL/IT) unit. For this unit, my primary tasks were to manage and supervise the availability of IT resources for the centre as well as to provide trainings and workshops for stuff of the centre in regards to technologies for teaching and learning. While managing this unit, I started to see that computer technologies are developing and growing at a very fast rate. There are new teaching and learning technologies being introduced every year and most carry high potential for enhancing lessons not just inside the classroom but also capable of taking it further beyond. I realised that this pattern is continuing into the future, with new technologies come new trainings, and realised that instructors (teachers or lecturers) need to prepare themselves for this technological onslaught if total integration of ICT in teaching and learning is to be a reality.

After two years in CELPAD, I started thinking of furthering my study. As the centre does not provide any allocation for its lecturers to further study at a PhD level (financial as well as leaves), I applied for a lecturing position in the area of instructional technology at the same faculty where I obtained my master'

degree, Kulliyyah of Education (IIUM). Upon successful application, I was offered a scholarship to further my study for a doctorate degree. One thing to note is that before I received my master's degree, I was very adamant that ICT can be the one and only catalyst to boost teaching and learning in this modern era. However, upon finishing my master's degree and being assigned the position of coordinator for EDUCALL/IT unit, I started to see the problems that occur in integrating ICT into teaching and learning. Training fellow colleagues and students to use learning technologies also revealed to me that not everyone could accept or understand the concept of ICT in education. It is not an easy task to create the understanding as well as to get educators and learners to voluntarily integrate ICT into their teaching and learning. I realised that in order to make the integration a success, these problems have to identified and rectified.

My times as a lecturer as well as a trainer compel me to look further into ICT competencies in teaching and learning. My experience in dealing with trainings for both lecturers and students in contemporary learning technologies has shown me that among the problems that hinders the integration of technologies in teaching and learning is the lack of competencies in dealing with the technologies itself. While some lecturers or students find that the integration of technologies into their teaching and learning is indeed an interesting aspect, mastering those technologies proved to be a hindrance. This is proven by many studies looking at technology acceptance in teaching and learning and why there are times that it fails to take flight. I started to look for a starting point in order to tackle this problem and found that the pre-service teacher trainees in the

Kulliyyah of Education would be a good base to develop contemporary learning technologies competencies, in the hope that it will carry over unto their students when they started their service as teachers and carry on to coming generations. My readings on this area of interest lead me to metacognition and the application of metacognitive strategies to improve learning. From this point, I found my focus for this study, which is to develop metacognitive strategies towards teacher's competency in learning technologies. My research proposal for my PhD study was then developed to focus on this area and was agreed upon by my supervisor.

1.2 Statement of problem

My purpose for doing this study originates from, first of all, my personal experience in teaching using ICT as well as teaching ICT skills to my students and colleagues. It is also from looking at the current scenario in the country and also based on my readings in the area of ICT competency among teachers. Despite efforts by relevant authorities in education to support teaching and learning with the latest state-of-the-art learning technologies, as well as various remedies being recommended to overcome teachers' lack of ICT competency towards contemporary learning technologies, the problem persist as a nationwide phenomenon.

Looking specifically at Kulliyyah of Education, International Islamic University Malaysia, the adoption and integration of ICT into teaching and learning are still very low. The use of technologies for teaching and learning is still struggling to produce teacher graduates who are competence in using and

utilising ICT into their own teaching. Since teachers' ICT competency is the determiner in the success of ICT integration in schools (Meyer et al 2011; Goktas 2009a; Guo 2008; Jorge 2012; Lee et al 2007; Lim & Chan 2007), the need to find a more plausible solution is obvious.

Secondly, findings from existing studies have shown that desirable effects on teaching and learning can be achieved via learning technologies and ICT (Aviram & Talmi, 2004; Baltaci-Goktalay & Ozdilek, 2010; Higgins, 2009; Maloney, 2007). However, can the use of such learning technologies make an individual a better and self-sustaining user of technology? While studies such as Phelps et al., (2004) and Prensky (2009), proposed the need for adaptability and digital wisdom for more competent users of ICT, very few studies are addressing the methods to help teachers and learners achieve the competent level in the use of ICT and learning technologies.

My reviews of literature have discovered that metacognitive strategies can be effective methods for users' competency in ICT and learning technologies (Gama, 2004; Phelps et al., 2004; Phelps & Graham, 2008). However, up to this date, very few studies conducted directly associate ICT competency and metacognitive strategies via an e-space community framework. Therefore, this study aims to explore whether or not the use of an e-space application for pre-service teacher trainees' of the Kulliyyah of Education, International Islamic University Malaysia, contributes to the development of metacognitive strategies for the enhancement of their ICT competency.

1.3 Research objectives

This study is to look at, in general:

1) To explore the current state of metacognitive strategies awareness among pre-service teacher trainees in using learning technologies; and
2) To what extent can contemporary learning technologies be used as a way to help students plan their learning goals, monitor their own learning processes, and evaluate their learning progress.

The overall aim is to explore the metacognitive strategies awareness of the pre-service teacher trainees towards contemporary learning technologies and to find out the extent of e-space applications in developing the pre-service teacher trainees' metacognitive strategies towards contemporary learning technologies. Specifically, the purpose of this study is to determine how the use of an e-space application (Moodle) by pre-service teacher trainees of the Kulliyyah of Education, International Islamic University Malaysia, succeeds in developing metacognitive strategies towards the use of contemporary learning technologies and to see whether such development has any effects on the subjects' ICT competency in contemporary learning technologies.

1.4 Research questions

The following research questions were investigated in this study:

1) What is the current state of metacognitive strategies awareness among pre-service teacher trainees in using learning technologies?

2) To what extent can e-space applications be used to develop pre-service teacher trainees' metacognitive strategies in using learning technologies?

1.5 Platform for an e-space community in this study

For this study, I am looking at the pre-service teacher trainees' involvement and collaboration in an e-space community as the catalyst for the possible development of metacognitive strategies towards learning technologies. In order to provide the trainees with in an online environment specific for the purpose of this study, I have chosen the International Islamic University's new learning management system called the Innovative Teaching and Learning Environment (iTa'LeEM). The iTa'LeEM replaces the university's previous Learning Management System (LMS) and is developed by the university using Moodle, an open sourced Course Management System (CMS). Moodle, a community-based learning tool for learning, is also known as a Learning Management System (LMS) as well as a Virtual Learning Environment (VLE). Utilising this widely used Moodle platform, the iTa'LeEM is customised for the university in order to provide both the academic staff and students with an advance and multi-functional learning management system or a virtual learning environment. This creates a perfect platform for the trainees to be in an e-space community.

1.6 Significance of the study

Technologies, especially information and communication technology (ICT), are bringing more impact in their integrations into education. While technology integration in teaching and learning is not uncommon, the current development of ICT that makes it more personal is changing the way it is used by learners and instructors. Academics are starting to realise that ICT can bring a change to the academic world. ICT is seen as a change agent that can make teaching and learning a lot more interesting and easier.

This paradigm change is happening on a global scale. Realising this new direction towards ICT at every level of education, the Malaysia's Education Blueprint 2013 - 2025 has proposed a long term plans to increase the usage and effectiveness of ICT for education sector. One of the blueprint's aim is to ensure that learners will not only be able to use ICT but also to effectively utilise ICT for their learning. To achieve this aim, one of the most critical aspects outlined by the blueprint is the importance of ICT literacy for teachers. This emphasis on the significance of ICT in education is in line with the benchmarks set by the International Society for Technology in Education (ISTE). These benchmarks help measure competence for the integration of ICT in education that Malaysia is trying to infuse into local education sector.

However, the integration of ICT into teaching and learning is not without its difficulties. This is despite the personalisation of technology that is becoming more of a necessity rather than a luxury, especially with mobile technology. Studies conducted locally as well as internationally have shown relatively

limited usage of ICT among teachers that can constitute towards fostering students' creativity, problem solving, critical thinking and communication skills.

The above discussion corroborated with studies such as conducted by Higgins (2009), Underwood (2009) and Prensky (2009) who pointed out the need for digital wisdoms and the learning benefits of digital technologies (these studies will be further elaborated in chapter 2. Starting early with pre-service teacher trainees, a teacher with digital wisdoms can digitally enhance their teaching towards meeting the objectives set in the national's education blueprint. At the time of study, literatures concluded that developing one's metacognitive awareness and strategies can assist towards possessing these digital wisdoms.

My study is established as an exploration on e-space as one of various tools that can be used to develop metacognition towards ICT competency in contemporary learning technology. The findings of this study could carry a significant impact on the clarification of this establishment, as it is to find out whether e-space platform works as it should and if not, what could be wrong about the platform. The official e-space platform of the university used for this study represents other similar platforms used in local institutions as well as international. As the use of e-space platform is now becoming a common practice in teacher training institutions, both nationally and internationally, this study can allow both the Ministry of Education as well as institutions to make informed decisions on the best approaches to undertake in utilising e-space

platforms for teaching and learning, especially towards developing metacognitive awareness and strategies in learning technologies.

1.7 Limitation and delimitation

This study is limited to exploring the possible effects of an e-space community framework towards the development of metacognitive strategies in learning technologies among pre-service teachers. This is in order to see the possibilities of metacognitive strategies development at the end of the study and would it be able to increase the ICT competency in contemporary learning technologies among the subjects. The subjects' metacognitive awareness will not be assessed and the study will only look at the possible outcomes of metacognitive strategies development via their participation in the e-space community and the outcome of such development in terms of the increase of ICT competency in contemporary learning technologies.

Subjects of this study consist of pre-service teacher trainees who are required to enrol in instructional technology modules offered by the Institute of Education in the International Islamic University of Malaysia. The modules are compulsory as part of the requirement for the trainees to complete their bachelor degree in education. One module concerning learning technologies is selected for the purpose of this study. In such case, generalisation will only be limited to the same study context.

The use of e-pace applications in the study only involves the creation of a virtual community in order to develop metacognitive strategies in learning

technologies. This is to be achieved by incorporating the core metacognitive strategies (planning, monitoring, evaluating) into the current instructional technology syllabus via the virtual community and to see whether such move has any effect on the subjects' ICT competency in contemporary learning technologies. However, the researcher will not be able to control any internal or external factors that might or might not affect the subject's development of metacognitive strategies in learning technologies. Methods such as careful data collection as well as usage of techniques from multiple perspectives will be planned and carried out to ensure the validity of the study.

1.8 Operational definitions

Listed are several important terms being used in this study:

1) *Metacognitive strategies*: Strategies used to achieve metacognitive goals of cognition. These include planning, monitoring, evaluating and managing of a student's learning process. For this study, these strategies will apply to how the subjects manage and control their learning goals for courses that involves technology used in teaching and learning
2) *Learning technologies*: Information and communication technologies (ICT) tools, applications and systems that is designed or adapted to support teaching and learning. These include, among others, distributed online or hybrid courses, open online repositories of educational materials, hypermedia environments, games, simulations, virtual worlds, intelligent

tutoring systems (ITSs), tutorial dialogue systems, electronic portfolios, and peer review systems.

3) *Pre-service teacher trainees*: Students in a teacher education program, at a college or university, preparing for professional-level teaching positions. For purpose of this study, the pre-service teacher trainees are students from the Institute of Education, in the International Islamic University Malaysia.
4) *E-space community*: A social network of individuals who interact through specific media, potentially crossing geographical and political boundaries in order to pursue mutual interests or goals. The study will be utilising the Moodle online application in order to create a space for the subjects to form a virtual community.

1.9 Organisation of the thesis

My thesis is presented in a total of five chapters. I start the thesis with Chapter 1 explaining about the research background, followed by a focus on the research framework. The next four sections describe the statement of problem, research objectives, research questions and the significance of the study, consecutively. To give a clearer focus of the study, I also briefly explain the importance of ICT competencies for teachers as well as the platform chosen for this study to create an e-space community. Finally, I discuss the limitation and delimitation of this study as well as define the operational terms used in this study.

Chapter 2 discusses the theoretical orientation that framed this study. I start the chapter with and overview of pre-service teacher trainees and ICT competencies in contemporary learning technologies. This is followed by an overview of metacognition that includes its origin and definition, main components as well as difference between cognition and metacognition. The next section elaborates on the e-space community framework used for this study and related theories that supports the framework, followed by what works and what does not works in previous studies that used similar framework. The chapter ends with highlights on the theoretical and conceptual frameworks of the study.

Chapter 3 elaborates on the research design and methodology of my study. I start with a brief purpose of the study, followed by an explanation of the research design. The discussion then focus on the rationale of choosing a mixed methods design and related components of the design, namely the data collection approach and the intervention. The following sections elaborate on the surveys and interviews used as the data collection methods of the study. The respondents of the study as well as the site where the study took place are briefly described in the next sections and the elaboration of ethical issues concerning the study ends the chapter.

Chapter 4 of my thesis is divided into two parts. Part 1 starts by describing in detail concerning the respondents of the study and the data analysis approach taken for both quantitative and qualitative data gathered. This includes the data analysis approach and procedures for both surveys and interviews of this study.

Part 2 of the chapter presents the findings of both quantitative and qualitative data analysis.

Chapter 5 discusses the in details of the quantitative and qualitative findings of obtained from the process of data analysis and how the qualitative findings supports the quantitative findings in answering the research questions of this study. Finally, chapter 6 concludes the thesis by providing the implications of the study, limitations of the study as well the directions for future research.

1.10 Summary

As Malaysia's Ministry of Education has spent a huge sum in order to support the integration of ICT in schools throughout the nation, the lack of teachers' ICT competency in order to make full use of the technological facilities and support can be considered as a threat to the effort. Scholars, researchers, government bodies, and tertiary institutions have attempted to determine the causes of this phenomenon and many have offered remedies. However, there have been very few studies that addressed the development of metacognitive strategies via an e-space community application in order to enhance the ICT competency or knowledge of learning technologies. This study attempts to explore the possibilities of metacognitive strategies development upon exposing the pre-service teachers to an e-space community application and can the application be used as a tool to enhance the pre-service teachers trainees' ICT competency of contemporary learning technologies. While there are other external and internal factors that contribute to the ICT competency of an individual, the study aims to explore if a planned and structured e-space

community can provide an environment whereby being in one can have any effects in increasing the competency in ICT/learning technologies. Ultimately, this study aims to find out if an e-space community can be the catalyst for the development of pre-service teachers trainees' metacognitive strategies and significantly influence their ICT competency/knowledge of learning technologies, after considering all major external and internal factors.

Chapter Two:Literature review

2.0 Chapter overview

This chapter is a result of an extensive review of literature related to the main issues of the study; the pre-service teacher trainees and metacognitive strategies in ICT competency in contemporary learning technologies. First, the study discuss the problems that surround the pre-service teacher trainees and ICT competency. The second part looks at research related to teacher's ICT competencies in contemporary learning technologies in Malaysia. These are where the research problems for this study are derived from as the basis for this study and to justify why there is a need for this study to be conducted.

The third part of the chapter focuses on metacognition and the application of metacognitive strategies towards enhancing ICT competency in contemporary learning technologies and the impact it carries towards teaching and learning. The chapter looks at suggested solution in addressing the research problems for this study. The fourth part reflects on possible impacts that e-space community can have on the development of the metacognitive strategies among the pre-service teacher trainees towards their ICT competency. Along the discussions, related learning theories surrounding the major themes of this study and how these theories form the foundations of the study are also explained in order to connect all the issues together.

The next section describes the research framework that forms the overall theoretical basis of the study. This is combined with the research problems and

suggested solution, as well as the issues and the learning theories to develop the theoretical framework for the study. Finally, this theoretical framework leads to the design of the proposed conceptual frameworks that ultimately guide the planning and execution of this study.

2.1 Pre-service teachers and ICT competency in contemporary learning technologies

Technologies are changing and advancing very rapidly and have long been part of teaching and learning. In looking at the current trends in the integration of technologies into education, The Horizon Report (2010) from EDUCAUSE Learning Initiative and The New Media presented four key trends in emerging technologies in the practice of teaching and learning. These are:

- *The abundance of resources and relationships made easily accessible via the Internet is increasingly challenging us to revisit our roles as educators in sense-making, coaching, and credentialing.*
- *People expect to be able to work, learn, and study whenever and wherever they want to.*
- *The technologies we use are increasingly cloud-based, and our notions of IT support are decentralized.*
- *The work of students is increasingly seen as collaborative by nature, and there is more cross-campus collaboration between departments.*

(The Horizon Report, 2010, p. 3-4*)*

These key trends are looking at mentoring and preparing learners for the future, where a faster, easier and collaborative approach is set to be the preference for accessing information and socialising, regardless of location and devices (The Horizon Report, 2010). Along with the key trends, the report also listed several critical challenges in the integration of technologies that can affect teaching and learning over time. These challenges are:

- *The role of the academy and the way we prepare students for their future life is changing.*
- *New scholarly forms of authoring, publishing, and researching continue to emerge but appropriate metrics for evaluating them increasingly and far too often lag behind.*
- *Digital media literacy continues its rise in importance as a key skill in every discipline and profession.*
- *Institutions increasingly focus more narrowly on key goals, as a result of shrinking budgets in the present economic climate.*

(The Horizon Report, 2010, p. 4-5*)*

Two of these challenges are related to the issues addressed in this study. Firstly, the challenges focus on issues such as the need to provide today's leaners with the necessary tools by adapting teaching and learning practice to meet their needs. Secondly, the challenges also highlight on the importance of digital literacy skills, making the usage wider across discipline as well as a norm, especially in teacher education programs (The Horizon Report, 2010).

The key trends and crucial challenges discussed above are connected to the general objective of this study, which is to explore for ways to increase teachers' ICT competency and by extension, help enhance teaching and learning. It is, thus, crucial to look at the connection between teachers in general and pre-service teacher trainees in specific to this study, and ICT competency in contemporary learning technologies. Earlier studies looking at the advantage of teaching and learning in a digital age are generally looking at ICT competencies in contemporary learning technologies and specifically at the constructivist approach of technology in education and their positive outcomes (Meyer et al 2011; Goktas 2009a; Guo 2008; Jorge 2012; Lee et al 2007; Lim & Chan 2007).

The United Nations Educational, Scientific and Cultural Organization (UNESCO) has long realised the importance of ICT competency for teachers and has been pushing for teachers to have adequate ICT competencies in order to cope with the impact that the rapid development of technologies brought to education. In its latest 2011 ICT Competency Framework for Teachers (the updated version of the 2008 publication), UNESCO emphasizes that having adequate ICT competencies and being able to help their students with ICT are no longer enough as teachers also need to be able to help the students become collaborative, problem-solving, creative students through ICT. This is in order to shape the students to become effective citizens and members of the workforce. All these in no doubt conform to the notion that constructivism is bringing a fresh outlook unto the digital age of teaching and learning; especially at the contemporary learning technologies.

For this study, it is in my opinion that pre-service teachers make the best candidates to be trained into adopting a constructivist approach to teaching as they are still fresh and not tied to the traditional teaching approaches as compared to what most in-service teachers are. This is based on Lim and Chan's (2007) argument that the pedagogical beliefs of the pre-service teachers are well set and established upon their enrolment into a teacher education program and will most likely be resistant to change. This is further supported by Lee et al. (2007), who stated the likelihood of pre-service teachers adopting a traditional teacher-centred approach in technology integration if they are not given the opportunities to experience a student-centred learning environment. This is where they can explore the scaffolding made between pedagogy, learning theories and learning technologies in order to support students' cognitive development. It is in my opinion that such exposure will give the pre-service teacher trainees windows of opportunity for ways to improve their ICT competency in learning technologies.

However, previous studies reported some barriers faced by educators in realising or materializing the full benefits of contemporary learning technologies in relation to ICT competencies. These barriers comprise of both extrinsic and intrinsic factors to an individual teachers' ICT competencies. Extrinsic factors include (among others) insufficient and ineffective ICT in-service trainings, lack of appropriate software and materials, lack of hardware and brief, unfocused course content (Lee et al., 2007; Goktas, Yildirim & Yildirim, 2009). As for intrinsic factors, the most obvious that contribute to

teachers' lack of ICT competencies are the lack of confidence and experience in the use of ICT related learning technologies to engage students' learning (Lee et al., 2007; Lim, 2007).

The intrinsic factors, the focus of this study, provide good evidence that there is a need to equip teachers with a supportive environment that can help develop efficient metacognitive strategies in order to enhance their ICT competencies in contemporary learning technologies. It is important that such environment includes asynchronous element and not limited to the physical walls of the classroom or the traditional teacher-centred value of teaching and learning. It is an environment that I hope e-space community can provide for the pre-service teacher trainees.

Web 2.0 has the capabilities of providing such environment to these pre-service teacher trainees. This can be seen from the emergence of social software as one of the major components of Web 2.0 (Alexander, 2006). The openness of Web 2.0 provides online functions such as content creation, resource sharing and peer collaboration that can take teaching and learning beyond the physical boundaries of a classroom (Alexander, 2006; Baltaci-Goktalay & Ozdilek, 2010; Maloney, 2007). Social and professional networking sites such Facebook and LinkedIn display similar characteristics that are now being integrated into many learning management system (Alexander, 2006). A learning management system or an e-space community with all these tools provides a potentially perfect environment for the development of metacognition. iTa'LeEM is an example of a learning management system that utilises these Web 2.0 tools.

The discussed issues of positive attributes of ICT for teaching and learning, the importance for teachers (especially pre-service teacher trainees) to be competence in ICT, as well as the barriers faced by the teachers proposed a solid evidence that there is a problem that needs to be addressed. While there have been a number of research done to address such issues, not many are looking at specifically linking ICT competency of teachers with metacognitive strategies and e-space environment. Thus, this study aims to add another dimension to help provide better solution to the research problem.

2.2 Teacher's ICT competencies in contemporary learning technologies in Malaysia

In order to develop teachers' competency in learning technologies, I feel that it is best to start at the entry level of teaching profession, which is the pre-service teachers. This is the reason why the chosen subjects for this study are the pre-service teacher trainees of the Kulliyyah of Education from the International Islamic University Malaysia. These new and future batches of pre-service teacher trainees will be those who are used to being surrounded by, as well as using, technology. However, they might not be digitally wise, as having used technology does not guarantee technological efficiency. Some of these pre-service teacher trainees, despite being adept at using technologies such as smartphones and tablets for their personal usage, do not have any idea or clue as to what to do with technology in teaching and learning, while some are totally inadaptable at utilising technology at all, personally or professionally.

Despite the above statement, current and future pre-service teacher trainees are already being confined in a digital environment for the duration of their existence and this has equipped or is equipping them with a digital mind-set that is ready to adopt and adapt learning technologies, once it is made clear to them of the know-how (Prensky, 2001). Evidences have shown that pre-service teachers demonstrate positive attitudes and a high acceptance level towards Web 2.0 technologies (which is also a part of learning technologies) in supporting their courses (Baltaci-Goktalay & Ozdilek, 2010). Web 2.0 provides users with the capabilities to create content, share resources as well as collaborate with others through online tools (Alexander, 2006; Baltaci-Goktalay & Ozdilek, 2010; Maloney, 2007). These functions allow teaching and learning to go beyond the physical boundaries of the classroom.

Internationally, many research have been conducted in relation to the issue of teachers' ICT competencies and learning technologies. Redmond and Albion (2002) discovered in their research that most pre-service teachers agreed on the benefits and usefulness of ICT integration, albeit different views of specific ICT practices in comparison to traditional teaching practices. They realised the challenges and obstacles in the implementation of ICT in teaching and learning, of which they have only a few models to take example from or are able to draw very little from their own experience despite their enthusiasm. Curriculum pressure, lack of ICT resources, inadequate technical support and a continuing need for teachers to receive appropriate professional development are among the problems that the pre-service teachers reported in the study.

In 2008 to 2009, several countries participated in a research by OECD (Organisation for Economic Co-operation and Development) focusing on *ICT and Initial Teacher Training*. The result supported their statement of why the initiatives for ICT training should begin with pre-service teacher trainees. It is revealed that several participating countries are focusing ICT training (ICT being part of learning technologies) to only in-service teachers, neglecting the potential that pre-service teachers have over professional development in regards to ICT in education.

Bringing the focus of this study closer to Malaysia, the Ministry of Education has given a lot of attention in strengthening the ICT infrastructure in schools for the whole country as well as the ICT competencies for teachers. In the preliminary report of Malaysia Education Blueprint 2013 - 2025, the ministry has laid out a long term plans to increase the usage and effectiveness of ICT for school's teaching and learning. The aim of the blueprint is to make sure that students will not only be able to use ICT but also to effectively utilise ICT for their learning. Several measures have been introduced in order to strengthen the foundation of ICT-enabled schools and at the same time to introduce proven ICT solutions into the education system. These measures are;

- To provide learners with the skills and knowledge to learn effectively and live productively in an increasingly global and digital world;
- To equip all 10,000 national schools with 4G Internet access and a virtual learning platform that can be used by teachers, students, and parents through the 1BestariNet programme;

- To train all teachers to embed ICT in teaching and learning in order to support student learning;
- To increase the number of ICT devices until the student- to-device ratio reaches 10:1. The ratio may be lowered further subject to an impact assessment and availability of funds; and
- To pilot ICT innovations for delivery such as distance-learning and self-paced learning before scaling up nationwide.

In order to achieve the stated measures, the blueprint has phased the education plan for Malaysia into several stages starting from the year 2013 all the way to 2025. One of the most critical aspects in improving and enhancing ICT competency and utilization in schools is the importance of ICT literacy for teachers.

In defining the ICT literacy for teachers, the Ministry uses the internationally recognized benchmarks set by the International Society for Technology in Education (ISTE) to help measure competence for the integration of ICT in education. Known as the National Education Technology Standards (NETS), it requires all teachers to meet the following standards:

- To facilitate and inspire student learning and creativity: Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments;
- To design and develop digital age learning experiences and assessments: Teachers design, develop and evaluate authentic learning experiences

and assessment, incorporating contemporary tools and resources to maximize content learning in context and to develop the knowledge, skills, and attitudes to utilise ICT;

- To model digital age work and learning: Teachers exhibit knowledge, skills, and work processes representative of an innovative professional in a global and digital society, including fluency in ICT systems and digital tools to support student success and innovation;
- To promote and model digital citizenship and responsibility: Teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behaviour in their professional practices; and
- To engage in professional growth and leadership: Teachers continuously improve their professional practice and model lifelong learning.

All these are backed up by an investment of approximately RM6 billion (about 1.2 billion pound) in order to support and achieve the international standards of ICT integration in education from all aspects. However, in a 2010 study conducted by the Ministry, it has been found that ICT usage among teachers was relatively limited. Approximately 80% of teachers spend less than one hour a week using ICT while only a third of students perceive their teachers to be using ICT regularly. The UNESCO review further clarified that "even when ICT is used in teaching, in most cases it has not gone much beyond the use of PowerPoint as an instructional tool. There is no evidence that ICT is being used to foster students' creativity, problem solving, and critical thinking and communication skills."

According to the blueprint, one reason that limits the usage of ICT among teachers is the fact that hardware was rolled out without sufficient training and support services to schools, such as technicians to maintain the equipment. Even in cases where training and support were provided, it was often not continuous or sustainable. As such, teachers were ill-prepared in terms of how to properly utilise and manage the ICT equipment in their day-to-day work. This finding is in line with international research that suggests that high-end facilities, like computer laboratories, smart classrooms, and science laboratories only become useful once teachers and students both know how to utilise the technology and equipment in ways that incorporate learning processes.

What currently transpires in Malaysian education in regards to ICT competencies as stated above is in contrast to an earlier observation by Sa'ari, Luan and Roslan (2005) stated that teachers displayed positive attitude in regards to new technologies. The teachers claimed that ICT is useful for education and provides them better confidence as well as lower their level of anxiety towards computer technology. However, despite the earlier claims, ICT literacy is still lacking and studies have shown that e-space environment such as provided in virtual learning environment solution can be one of the solution to improve ICT literacy in Malaysia. Mohd Nordin, Amin-Embi and Abdul Wahab (2011) observed that the use of e-space for virtual learning environment has been found to be encouraging for learners. Most instructors also provide positive feedback that there is an increase of virtual learning activities in the recent years. The same study also stated that most instructors

agree that the integration of virtual learning environment is beneficial for their learners. These findings suggest that e-space can play an important in improving ICT literacy for teaching and learning in Malaysia.

This brings the focus back to the earlier attention on the needs to start developing teachers' ICT competency at the entry level, which is the pre-service level. This is where Prensky (2009) suggested that one sees the importance of having digital wisdom. Digitally enhanced teachers possessing digital wisdom will be on the right path that is set by the nation's education blueprint. The question now is how can these pre-service teacher trainees be trained to be digitally wise? Based on earlier analysis and observation, I believe that teachers should not be equipped with just specific learning technologies at a particular time, with the notion that they should master the technologies and in the long run be able to integrate those technologies into their teaching and students' learning. They need the digital wisdom as per Prensky's (2009) notion, of which will enable them to handle any given technology and apply that into educational setting. From the perspective of this study, the question is that can a specific tool be used as a catalyst to generate the required digital wisdom towards ICT among the pre-service teachers?

As an example, a learning management system (LMS) is now becoming a standard in many learning institutions to digitally enhance and extend teaching and learning beyond the boundaries of the classroom. There are several LMS applications currently being utilised by different institutions and Moodle is one of the leading tools in this market by being an open source application, making

it more cost effective. Moodle is considered as the 'in thing' now and many institutions are or going to be introducing Moodle as their LMS solution. The same scenario applies to the International Islamic University Malaysia, specifically the pre-service teacher trainees for this study. The previous LMS solution provided for staff and students has been proven ineffective. This system was difficult to learn for most and not updated regularly. After many attempts of getting staff and students to learn and use the system, university board of management has decide to discontinue the use of the failed system and propose the more current and open source learning management system, Moodle. Given the current trend of adopting Moodle for learning institutions throughout the world, the university is hoping that the same move with Moodle will start a new culture of ICT integration throughout the university, for both staff and students.

However, the application and dissemination of Moodle as the new and updated learning management system are still going down the same road as the previous failed system. Staff and students are now being trained from scratch on how to use the system. Trainings that would take months (if not years), are now being conducted for teachers, students and technicians. Now, imagine the same scenario being repeated with every new application introduced to the university community and the cycle continues. While such rapid changes are expected of technology, the trainings and retrainings will burden the teachers and students.

There are several reasons that contribute to the ineffectiveness of learning management system integration in Malaysia. Among the reasons is as observed

by Hamat, Amin-Embi and Sulaiman (2011) on the use of existing learning management system for e-learning integration among higher education institutes in Malaysia. Overall, the integration of e-learning in Malaysia is still focusing on the mechanical features of teaching and learning. The system is still focusing on features such as content delivery and assessment, instead of supporting more important features for learning such as creative learning and knowledge synthesis. Despite the efforts of the ministry to bring ICT literacy for teaching and learning to international standards, there are still several aspects that need to be addressed by the academic development centres especially in the higher educational institutes. There should be more effective training programmes to tackle issues that hinder the development of ICT literacy such as lack of ICT skills and skepticism towards e-learning (Hamat, Amin-Embi & Sulaiman, 2011).

A solution is needed to make the learning or skills mastery of learning technologies to be a long-term, life-long solution. In accordance to Prensky (2009), there is a need to instil into these pre-service teachers the digital wisdom needed to enable them to use or utilise any given technologies for teaching and learning. Most importantly here is that the wisdom should come in the form of the awareness and knowledge of how to understand and use any learning technologies that come their way. They need to be self-directed, self-independent and self-aware in order to be able to do that, to be digitally wise and know their way around in the digital world. In order to achieve this, one possible solution is to introduce the pre-service teachers to metacognitive strategies.

Wong and Abu Bakar (2010) observed that in order for a technology enhanced learning environment (the use of e-space in particular) to be engaging, it requires the learners to be metacognitive in the learning process. They must have the correct thinking skills in order for them to navigate their way on e-space. This approach also has been found to work both ways. Othman (2014) stated that the use of technologies enhanced instruction (which is one of the features of e-space platforms) can help to develop metacognitive skills among learners. The online tasks given to learners through the e-space platforms can also be used to track cognitive monitoring (thinking of thinking). This is an advantage where instead of getting only verbal feedback from learners on what they say they do, online measuring tools can be utilised to observe what the learners are actually doing (Othman, 2014).

Being metacognitive also helps to provide a constructive environment for learners to have greater ICT competencies (the concept of constructivism will be further discussed in later section of this chapter). In Malaysia, several studies have looked both aspects of ICT competencies, metacognition and constructivism. Neo and Neo (2010) stated that incorporating technology into a constructivist learning environment can result in an innovative teaching and learning environment. Their study reported an increase of motivation and activeness in learners' learning process upon the introduction of such learning environment.

Hamat and Amin-Embi (2010) proposed that the concept of constructivism, especially social constructivism, also provides a good theoretical basis to explain and guide communication on e-space. This will help in guiding the online communication and assist in construction of knowledge among learners. E-space platforms indeed possess the right tools for creating a constructivist learning environment that in turn can support the development of metacognitive strategies.

However, more effective measures need to be taken to improve the development of metacognitive strategies and ICT competencies in Malaysia. The right and constructive environment need to be created for improving ICT competencies in Malaysia. In accordance to Ramli, Darus and Bakar (2011), learners' use of metacognitive strategies depend on the learning environment available and accessible to them. The right environment determines the right strategies applied in constructing their knowledge.

2.3 The importance of metacognitive strategies for pre-service teachers' ICT competencies

In order to achieve such level of understanding and efficiency towards any given technology-centred tasks and environments, as well as making teachers become more adaptive towards current and future learning technologies by way of planning, monitoring and evaluating their approaches in utilising and manipulating learning technologies, there exists a need for the development of teachers' metacognitive. The development of teachers' metacognitive strategies forms the general objective of the study. As proven by Phelps,

Graham and Kerr (2004), metacognitive approach indeed helps teachers and their students in forming support structures and networks that not only helps them cope with their ICT professional development, but also carry a broader outcomes and implications beyond the professional development initiative and act as vehicle to support the process of change. A metacognitive approach also has been proven to be a strong factor, an agent of change, in changing teachers' understandings of technology integration and also promoting a positive attitude towards ICT (Phelps and Graham, 2008). This is also supported by Gama (2004), saying the use of a computer-based environment in metacognition instruction does provides positive impacts upon students by increasing their awareness of their own learning processes and metacognitive skills.

Originating from the works of John Flavell, the first to coin the term, he states that metacognition is formed of both metacognitive knowledge and metacognitive experiences or regulation (Flavell, 1979). It is a knowledge that looks into an individual's own cognitive processes, followed by the active monitoring and regulation of these processes in order to achieve the individual's pre-set cognitive goals (Flavell, 1976). This coincides with the explanation on learning by Zimmerman (1998) saying that it is a 'proactive activity', one that requires a combination of self-initiated motivational, behavioural and metacognitive processes. The self-initiated or self-appraisal is to reflect on what you already know and how you think, while the behavioural and metacognitive processes (cognitive self-management) refers to one's planning and implementation of appropriate strategies, as well as monitoring, adjusting, and trouble-shooting performance (Paris & Winograd, 1990). This is where, in the

area of teaching and learning, lies the benefits of metacognitive teaching for the ability to transfer responsibility for monitoring learning from teachers to learners and in promoting positive self-perceptions, affect, and motivation (Paris & Winograd, 1990).

Schunk and Zimmerman (1994) looked at metacognition as the crucial element of learners' self-regulation, from which the learners achieve their cognitive goals through the process of activating and sustaining their thoughts, behaviours and affects. Ertmer and Newby (1996) supported the above statement and asserted on the importance for learners to acquire monitoring and self-regulatory skills. These skills are the metacognitive strategies to know not only what is important (declarative knowledge) but also how (procedural knowledge), when, where, and why (conditional knowledge) to apply the right knowledge and actions. Learners who are able to strategically apply the said strategies are considered as expert learners (Ertmer & Newby, 1996). As a whole, metacognitive strategies help learners to be aware of the knowledge and skills that they have or have not acquired and to follow with appropriate strategies to properly activate or acquire them, without being told to do so.

Brown (1987) mentions that the use of metacognitive strategies or metacognitive regulation forms an individual's metacognitive experiences. Brown also said that it is one's ability to control his or her own cognitive processes (described as self-regulation) that is known as metacognition and this has been linked to intelligence (Brown, 1987). Sternberg (1984) supported this by stating that figuring out how a particular task or set of tasks are done, and

followed by making sure that the task or set of tasks are done correctly; is determined by higher level or meta-components. These internal processes involve planning, evaluating and monitoring problem-solving activities.

Sternberg (1984) further stressed that the ability to appropriately channel cognitive resources, such as making the decision of how and when a particular task should be accomplished, is crucial to intelligence. This can be put into context when it comes to rapid changes or unfamiliar domains faced by pre-service teacher trainees (such as dealing with the inevitability of technological advancement). Metacognitive strategies can, as such, help them to be independent learners, able to cope with the ever changing and progressing learning technologies, without being burden with trainings and workshops every time new learning technologies are introduced into education system.

In order to inculcate metacognitive strategies into pre-service teacher trainees' technology curriculum, I am proposing for the use of an e-space community framework as the scaffolding to develop metacognitive strategies. This is to see whether there will be any changes to the subjects' ICT competency in contemporary learning technologies upon developing metacognitive strategies during the time that they spend in an e-space community. If there is any significance changes in their knowledge, it is hoped that this will help pre-service teacher trainees to be independent, to be among the same cohort who 'speaks' the digital language and be able to relate to each other while at the same to escape from depending on what the instructor tells them to do.

This is in accordance to what is stated by Zimmermann (1998), of which "learning should be something that the student does rather than something that is done to them". Gama (2004) mentioned as future suggestion to her own research on the effectiveness of metacognitive approach in interactive learning environment, the inclusion of a social component, through collaborative activities, and a more flexible model of metacognition training are promising directions to make such environments more meaningful and effective to students. It is in the my opinion that an e-space community can provided the social collaborative component that can act as a catalysis to awaken the pre-service teacher trainees to the fact that being surrounded by technologies in this 21st century, they not only have to 'speak' the digital language, but also need to possess the digital wisdom to be able to effectively use metacognitive strategies to govern their professional development in the utilisation of contemporary learning technologies. Thus, the study is focusing on this dilemma whereby the crucial development of teachers' metacognitive strategies in utilising learning technologies is to be explored using online or electronic space (e-space) applications. This is to look at whether the use of Moodle as an e-space application might or might not affect the pre-service teachers' development of metacognitive strategies.

The rapid advancement of technology today has been making an impact in all aspects of human life. Directly or indirectly, the presence of technology can be felt in enhancing or augmenting the day to day goings of people and as time progress, people began to crave for more advanced technology to help make their life more efficient. This effect can also be felt in the field of education,

where teaching and learning has now moved from a simple interaction in the classroom between a teacher and students, from using chalks and blackboard to more advanced tools such as LCD projector, smart board, tablets and computers to help make teachers' task of helping students construct knowledge a lot more efficient. Those are just a sample of tools that fall under the term "learning technologies" that covers information, communication, as well as instructional technology, which include examples such as telecommunications devices, hypermedia applications, and systems that support learning, teaching and assessment.

A growing number of education authorities are beginning to see the impact of learning technologies upon teaching and learning. As mentioned by Aviram and Talmi (2004),"The ICT revolution is a deep cultural revolution changing all modes and patterns of our lives and hence bound to lead to dramatic changes in education". Citing Higgins (2009), who noted that while the positive impact of digital technologies on learning is still debatable, there is indeed growing evidence that supports the increase of learning benefits via the use of learning technologies. (Underwood, 2009). This shows that the usage of technology in education is gaining higher ground as a contributing factor in changing the core element of teaching, whereby the same knowledge is being taught and what changes is just the vehicle of delivery; current research today are starting to see the impact that is shifting the core. As it is, at present there is indeed a need for a better technology integration in education. Such initiatives are being taken by multiple parties in order to create a path for technologies to become an integral part of education and enhance the construction of content and knowledge.

This is in line with Prensky's (2009) notion of digital wisdom, where people develop the skills to utilise and manipulate technology to extend and enhance thinking and other capabilities. To be digitally wise does not only mean to be good at easily or creatively utilising technology, but more towards making the wiser decisions through the enhancement of technology. People today are now reacting differently towards teaching and learning. This can be contributed to being surrounded by the advances of technology that is making a big presence in so many fields, which include education. The need for a better technology integration in education today is seen as integral in order to enhance teaching and learning. In order to do that, Prensky proposed that people need to be digitally wise, not only to enhance human's existing capabilities with technology but also to further explore what other areas of our human nature that can be extended or enhanced by technology. In effect, teachers who possess this digital wisdom will continue to look for further methods to improve teaching and learning through technology and in the process, becoming good at technology themselves. In the case of this study, it is to become competence in information and communication technology (ICT).

The United Nations, Education, Scientific and Cultural Organization (UNESCO), in its 2008 ICT Competency Standards for Teachers, stated 1) Technology Literacy, 2) Integrate Technology and 3) Digital Literacy as criteria to be met for the early stages of developing teachers' ICT competency. This indicates how important it is for teachers to learn the basics in order to be better users and integrators of technology in education.

Taking ICT as an example from learning technologies, Phelps et al., (2004) asserted that the process of acquiring computer skills requires the learner to be adaptable to change, to be flexible, intuitive and most importantly, to be persistent. Being self-directed and independent can ensure a more successful skill acquisition than those who are dependent on structured guidance (Ropp, 1998). This is the ultimate aim in ensuring that teachers will have the needed skills to utilise any given technology to be used in their teaching, as well as guiding the students to use the same technology for learning. This indicates that any inabilities from teachers to move along with the advances of technology will hamper its integration into teaching and learning and will leave education behind in the modern age of information and communication technology (ICT).

While many teachers are now becoming more competence, they might not yet develop the digital wisdom. Steps are being taken by teacher education institutions to enhance teacher's proficiency towards technology, specifically learning technologies. Tools are also carefully chosen to reduce the learning curves for teachers in dealing with the influx of technologies specifically crafted for teaching and learning. Choose an inappropriate technology and teachers will refuse to utilise due to the high or complicated learning curves. Efforts to minimise learning difficulties towards technology among teachers include courses, classes, trainings as well as workshops. These are regularly conducted for teachers as a mean to foster the much needed digital wisdom in facing the rapid advances of technology. This is to ensure teachers are well equipped with the knowledge and the technical-know-how when it comes to dealing with

learning technologies in order to enhance and enrich their teaching and students' learning. However, Melczarek (2000) argued that relying merely on training regimes such as workshops and seminars to enhance learning technologies competency is inadequate as this approach is unable to cope with the diversity and rapid development of technology (as cited in Phelps et al., 2004, p. 2).

At the International Islamic University Malaysia, the institution is beginning to go further into embracing online technology for teaching and learning. Previously, the solution for an online learning tool was a customised learning management system that did not garner much attention from the university's community. Over time the tool was neglected and was very minimally used. It is now being replaced with a more modern, more capable and standard application, which is Moodle. This move shows that the institution is accepting that to move forward and be at par with other world class institutions, it should conform to the current outlook of teaching and learning. This new point of view focuses on a more important and central role that technology is beginning to play in the academic world. Yet, the same problem faced by teachers around the world when it comes to learning technologies is also being faced by academics in this university. Specifically in the Kulliyyah of Education of the International Islamic University Malaysia, where students are being trained to be future teachers in the world where technology would definitely be far more advanced that what it is currently. The subjects for this study are these students who one day will go out and become teachers themselves. This is where the need to equipped these student teachers or pre-service teacher trainees with lifelong skills of technology compatibility becomes apparent. The moment they

become teachers in service, they must be able to adapt to any types of technology used for teaching and learning. The focus should be on delivering the knowledge to their students, with the help of technology and not being burden by having to learn every new technology introduced for teaching and learning.

However, to focus only on skills training proves inadequate for an effective professional development of teachers in dealing with learning technologies. It will require changes in attitude, values and beliefs that will result in the development of confidence for an on-going learning. While these prove as a challenge to teacher preparation and professional development programs, it does without doubt present the need to move away from skill objectives and to focus more on teachers' approaches to learning, their beliefs, attitudes as well as metacognitive understandings. A teacher must be assisted and equipped in dealing with the nature of technological change and their abilities to face this change. It is also crucial that both the teacher and institution must put the stress on effective learning strategies that will enhance learners to continue to learn and explore learning technologies throughout life (Phelps, 2007).

2.4 Overview of metacognition

First of all, it is crucial to look into the general idea of metacognition. In a simple general term, metacognition refers to thinking about thinking or reflecting on one's own cognition (Schoenfeld, 1987). It is a form of cognition situated at a second or higher order of thinking process where one has awareness and control over his or her own cognitive processes (Eggen & Kauchak, 2010).

Specific to learning, metacognition has become an essential component that refers to one's ability to manage his or her own learning and create a more meaningful approach towards learning.

Even though the term metacognition is almost always being used to discuss thinking and learning, the meaning of metacognition can carry different interpretations for users. These various interpretations occurs, among other reasons, due the multi-faceted aspect of metacognition. Among early definitions of metacognition refers to it as thinking about what one knows, what one is doing, or what one's current cognitive state is (Hacker, 1998a). Taylor (1999) later defines metacognition as an "appreciation of what one already knows;, together with a correct apprehension of the learning task and what knowledge and skills it requires, combined with the agility to make correct inferences about how to apply one's strategic knowledge to a particular situation, and to do so efficiently and reliably" (p. 37). It is also defined by McCormick (2003) as having the knowledge about oneself as a learner, about how to do things as well as when and why to use the knowledge. Metacognition also refers to the awareness and understanding of one's own thinking and learning processes, as well as how these processes are regulated to enhance learning and memory (Ormrod, 2012). Puzziferro (2008) adds to the definition of metacognition by referring to the skills that learners employ in planning their strategies for learning, monitoring how well those strategies are working, and regulating the effort needed to facilitate learning.

Different researchers provide slight variations in the definitions of metacognition but it is commonly agreed that the foundation of metacognition is a body of knowledge that includes awareness of one's own abilities, general strategies that used for different tasks, and knowledge of the conditions in which the strategies should be used (Flavell, 1979; Schraw & Dennison, 1994; Pressley et al., 1998; Pintrich et al., 2000; Erskine, 2010, Ormrod, 2012).

2.4.1 The origin and definitions of metacognition

This section explains the origin and definitions of metacognition, specifically looking at two of the most prominent figures in the subject of metacognition, John Flavell (1979) and Ann Brown (1979). The section also discusses the two main components of metacognition, which are (1) Metacognitive Awareness and (2) Metacognitive Strategies, as well as looking at the differences between metacognitive and cognitive strategies.

In general, the theory of cognitive information processing forms the basis of metacognition. It focuses on the notion that learning is a mental process. Learners go through this procedure by processing the information received, storing it, remembering it and in the end, turning it into behaviour. In order to achieve an effective learning, the theory also states that learners' involvement in the learning process is required during the learning experience. It is only when learners participate in the learning experience, that they are able to guide their own learning. This guided learning will assists the learners to decide their learning goals, reflect on what they know about the subject, plan how much time that they need to learn a subject, select relevant learning strategy to learn,

execute the strategy, verify the outcome, and adapt their strategy as required. These processes illustrate an example of metacognitive strategies in action executed by guided learners. These strategies guide a learner's information processing and monitors their effectiveness when applied to a learning task (Schoenfeld, 1987).

Flavell (1979) and Brown (1979) are two of the most prominent figures in the area of metacognition and are considered pioneers in the field, however studies on the aspects of metacognition began long before. In the 1920s, Piaget (1976) and Vygotsky (1978) already discussed metacognitive processes in their theories of children's thinking and metacognition's general definition of thinking about thinking can be traced back to John Dewey (1933), where he discussed about thinking and its connection to learning.

Piaget (1976) described four stages of cognitive development in his theory of cognitive development. The theory proposed that age plays a role in a child's ability to reflect on his or her own thinking process. Upon reaching the age of 11, learners reach the formal operations stage and will be able to think about their thinking. At this stage, instructors can facilitate the process by asking learners of the process that occurs during learning, what they understand of the topic as well as the strategies that they utilise to reach the understanding.

Vygotsky's (1978) theory of cognitive development states learning as a social process where a more knowledgeable person, or instructor, guide learners to learn and to think. In this process, the instructor guides learners until they can

think on their own. In a classroom setting, the same process is used by the instructor in helping the learners to develop the metacognitive strategies of planning, monitoring, and regulating through means of modelling and practice. The instructor or teacher plays the role of the cognitive regulator who facilitates the learning process and, when the learner is able, hands over the regulation task to the learner.

While previous studies have discussed on the general aspects of metacognition, it was not until the 1970s that the work of Flavell (1979) and Brown (1979), focusing on children's memory processes, started extensive studies on metacognition. Based on the work of Piaget (1976) and Vygotsky (1978), Flavell (1979) and Brown (1979) extended the formers' theories of cognitive development and added regulation of information on top of storage and retrieval of information (Schraw & Dennison, 1994; Taylor, 1999). From these studies, Flavell (1979) and Brown (1979) proposed their respective models of metacognition in order to provide a proper definition of the concept. Their models of metacognition provide the general framework for metacognition and many subsequent researchers refer to Flavell's (1979) and Brown's (1979) models in order to study specific aspects of metacognition and propose their own models. The following sections discuss the models of metacognition as proposed by Flavell (1979) and Brown (1979).

2.4.1.1 Flavell's model of metacognition.

In 1976, John Flavell set the groundwork for a proper definition of metacognition, stating that:

> …one's knowledge concerning one's own cognitive processes and products or anything related to them, e.g. the learning-relevant properties of information or data. . . . Metacognition refers, among other things, to the active monitoring and consequent regulation and orchestration of these processes in relation to the cognitive objects or data on which they bear, usually in the service of some concrete goal or objective. (Flavell, 1976, p. 232)

In this definition, Flavell emphasises on the main function of metacognition in the monitoring and regulation of cognitive processes. Flavell asserts that these processes are connected to how information is processed in relation to objective set and what are the actions chosen to reach the objective, as well as how task-specific processes are implemented and monitored.

In 1979, Flavell proposed a model of cognitive monitoring that further explained metacognition as a learning control system that can be divided into four components. These components are: (a) metacognitive knowledge, (b) metacognitive experiences, (c) goals (or tasks), and (d) actions (or strategies). As illustrated in Figure 2.1, these components interact with one another to control one's cognitive activities. The first component, metacognitive knowledge, is the learners' acquired knowledge of their cognitive processes. Flavell (1979) further expanded this component into 1) a person variable, 2) a task variable, and 3) a strategy variable.

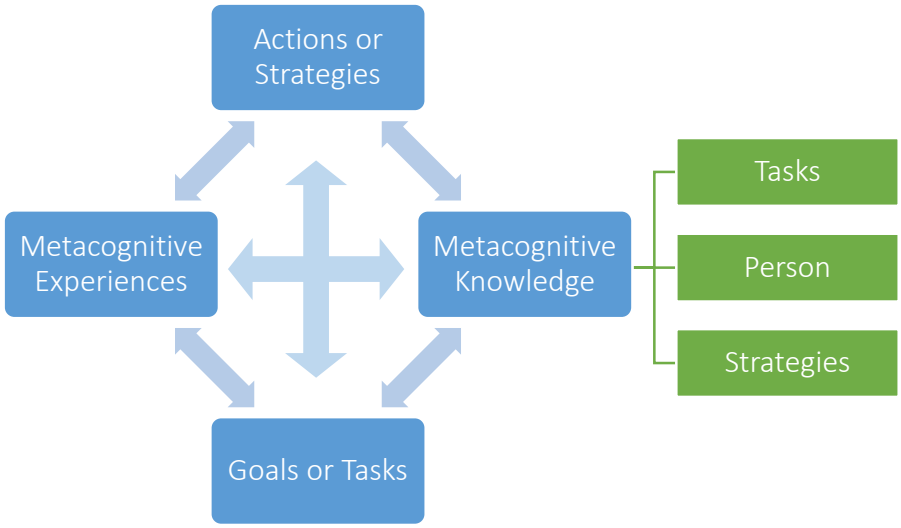


Figure 2.1: Flavell's (1979) Model of Metacognition

The task variable of metacognitive knowledge refers to a learner's information of a task and its required demands from the learner (Flavell, 1979). Having the knowledge of the task helps guide the learner's actions in accomplishing his or her task and provides information on the possibility of success. As an example, a learner possessing task knowledge will be able to plan a strategy to achieve a reading task when reading and understanding a research article take longer time as compared to reading a magazine article.

The person variable of metacognitive knowledge includes the individual's knowledge and beliefs about oneself as a learner. One example of the variable is a learner who knows that she is good at biology. Another example is a learner who knows that he is more productive when he studies in a group. It should be noted that the leaner's knowledge and belief about his or herself as a learner might positively or negatively impact performance in learning

situations.

The strategy variable completes the metacognitive knowledge variables and refers to the identification of goals and the choices of strategies in assisting learners' achievement (Flavell, 1979). A learner who knows that he must summarise each chapter to check for understanding is an example of this variable. Learners must acquire a vast repertoire of cognitive and metacognitive strategies to choose from in order to identify the correct strategies in achieving a goal.

The next component in Flavell's (1979) model of metacognition is metacognitive experiences. This component refers to the experiences and feelings that accompany a cognitive action. The confusing feeling that a learner is experiencing after reading a new book chapter would be an example of a metacognitive experience. Flavell (1979) stated "Metacognitive experiences are likely to occur in situations that stimulate a lot of careful, highly conscious thinking" (p. 908). These learning experiences carry a significant impact on learners' interests and approaches to similar tasks in the future.

The goals or tasks component of metacognition refers to the aim of achieving a particular cognitive activity as decided by leaners. An example of this can be seen when a learner tries to understand a text that he or she is reading. The leaner might find trying to understand exact wordings of a text is difficult and set his or her goal to understand the gist of the text instead. In this component,

successful achievement of a goal or task relies greatly on both the learners' metacognitive knowledge and prior metacognitive experiences (Flavell, 1979).

Finally, the actions or strategies component refers to approaches taken by learners to achieve their cognitive goals. These approaches are employed by learners to monitor the progress of their cognitive processes, to ensure whether the cognitive goals have been met of or otherwise. These strategies, which also rely heavily on a learner's metacognitive knowledge and experience, include learners' planning, monitoring, and regulating of their cognitive processes. As an example, a learner trying to understand a new math formula may strategise to achieve that goal by working through practice exercises (Flavell, 1979).

Subsequent researchers used Flavell's idea of metacognition of active monitoring and consequent regulation and orchestration of cognitive processes to achieve cognitive goals, as the general framework to investigate different forms of monitoring, regulation and orchestration. These include checking, planning, selecting, and inferring (Brown, 1978); self-interrogation and introspection (Lieberman, 1979); interpretation of ongoing experience (Flavell and Wellman, 1975); as well as referring to the act of evaluating what a person knows or does not know in regards to accomplishing a task (Metcalfe and Shimamura, 1994).

2.4.1.2 Brown's model of metacognition.

Another prominent researcher who has conducted extensive research in the field of metacognition is Ann Leslie Brown. She stated "Metacognition refers to understanding of knowledge, an understanding that can be reflected in either effective use or overt description of the knowledge in question" (Brown, 1987, p. 65). Her definition of metacognition focuses on one important aspect, the awareness of one's own knowledge or understanding of knowledge. From this point of view, a learner is assumed to understand a particular cognitive activity given the condition that he or she is able to use it appropriately as well as discusses its use. However, understanding can come or be approached from various degrees and it is not unusual for learners to utilise knowledge effectively without being aware of or able to justify how they come across the process. From this perspective, the term "metacognitive person" is used to signify an individual who is aware of his or her own knowledge, as well as its limitations. Two other terms, high metacognitive and low metacognitive have emerged out of the earlier justification to differentiate learners who are aware of their knowledge and strategies from those who are less aware.

Brown (1978) categorised her definition of metacognition into two components:

1) Knowledge of cognition (what individuals know about their own cognition)

2) Regulation of cognition (metacognitive activities that help regulate and control one's thinking and learning).

A learner who acquires these two components as his or her individual's

learning control system has higher chance of becoming better learners.

Figure 2.2 illustrates Brown's (1987) model of metacognition divided into two components – knowledge of cognition and regulation of cognition. Knowledge of cognition, which is further categorised into declarative, procedural, and conditional knowledge, refers to the information that learners have about their own cognitive processes. This information assists learners in the allocation of resources and the use of more effective learning strategies.

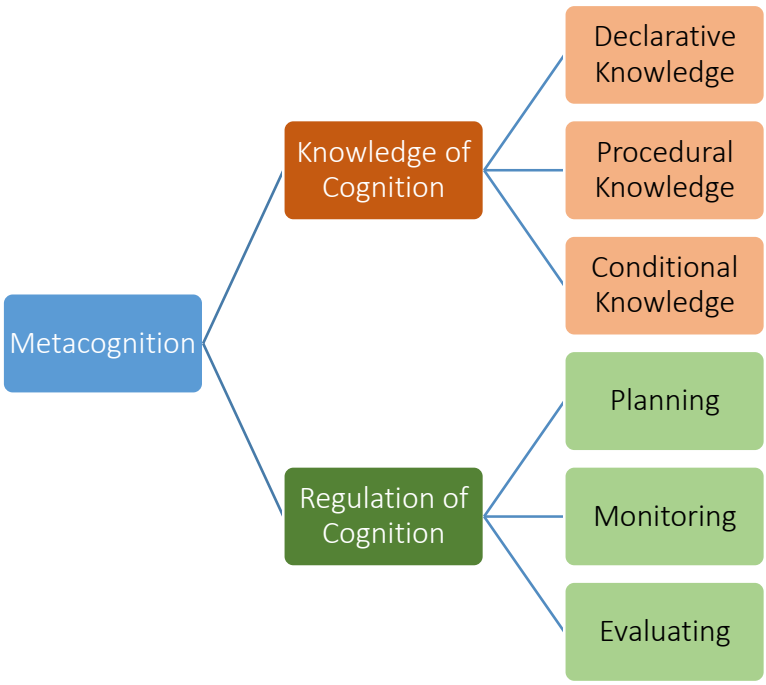


Figure 2.2: Brown's (1987) Model of Metacognition

Declarative knowledge is the aspect that represents the learners' knowledge of how they learn. As an example, a learner may be aware of the fact that he or she does not learn well by just listening to a lecture. Better learners have more declarative knowledge and are more likely to apply this knowledge as they go through their learning process.

Procedural knowledge refers to the learners' knowledge about the strategies that have the most impact upon their learning. A learner who has difficulties learning just by listening to an instructor may realise that he or she need to apply different strategies to overcome that obstacle. These strategies may include procedures such taking notes of the instructor's lecture, rewriting them and supplementing the notes with additional readings. The leaner will have a more meaningful learning experience by knowing better strategies.

The final category in Brown's (1979) knowledge of cognition is conditional knowledge. Conditional knowledge indicates knowledge that learners have in regards to when and why to implement learning strategies. This knowledge of metacognitive strategies, however, will not be useful until the learner knows how to utilise them. At the start of a class lesson, a learner realising that notes need to be taken in orders to understand the lesson is an example of this knowledge. Right after the class, the learner might take the next step and rewrite the notes in order to make the information clearer and follow that step by reading the textbook for clarification. The learner realises that applying these strategies will make learning more meaningful.

Regulation of cognition is Brown's (1987) second component of metacognition. Regulation of cognition refers to the activities used to control and manage learning. The component is categorised into planning, monitoring, and evaluating.

Brown (1987) defined planning as selecting appropriate strategies and cognitive resources before learning occurs. As an example, learners may plan his or her learning by allocating time to read a chapter and then skimming through the chapter before reading it. The learners take control of the learning situation by providing themselves enough time to read and skimming for important points in the chapter.

Monitoring, another part of regulation of cognition, is the learners' awareness of their performance during learning (Brown 1987). Learners reading a chapter and questioning themselves on their understanding is an example of monitoring. The process revolves around the learners asking themselves if they know what the author means or if they can pick out the main ideas.

The final category in Brown's regulation of cognition component is evaluating. According to Brown (1987), leaners evaluate learning by assessing the effectiveness of the strategy in achieving its goal. Learners may evaluate by looking over their learning goals to see if they have been met. If the learner's goals have not been met, they can manage their own learning by planning a new strategy to use.

Learners may then use these categories of regulation cognition in cycle (planning, monitoring and evaluating) until their learning goals have been met. When the learners engage in this approach towards a learning process, they are in control and are managing their learning.

My study focuses primarily on the regulation of cognition component from Brown's (1987) model of metacognition. In order to measure the metacognitive awareness in the pre-service teacher trainees of this study, I used Schraw and Dennison's (1994) Metacognitive Awareness Inventory (MAI). The instrument is a self-reported questionnaire developed to measure metacognitive awareness in adults and features the same dimensions of metacognition as proposed by Brown (1987), knowledge of cognition and regulation of cognition.

2.4.2 Metacognitive awareness.

Wilson (1999) stated that metacognitive awareness is the learners' awareness of their learning process, knowledge about content knowledge, and knowledge about the own strategies. Specifically it refers to learners who know what they know and do not know, know what they understand and do not understand, and know why they do not understand have metacognitive awareness. By being aware of their metacognitive knowledge, learners will be able to plan, monitor, and regulate their own learning. It will also allow learners to plan, sequence, and monitor their learning experience to for the purpose of improving performance (Schraw & Dennison, 1994).

Literature on metacognition indicates that learners who display high level of metacognitive awareness outperform learners who score lower on measures of metacognitive awareness (Eggen & Kauchak, 2010). This is probably due to the fact that metacognitively aware learners are more independent and reflect, monitor, and evaluate their cognitive processes more than less metacognitively

aware learners (Gott, Lesgold & Kane, 1996). This resulted in learners who are more metacognitively aware outperforming learners who are less metacognitively aware.

Swanson (1990) conducted a study on 56 children in fourth and fifth graders and concluded similar outcomes. He discovered that metacognitively aware learners used more strategies and performed better on problem solving tasks than unaware learners, regardless of their aptitude level. Another study by Howard, McGee, Shia, and Hong (2001) replicated Swanson's study on 1,502 fifth through ninth grade students and confirmed the same results. Both these research are aligned in suggesting that learners who are more metacognitively aware may outperform the less metacognitively aware learners.

Given the fact that learners who show signs of being more metacognitively aware outperform learners who are less metacognitively aware, the process of teaching and learning should help learners become metacognitively aware. Paris and Winograd (1990) stated "Students can enhance their learning by becoming aware of their own thinking…Teachers can promote this awareness directly by informing learners about effective strategies" (p. 15). Schraw and Dennison (1994) supported this notion, whereby being metacognitively aware is seen the factor that enables learners to plan, sequence, and monitor their learning with the aim of improving performance. However, just knowing about metacognition is not enough for learners. They need to practice the metacognitive skills in academic settings in order to achieve the impact of metacognition.

Dick, Carey, & Carey (2005) agrees with the aspect of practice as one of the most powerful tool in learning process. Practice allows learners to use the metacognitive strategies by helping them not only understand how to use the strategies, but also when and why to use the strategies. In order to assist in developing the learners' use and transfer of metacognitive strategies, instructors should allow and give ample time for learners to practice. "Effective teachers are those who engage in continual prompts to get children to plan and monitor their own activities" (Brown, 1987; p. 102). Learners' engagement in the processes of monitoring and evaluation of learning will gradually move them towards their metacognitive awareness.

Knowing how metacognitively aware learners are can help instructors plan and foster metacognitive awareness into their lessons. In order to find out how each learner is metacognitively aware, it is crucial to be able to measure this attribute in the learner. Various instruments have been developed for the purpose of identifying metacognition in learners (Schraw & Dennison, 1994). Schraw and Dennison (1994) developed the MAI, a 52-item self-reported inventory, to measure adults' metacognitive awareness. The instrument is used to assist in identifying metacognitively aware learners quickly and reliably as well as to measure learners' knowledge of cognition and regulation of cognition.

2.4.3 Metacognitive strategies

This study will focus on the possible development of metacognitive strategies among the pre-service teacher trainees upon exposure to e-space environment. The metacognitive strategies in this study refer to regulation of cognition where metacognitive activities are used to help regulate and control one's thinking and learning (Brown, 1987). Possibilities of these strategies development also refer to other behaviours employed to achieve metacognitive goals or tasks (Flavell, 1979). Learners aiming to reach these goals or targets in their self-regulation of learning would require metacognitive strategies that include planning, monitoring and evaluating (Schunk 2012). This approach is proposed for my study to promote any improvement in the subjects' knowledge of learning technologies upon their engagement with others in the e-space community.

Pressley, Forrest-Pressley, Elliot-Faust, and Miller (1985) described metacognitive strategies as "composed of cognitive operations over and above the processes that are natural consequences of carrying out the task, ranging from one such operation to a sequence of interdependent operations" (p. 4). The application of these strategies aim for cognitive purposes and are set of activities that have the potential of being done consciously, as well as controllable (Pressely et al, 1985). In simpler term, metacognitive strategies are methods used to help an individual think about their own thinking. These strategies assist learners in increasing their knowledge and regulation of cognition.

Metacognitive strategies are also a way for learners to ensure that a learning

goal is achieved. Focusing on this aspect, Zimmerman (2002) provided a comprehensive explanation on these learners' processes of using metacognitive strategies. Components of these specific processes, personally adapted to each learning task include: (a) setting specific proximal goals for oneself, (b) adopting powerful strategies for attaining the goals, (c) monitoring one's performance selectively for signs of progress, (d) restructuring one's physical and social context to make it compatible with one's goals, (e) managing one's time use efficiently, (f) self-evaluating one's methods, (g) attributing causation to results, and (h) adapting future methods. For example, learners might aim to understand a topic for exam by summarizing it into simpler notes and memorising the key points. The learners then quiz themselves to determine how well they understand the topic and if progress is still unsatisfactory, might change strategy by seeking assistance from instructors or peers. Following these approaches, learners are also aware of the time that they have before the exam and keep evaluating own understanding until a satisfactory result is achieved. Upon finding the right for achieving the goal, the learners might try to use the same approach for other learning goals.

While using metacognitive strategies is seen to provide advantages to the learning process, learners are usually unaware about learning techniques and strategies (Pressley et al., 1998). Zimmerman and Pons (1986), discovered that high-achieving high school learners reported greater use of strategies as compared to low-achieving high school learners. This indicates that some learners are better strategy users than others. As much as some learners are better at using metacognitive strategies than others, they are also not

automatically good users of strategies. They must be guided in order to be good at recognising and using metacognitive strategies. To achieve a good level as strategy users, learners should know and possess various metacognitive strategies. Prior to learning, learners can utilise strategies that include setting learning goals, determining how new information relates to prior knowledge, and deciding the usefulness of the new information. During learning, learners should identify important information and predict, monitor, analyze, and interpret what they are learning. Reviewing, organizing and reflecting on the acquired information are among the strategies that can be used post-learning (Pressley & Wharton-McDonald, 1997; Schunk, 2012).

Studies discussed above have proven that utilising specific metacognitive strategies has many benefits towards improving one's learning. Learners achieve better results if they use metacognitive strategies more frequently as compared to those who do not. The learners also are better at regulating their cognitive processes upon using metacognitive strategies. Those who understand and utilise metacognitive strategies are more metacognitively aware and are capable of transferring the same approach towards learning into other contexts or situation.

Instructors can help learners learn and use these strategies, as well as monitor the development of these strategies in learners. While all the studies presented in this chapter discusses useful knowledge of metacognition, most of these are conducted in a traditional classroom setting. Several studies of metacognition have taken place in e-space or virtual learning environment. With the

advantages that learners gain from using metacognitive strategies in their learning, guided by instructors and peers, it would also be advantageous to determine if e-space community can the factor to develop similar strategies for learners.

My study was designed to determine the possibilities of e-space community in developing metacognitive strategies awareness of learners' competency towards learning technologies. It tried to find out if the specific e-space community used in this study can encourage the pre-service teacher trainees to apply metacognitive strategies when using contemporary learning technologies. The development of metacognitive strategies has the possibilities of giving a significant impact to both learners and teachers' competency in learning technologies as well as opening up more possibilities for better technology integration in a learning environment (Phelp, Graham & Kerr, 2004; Phelp & Graham, 2008; Wassilow, 2009).

2.5 Metacognitive strategies and ICT competency in contemporary learning technologies through e-space

As a general assumption for this study (based on related learning theories); to successfully integrate technology in their teaching, teachers first have to be adapt at utilising the technology themselves. This does not indicate that teachers have to be an expert in technology or specifically computer technology, but should be proficient enough to manage and handle current and future technology without consistently relying on technical support staff or training workshops that might hinder teaching and learning progress whenever technology is

concerned. This appears to fit perfectly with the theory of metacognition, a theory that looks into one's metacognitive ability to select and use particular strategies in a given context for a specific purpose means that the learner can think and make conscious decisions about the learning process (Cohen, 1998). The general hypothesis of this study is that the development of metacognitive strategies via an e-space community in educational technology class can help strengthen the subjects' grasp of learning technologies. This is to see whether such notion is essential in successfully integrating technology in teaching and learning.

In the past ten years, a lot of research has been conducted in this area looking at either metacognition or learning technologies. While studies have been conducted to show both, 1) the effectiveness of technologies in enhancing teaching and learning, as well as 2) the effectiveness of being metacognitive when subjects are exposed to a technological enhanced learning environment, I have found little research conducted that ties between the two. Gordon (1996) is one of the earlier researchers who discussed how learners' awareness of metacognitive strategies could be the factor that can address the relationship between metacognition and learning technologies. Gordon asserted that a well-planned and designed interactive multimedia programs that incorporate metacognitive support tool can promote problem solving skills and increase understanding of learners' own interaction with the learning process. These will further stimulate learners' cognitive processes for the subject that they are learning.

The stimulation of the learners' cognitive processes, bringing it to a higher level of awareness (metacognition) can result in learners' ability to manage their own learning without much dependency on teachers (Cohen, 1998). Many researchers use different terms to describe this metacognitive process. Among the terms used to describe the process are: self-efficacy, self-awareness, self-directed and self-regulated learning. All these terms lead to the same aim, which is becoming better learners through metacognitive awareness and strategies.

Gravill, Compeau and Marcolin (2002) discussed the influence of these metacognitive strategies in influencing individual's cognitive process in becoming a more effective learner in relation to technologies. They found that learners' metacognitive awareness and learning outcomes in technologies is related to their level of confidence in their own ability. The increase in confidence affects the subjects' level of knowledge in technologies as they utilise metacognitive strategies in order to self-assess and self-monitor their own learning.

The finding is supported by Lewis (2006) who conducted a similar study on the application of metacognitive strategies by pre-service teachers attending technology-based training modules. The subjects successfully completed the course by utilising metacognitive strategies such as goal-setting, self-monitoring and self-evaluation. The result of the study again illustrated the needs to incorporate metacognitive strategies; as such method was proven successful in developing the pre-service teachers' self-regulated learning skills.

Other than developing skills that leads learners' to be independent in their learning, the application of metacognitive strategies in a technology based learning environment can also cater to the different learning styles of learners. Shannon (2008) has looked into learners' selection of metacognitive strategies to support their individual learning styles in order to become self-directed learners. The findings have shown that the teaching of metacognitive strategies has a positive impact in providing learners with valuable skill sets towards becoming self-directed.

While Shannon's study looked at the application of metacognitive strategies in general, Wassilow (2009) focused specifically on the implications of a metacognitive approach of learning technologies towards today's different types of learners. It is argued that an effective implementation of technology in teaching and learning could give a huge impact in helping today's educators to become more metacognitive. Despite the teachers' feeling that they lack the skills and resources in utilising technology in education, such approach can help them to overcome such notion and increase more opportunities in technology integration (Wassilow, 2009).

Nat, Walker, Bacon and Dastbaz (2011) supported the previous finding by also looking at the application of metacognitive strategies specifically in technologically enhanced learning environments. They argued that one requirement that learners should have to identify their own learning styles to suit both formal and informal learning situations is to develop metacognitive strategies. Their findings concluded that learners' learning performance are

affected directly by the design of a technological enhanced learning environment, as well as the development of their metacognitive awareness.

Gama (2004) discussed about the positive impact of an interactive learning that incorporated metacognition instruction. The result showed that the study was beneficial for the learning process as the subjects were observed to give up less on problems and answered more problems correctly. Research by Phelps, Graham, Brennan and Carrigan (2006) further supports such approach by outlining six strategies in order to build educators' confidence and capability of computer technology via metacognition. These strategies include 1) embedding discussion in staff meetings, 2) reflection sheets and scaffolds, 3) reflective journals, 4) visual displays and graffiti boards, 5) informal discussions and 6) video reflecting. Focusing on metacognitive discussion and reflection, it is argued that the strategies can help educators to discover the potentials that technology can bring as teaching and learning tools and at the same time realise that anybody can be good at technology if he or she employs the right attitudes and learning strategies (Phelps, Graham, Brennan and Cardigan; 2006).

Phelps (2007) argued that the ability to use metacognitive strategies could provide a life-long solution for learning, instead of a quick-fix solution when it comes to adapting to learning technologies. In the long run, not only learners (in the context of this study, the trainees themselves are learners) will be better at using learning technologies but teachers also will be more efficient towards adapting technology in their teaching. Such approach can direct the focus of the learning more towards the subject itself and less towards the learning

technologies involved. Other than giving a significant impact to both learners and teachers' competency in learning technologies (Phelp, Graham & Kerr, 2004), it will also open up more possibilities for better technology integration in a learning environment (Phelp & Graham, 2008; Wassilow, 2009).

Finally, the impact of learning technologies is not only restricted to the community in a learning environment but also even after the learners have moved into their respective professional field. This is as discussed by Mustafa, Kemp and Kemp (2007) who found that there is a need for a computer-based system that provides metacognitive training to help novice university graduates make the transition to their professional fields. The authors claimed that such training would provide the novice graduates with the necessary expertise and problem solving skills needed for their transition to the working world. The pre-service teacher trainees in this study (being learners themselves), will be able to understand the advantages as well as barriers in being competence in ICT for contemporary learning technologies and rely on similar experience to help their own future learners when it comes to dealing with learning technologies.

I believe that having the ability to apply metacognitive strategies can help the pre-service teacher trainees cope with the rapid advances of technologies in teaching and learning. If the trainees can develop the correct strategies to better manage learning technologies, they can be less dependent on their instructors or support staffs to help them every time they are introduced to a new technology in teaching and learning. The ability to self-discover or self-regulate their use of learning technologies would appear to help the trainees in the long run,

especially when they have entered the actual teaching profession and will be using learning technologies in their classroom.

2.6 E-space community framework

This study uses the e-space community framework as a tool to explore the possible development of the pre-service teacher trainees' metacognitive strategies towards ICT competency in contemporary learning technologies. For this section of the literature review chapter, I will discuss about related theories that surround the e-space community framework used for this study. The section will look at all the related theories that I have reviewed in detail in order to help me understand the theoretical framework that forms the basis of my understanding of the research issues. It is also this understanding that helps me form a conceptual framework to guide me in conducting the study in order to address the research problems.

2.6.1 Social constructivism

From the discussion of the problem or dilemma faced by teachers of the current educational scenario when it comes to dealing with learning technologies, it would appear that teachers of the present and especially the future need to be able to utilise and manipulate technologies well in order to enhance their teaching as well as coping with technology-savvy learners. The teachers need to be independently competence without much help from the usual educational technology "line of defence" namely out-numbered technicians, occasional workshops, far-in-between trainings or ill-equipped computers labs.

One learning theory that can relate to the study's research problem is the social constructivism learning theory. This section will describe how social constructivism learning theory forms the first layer in the formation of the theoretical and conceptual framework of this study.

2.6.1.1 The origins and definitions of Social Constructivism

In order to understand social constructivism, it is important to look at related theory that influenced social constructivism in the first place. The following sections, thus, will look at the works of several prominent figures in the field of constructivism learning theory, namely, Jean Piaget (1896 – 1980) and Lev Vygotsky (1896 – 1934).

Social constructivism originated from many works focusing on constructivism and Piaget's works are among the prominent ones. Constructivism is a vague concept that is a combination of several different but related theories (D' Angelo, Touchman & Clark, 2009; Powell & Kalina, 2009). In general, the term of constructivism is widely used to explain how humans construct meaning from current knowledge structures. Basically, it is a theory that focuses on the development of knowledge and learning. In education, constructivism values developmentally appropriate facilitator-supported learning that is initiated and directed by the learner. The application of the constructivism learning theory in education is often associated with two different sub-divisions of constructivism: 1) Cognitive Constructivism and 2) Social Constructivism.

2.6.1.2 Cognitive Constructivism

Cognitive constructivism, also known as individual constructivism, originated from Piaget's (1952) theory of cognitive development. Piaget looked at knowledge acquisition as a continuous process of self-development, where he proposed that concepts are constructed in individuals through a personal process. He observed how children actively interact with their surrounding and gain knowledge from such actions. In his theory, Piaget focused on individuals and how the individual constructs knowledge. He also stated that humans are not capable of immediately understanding any given information; instead, understanding comes from individual human's construction of knowledge (Piaget, 1952).

Piaget (1952) proposed that in order for an individual to construct knowledge, he or she needs a schema as the building block for the construction. According to McLeod (2015), Piaget defined a schema as 'a cohesive, repeatable action sequence possessing component actions that are tightly interconnected and governed by a core meaning'. An individual's schema is developed through assimilation and accommodation, two core elements crucial to the process of knowledge construction (Wadsworth, 2004). An individual constructs new knowledge based on his or her prior knowledge using these two processes (D' Angelo, Touchman & Clark, 2009).

Piaget (1952) looked at assimilation as a process of utilising existing schema in order to deal with a new situation or experience. An individual will make comparison with existing schema to see if any can help make sense or matches

the new situation. Should none of the existing schema or knowledge manages to help an individual make sense of the new situation; the individual will go through the second process, accommodation. This is when the existing schema will be changed or adjusted to suit the new situation and in turn creating new schema or knowledge for the individual (Wadsworth, 2004).

These processes occur when an individual goes through the four stage of development as described by Piaget (1952) in his work. In brief, these stages are; (1) sensorimotor stage, ages zero to two – where sensory experiences and motor activities dominate a child's growth, (2) preoperational stage, two to seven years old – where intelligence is intuitive in nature and knowledge is acquired through mental representation, (3) concrete operational stage, seven to eleven years old – intelligence becomes logical, conserved and dependent on concrete references, and (4) the formal operational stage, eleven years old to adulthood – uses higher level thinking or abstract ideas in order to solve problems (Piaget, 1952).

These processes described above become the core elements that represent cognitive or individual constructivism as proposed by Piaget and has become one of the most prominent concept in human development as well as teaching and learning until now.

2.6.1.3 Social Constructivism

In contrast to Piaget's cognitive or individual perspective of constructivism, Vygotsky (1978) considered as the founding father of social constructivism,

focused on the social element of constructivism. He proposed the role of social interactions in shaping an individual's construction of knowledge. Piaget (1952) looked at knowledge construction as an individual process, where individuals internally build their schemata based on interaction with the environment and respond accordingly via assimilation or accommodation. While Vygotsky (1978) still subscribed to the same basic principle of knowledge construction, he believed that social interaction also played an important role in the construction of knowledge for individuals. In such setting, each individual collaboratively constructs knowledge for one another, resulting in shared artefacts with shared meaning (D' Angelo, Touchman & Clark, 2009; McLeod, 2014; Powell & Kalina, 2009)

Vygotsky (1978) stated that for learning to occur, an individual (especially a child) would first make contact with his or her social surrounding on an interpersonal level. Upon establishing this contact, the new experience is internalised to make connection with existing schemata, thus constructing new knowledge. This is especially relevant in a classroom where learners construct knowledge by interacting with their surrounding (other learners, instructors) rather than learning occurring in isolation. This again plays an important role in resolving any cognitive conflict that is internally experienced by an individual during the process of knowledge construction (D' Angelo, Touchman & Clark, 2009).

While Vygotsky's social constructivism does not refer to stages, as Piaget's theory of cognitive development does, it is still a concept that has been widely

accepted and found significant relevance in teaching and learning. It is also an element that becomes crucial for the framework of this study and will be discussed in the following sections.

2.6.1.4 Social constructivism and metacognition

In relation to this study, the social constructivism forms the basis of the whole study. The premise is to look at how pre-service teacher trainees being in an online social environment can develop the metacognitive strategies to better handle technology for teaching and learning. Constructivism is closely related to metacognition as both share similarities in concept. Brown's components of metacognitions (knowledge of cognition and regulation of cognition) and Vygotsky's social constructivism approach both aim and strategise for several similar aspects of learning. Example of these are self-regulation, collaborative learning and problem-based learning. From the virtual or online perspective, these shared aspects of learning are the online pedagogical influences provided by both theories, where learners construct and become aware of their own knowledge.

Bay, Bagceci and Cetin (2012) also stated that every individual today should possess two basic skills, which are problem solving and metacognitive awareness. These two skills can be nurtured or improved effectively through authentic task-based social constructivist learning environments (Bay, Bagceci & Cetin, 2012). These types of learning allow the instructor to monitor the learners' learning process through various methods. These methods include interviews, journaling and group discussions. These methods can be

approached both offline as well as online. Learners in turn gain benefits from these methods when they develop the metacognitive learning skills and research skills that can be utilised to further enhance their future educational experiences (D' Angelo, Touchman & Clark, 2009).

Individuals can utilise the methods stated above to assist their learning development individually (intrapersonal) as well as between their peers in the same group (interpersonal). This is true to the concept of both cognitive constructivism and social constructivism by Piaget and Vygotsky. According to Chan (2012), any individual participating socially in a team for regulating their learning has the potential of achieving better learning outcomes. This provides more evidence that social constructivism can assist in improving an individual's metacognitive strategies.

In relation to e-space environment, Talamo and Ligorio (2000) discussed the social influence of online virtual interactions in shaping a learner's identity. They proposed that this element promotes the metacognitive awareness of knowledge and regulation. In extension, a carefully planned, designed, developed and implemented online learning module based on the social constructivism learning theory can help learners achieve both the characteristics of social constructivism and metacognition (Sthapornnanon, Sakulbumrungsil, Theeraroungchaisri, & Watcharadamrongkun, 2009).

E-space learning environment provides learners with technologically supported learning platform and according to Chan (2012), this approach provides more

supports for learners in terms of regulation process (metacognition) in more ways when compared to traditional instruction. Supporting learning with technology enables learners as well as instructors to better facilitate shared understanding for co-regulation between members of any subscribed e-space learning platform (Chan, 2012; Lajoile & Lu, 2012).

Sultan, Wood and Koo (2011) stated that learners believed that they have more opportunity to think critically and adopt more meaningful learning strategies when they are situated in a constructivist-oriented learning environment such as provided by e-space platforms. Relationship between social constructivism and metacognition is evidence in other studies that discussed about the significant of interaction and its positive correlation with achievement when participating in e-space environment. This provides opportunity for learners to regulate, monitor and reflect on their learning performance, both individually and collectively (Chan, 2012; McGhee & Meyinsse, 2010).

Several studies conducted in Malaysia supported the positive impacts of constructivism teaching and learning through the use of e-space or digital environment. These show that the concept of constructivism is effective in providing a theoretical basis for utilising the tools provided by e-space learning platform and this is especially true for social constructivism. In fact, a constructivist learning environment can have positive effects for both individual and social knowledge construction, as well as helps create an innovative teaching and learning environment (Hamat & Amin-Embi, 2010; Neo & Neo, 2010; Sultan, Wood & Koo, 2011)

Thus, as this study involves an e-space or virtual learning environment and focuses on the trainees' interactions as a virtual community, I see social constructivism as an apporiate theoretical basis in utilising the e-space tools to scaffold the development of metacognitive strategies among the subjects.

2.6.2 Zone of proximal development

Following his social constructivism learning theory, Vygotsky (1978) proposed the concept of Zone of Proximal Development. Famously known as ZPD, he defined the zone of proximal development as "the distance between the actual developmental level as determined by independent 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, p. 86).

In line with his previously discussed theory of social constructivism, the zone of proximal development puts peer interaction as an effective way for learners to develop their skills and strategies. Vygotsky suggested that teachers use cooperative learning exercises to help less competent children develop by receiving guidance from more skilful peers (Figure 2.3).

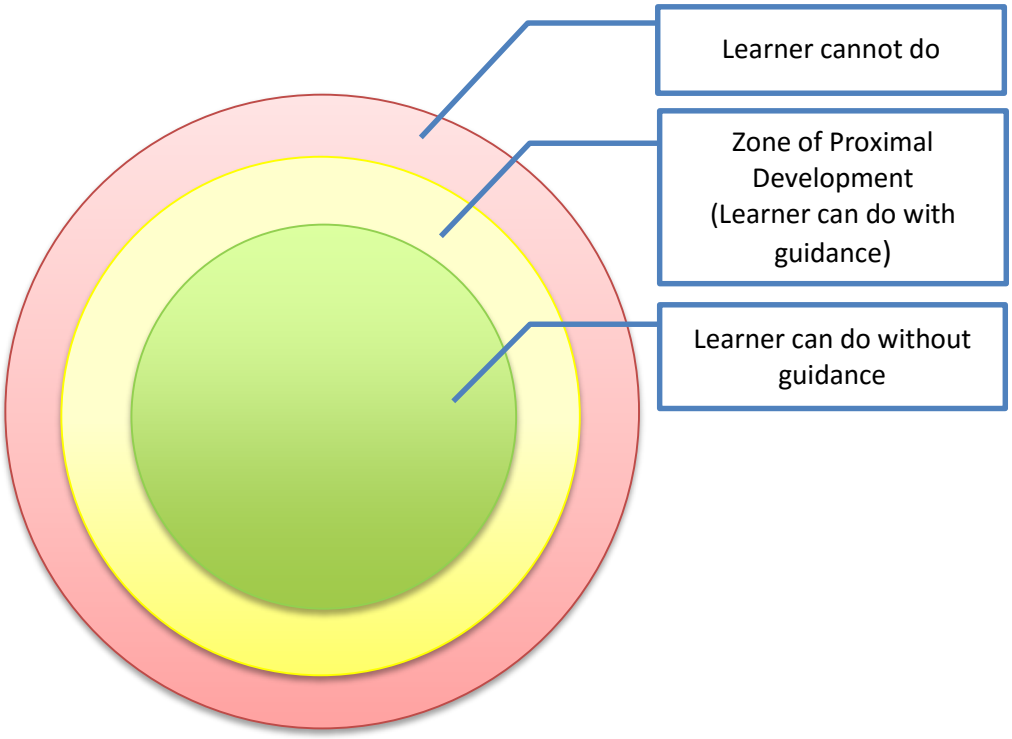


Figure 2.3: Zone of Proximal Development

Vygotsky (1978) added that such interaction that occurs within this zone provides the scaffoldings that shape learners' ability to achieve a particular task. As illustrated in Figure 2.3 above, instead of just working individually in trying to solve a problem (things they cannot do), a learner gets help from their peers or instructors the problem (they can do with guidance). Subsequently, successful solving the problem will add new knowledge to the learner (they can do without guidance) and in turn will enable them to help other peers who still cannot solve the problem. This is in line with Vygotsky's concept of social constructivism where it takes the social aspect of learning into consideration in order for it to work successfully for a learner's development (Shabani, Khatib & Ebani, 2010).

Shabani, Khatib and Ebani (2010) also suggested that anything that a learner perform collaboratively or with guidance (either from peers or instructors), will be performed independently afterwards. This is supporting Vygotsky's (1978) notion that creating a zone of proximal development helps to define the learner's immediate, future learning. He state that any methods used to help each other between individuals (interpersonal) would then be internalised by the learner and used individually (intrapersonal).

The ZPD approach also leads to another similar concept used concurrently when describing Vygotsky's social constructivism and related concepts. Scaffolding, another term used to describe the same concept was introduced by Wood, Bruner and Ross (1976, pg. 90) who defined it as "those elements of the task that are initially beyond the learner's capacity, thus permitting him to concentrate upon and complete only those elements that are within his range of competence". It is argued that once the learner successfully masters the task as guided by the scaffolding, it can then be removed and the learner will be able to independently complete the same task again.

Similar to ZPD, scaffolding also utilised the same requirement for social element in order for a learner to be successfully guided in solving problems. As observed by Awbi, Whalley and Philpott (2015), learners who receive appropriate scaffolding will be able to extend their ZPD and in turn assist their learning development. In literature, both terms have been used interchangeably to refer to the concept as proposed by Vygotsky (1978).

The findings above suggest that the concept of ZPD can be utilised as an effective tool in improving teaching practice, particularly for pre-service teachers. In this study, the pre-service teacher trainees are grouped together in an e-space environment through the learning management system, Moodle. During their interactions within the e-space environment (where the topic of discussion will be their course on learning technologies in teaching and learning), each member of the group will bring with them their pre-existing knowledge in contemporary learning technologies and possibly discover new ones from other group members.

Along the course of a semester, spending their time in this e-space environment, it is hypothesised that the peer interactions will allow each of the trainees' zone of proximal development to cross path and provide the scaffolding needed for better ICT competency in contemporary learning technologies. It is hoped that this occurrence, having received assistance from their peers, might be able to improve their existing knowledge level of learning technologies and develop the necessary metacognitive strategies required to sufficiently make them self-regulating and self-sustaining learners.

2.6.3 Communities of Practice

Communities of Practice, or CoPs, is another theory that can be associated with the study's approach of grouping the pre-service teacher trainees in an e-space environment in order to develop metacognitive strategies towards contemporary learning technologies. Communities of Practice (from now on will be referred to as CoPs throughout the study), as well as the parallel concept Virtual

Communities of Practice (also from now on will be referred to as VCoPs throughout the study), are the frameworks that underpin the e-space community aspect of this study. These two frameworks also share some similarities with the previously discussed learning theories (social constructivism, ZPD and scaffolding).

2.6.3.1 Definitions of Communities of Practice

The term "Communities of Practice" (CoPs) was first coined by Lave and Wenger in their 1991 book *Situated Learning* and Wenger has expanded and redefined the term his later works. Lave and Wenger (1991) first described the concept of CoPs as "…a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice". According to this description, newcomers of a community learn from old timers who allowed the former to participate in certain tasks specific to the practice of the community. Over time, the newcomers progress from being just peripheral to fully participating in the community.

Based on Lave and Wenger's work, there were also other attempts at defining what communities of practice are. Manville and Foote (1996) defined the term as: "…a group of professionals informally bound to one another through exposure to a common class of problems, common pursuit of solutions, and thereby themselves embodying a store of knowledge" (as cited in Hildreth, Kimble & Wright, 2000). Brown and Gray (1998) provided further definition of the term as:

> At the simplest level, they are a small group of people … who've worked together over a period of time. Not a team, not a task force, not necessarily an authorised or identified group … They are peers in the execution of "real work". What holds them together is a common sense of purposes and a real need to know what each other knows (as cited in Hildreth, Kimble & Wright, 2000).

Wenger, McDermott and Snyder (2002) later redefined the concept of CoPs as "Groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis". However, current and widely referred definition of CoPs is in accordance to Wenger's updated version, which is "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (Wenger, 2006).

2.6.3.2 Characteristics of Communities of Practice

Wenger (2006) argued that not every community can be automatically categorised as a CoP. Being in a neighbourhood, even though termed as a community, does not necessarily make the neighbourhood a CoP. Wenger explained that a CoP is only formed when a group of people shares the same domain of interest, engages in collective sharing of thoughts and information within a community as well as a shared practice of their expertise and knowledge. Within the community, these characteristics contribute to each member's knowledge enhancement and management. For further elaboration

this discussion, Wenger proposed that these three important characteristics must be met in order for a CoP to exist. These can be categorised into (1) the domain, (2) the community and (3) the practice.

The domain characteristic refers to the shared domain of interest between the members of the community that distinguished them from other people. Members of the community submit to a commitment to the domain that in turn defined an identity that is unique to the domain. These commitments do not necessarily require recognitions from others outside of their community but are usually valued from within the membership. A youth gang is an example of a CoP where the members subscribed to the same domain of interest recognition only from within and not necessarily by outsiders.

Wenger's second characteristic of CoP, *the community*, looks at interactions between members once they have shared a common domain of interest. In order to further build the relationship where members can learn from each other, they engage in collaborative activities and discussion, assist one another and exchange information. Without these interactions, a group that share common interest will not be a CoP until they interact. A group of high school students, though they share a common interest or goal, will only be a CoP once the students interact. A non-governmental organisation (NGO) that work together out of common interest can be referred to as a CoP even though the members do not meet as often.

The last characteristic of a CoP, according to Wenger, is *the practice*. Once the earlier two characteristics have been meet, a community can only be categorised as a CoP if a shared practice occurs between the members. This practice takes time and requires sustained interactions. During these interactions, members of the CoP may, either with more or less self-conscious, developed a shared repertoire of resources. These can be in the forms of experiences, stories, tools, skills, as well as ways to deal with problems coming from their shared domain of interest. Wenger gave an example of nurses who might only meet during lunch in the café of their hospital but would take the time during lunch to discuss on how to better care for their patients. Without them realising it, these lunch discussions have become their main source of knowledge sharing and created a shared repertoire for their practice. Wenger (2006) asserted that a community can only be categorised as a CoP once all three of the above discussed characteristics have been fulfilled.

In simpler definitions, a CoP represents where the members of similar group together (domain), who the members are in terms of shared interest through interactivity (community) and what they do together based on their shared interest within the community (practice).

2.6.3.3 Effects of Communities of Practice in education

Wenger and many other researchers have also looked at the application of the concept in many relevant areas including education. Wenger (2006, pg. 5) asserts that the concept of communities practice affects education along three dimensions:

a. *Internally*: this dimension looks at how learners' educational experiences can be shaped within school's practice through their involvement in CoPs.
b. *Externally*: the second dimension looks at linking learners' experience to actual practice beyond the school's environment via CoPs.
c. *Over the lifetime of learners*: the last dimension looks at the prospect of a lifelong learning for students by extending learners' involvement in the CoPs even after they leave school.

Brown and Duguid (2000, pg. 127) supported this concept by stating, "Practice is an effective teacher and the community of practice an ideal learning environment". They further stated that practice both shapes and supports learning.

Given the social element of the CoPs, it is in accordance with Vygotsky's concepts of social constructivism and the zone of proximal development (ZPD). All three approaches share the same notion of the social interactions' contributions towards an individual's cognitive development (Vygotsky, 1978; Wenger, 1991, 1998; Wenger et al, 2002). The notion looks at how an individual develops and manages their knowledge by being involved in a community or a group, whereby they contribute what knowledge they already possess and receive what they do not possess in return. The process thus forms a continuous circle of learning within a particular community.

Being in a community of practice is also about "knowing how to be in practice", rather than "knowing about practice" (Brown & Duguid, 2002). This statement explains the metacognitive aspect of knowledge where an individual is aware of what they know and how they know (Flavell, 1979). A member of CoPs can only contribute to the community by knowing how to contribute their existing knowledge as well as knowing what they do not already know. This cognitive awareness is the factor that makes the learning interactions within the community an effective one. This is in accordance with the concept of metacognition (as first discussed by Flavell in 1975) and the same concept that forms one of the core themes of this thesis.

2.6.3.4 Virtual Communities of Practice

Virtual Communities of Practice (VCoP) is an extension of the Communities of Practice (CoP) framework. Also known as the Online Communities of Practice (OCoP), it helps guide the study's approach towards the e-space community used for this research. Rheingold (1993) defined virtual communities as "social aggregations that emerge from the Net when enough people carry on public discussions long enough with sufficient human feeling, to form webs of personal relationships in cyberspace" and Wenger (2006), defined communities of practice as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly."

Both virtual communities (VCs) and communities in practice (CoPs) share a parallel concept. While not every VC is necessarily, a community of practice and not every CoP is a virtual community, when combined it forms a

community with a unique relationship where positive traits of either communities are shared. Rheingold's use of the Net in his definition of is the added value of an e-space community to the parallel concept that both definitions shared. This is further supported by Zimitat (2007) and Fredskild (2008) in each other's approach on online learning communities.

Gannon-Leary and Fontainha (2007) defined VCoPs as "network of individuals who share a domain of interest about which they communicate online". Describing the same concept of Wenger's CoPs, they added an online domain to practitioners who communicate and share resources such as experiences, problems and solutions, tools and methodologies.

It is in my opinion that the VCoPs describes the members of a community (including teachers) more as guiding agents than teaching agents. Lave & Wenger (1991) describes the process undergone by a member of VCoPs as "becoming a full participant on a sociocultural practice", where more experienced members of the community pass on to neophytes the knowledge and skills they possess and, as a result, this increases the shared expertise of the community members (Gannon-Leary & Fontainha, 2007). This idea is also in line with the previously discussed concept of the Zone of Proximal Development (ZPD) as proposed by Vygotsky.

Both the combined terms of Rheingold's Virtual communities and Wenger's Communities of Practice are used in this study as a single term Virtual communities of Practice or VCoPs. This is to signify a community or

communities that share a parallel interest in what they do and learn how to do it better by their regular interactions within a virtual or an e-space environment. In the context of this study, the community would be a cohort consisting of the pre-service teacher trainees, who not only share similar traits by undergoing the same teacher-training programme in general, but also specifically share the same learning goals enrolling in the learning technologies course that is used for this study. The online or e-space element is then injected into the community by requiring the trainees to interact within Moodle as the e-space application chosen for this study.

Han and Hill (2006) proposed that a VCoP is comprised of three separate concepts: a) collaboration, referring to a social process of learning, b) communication, a tool for generating learning, and c) learning, representing collective intelligence. Based on these concepts and supported by related literature, several elements are proposed for the VCoP utilised in this study's e-space platform to observe the development of metacognitive strategies towards ICT competencies among the participants. These elements are: 1) Synchronous and asynchronous communication, 2) Synchronous and asynchronous learning, 3) Collaborative learning, 4) Collaborative knowledge construction, and (5) Learner centred interaction. These elements share common traits as explained by Wenger (2006) when describing CoPs as groups of people who do something of similar interest collaboratively and learn how to do it better through continuous interaction.

Formation of a VCoP through e-space allows members of the community to communicate both synchronously and asynchronously. Asynchronously, where members communicate at different times (email, forum or discussion board) is an aspect available through e-space platforms (Eryilmaz, van der Pol, Gannon-Leary & Fontainha, 2007; Ryan, Clark & Mary, 2013; Kennedy, 2009; Phelp, 2007). Other than for communicative purposes, the synchronous and asynchronous aspects also can be extended to learning. In contrast to traditional, face to face learning, VCoPs allows member to learn both synchronously and asynchronously. Surpassing the geographical location of individuals, this aspect allows learning to occur regardless of where each individual is situated. This creates a very flexible learning approach for learners who favours learning at their own time and also encourage knowledge sharing among members of the community (Sife, Lwoga & Sanga, 2007; Tucker, 2010).

Collaborative learning and knowledge construction are another aspects of VCoPs that are deemed important in the formation of e-space environment for this study. These two aspects has the theoretical basis from constructivism that can lead to the utilisation of the member's ZPD within the e-space environment. By collaborating, members are able to help each other in achieving the desired goals of the lesson. This can also help scaffold the members' development of their metacognitive strategies in learning (Kramarski & Michalsky, 2008; Pifarre & Cobos, 2010).

The final aspect that is deemed crucial for the formation of e-space environment for this study is learner centred interaction. Learner centred here refers to the

nature of interactions between the participants and the e-space environment. According to Laghos (2010), the collaborative aspects of a virtual community can help foster interdependence among members as well as create engagement, autonomy and independence for individuals. This will promote less dependency towards instructors in dealing with problems in their learning. This aspect goes back to the concept of ZPD as proposed by Vygotsky (1978), where individuals increase their ZPD by first internalising received knowledge and contribute the newly constructed knowledge back to those in their community. It becomes a continuous circular process that helps both the individual and community construct knowledge collaboratively.

2.7 Issues arising with e-space environment, ZPD and metacognition

The use of ZPD mediated e-space environment in developing metacognition is not without its issues. Not all studies conducted resulted in positive outcomes. Regulating one's own learning through e-space environment that includes hypermedia involves a complicated cycle of temporally unfolding cognitive and metacognitive processes that influences student learning (Azevedo, Moos, Johnson, & Chauncey, 2010).

ZPD is an interesting concept with lots of potential for designing instruction and analysing learning. However, putting the concept into practice can be a real challenge despite present research highlighting procedure of implementation (Shabani, Khatib and Ebadi, 2010). Implementation also does not guarantee effectiveness in achieving the desired outcome of ZPD. Freeman (2010) stated that one of the issues that could hinder the achievement of ZPD is insufficient

opportunities for members of any given communities in an environment to interact between one another. This could be a potential threat for this study, of which ZPD forms the theoretical basis for developing the metacognitive strategies among the pre-service teacher trainees in an e-space environment.

In order for ZPD to be most effective in e-space, the platform used for teaching and learning must possess the right tools to promote constructivism and bring ZPD into effect. This is an issue that still need to be further researched thoroughly. Elliot (2009) reported negative outcome when looking at maximising the potential of current technologies when teacher trainers and trainees are online. Failure in doing this will put a barrier in promoting ZPD in an e-space environment thus removing the constructive scaffolding towards developing metacognitive strategies from its intended purpose.

The right tools in an e-space platform are crucial in ensuring constructive interaction for ZPD. Mello and Gobara (2013) raised several issues relating to ZPD and interactions in an e-space environment. They questioned the effectiveness of ZPD in such environment when interactions occur in different ways from what the researchers intended. Learners could have individually solved tasks intended for collaboration with peers (in order to provoke interaction to promote ZPD). Different groups also could interact differently when they are required to participate in an e-space environment (Mello & Gobara, 2013). These issues posse challenges, not just to instructors, but also to the learners in creating a constructive environment in e-space.

A lot of institutions today are using a dedicated or custom-made e-space environment such as LMS or Moodle as a medium to enhance teaching and learning. Users now are getting wider and more flexible selections of tools that can be used to design effective and meaningful learning. These increasingly integrated tools include Web 2.0 and social software tools (blogs and wikis), as well as better assessment features (peer review functionality, electronic portfolios and grading rubrics) (Alexander, 2006; Maloney, 2007; Baltaci-Goktalay & Ozdilek, 2010). While studies have proven that this approach can help foster metacognition or self-regulation learning for learners (Chittleborough, Jobling, Hubber, & Calnin, 2008; Dunlap & Lowenthal, 2011), the rapid emergence of new learning technologies is constantly challenging today's teaching and learning (King, 2011).

Academic institutions are now faced with challenges in keeping up with the latest trend in learning technologies in meeting learners' demands for more engaging learning experiences and instant access to information (The Horizon Report, 2007). Bates, Coleman and Many (2006) also reported on issues that involves ICT competencies in utilising the technology used as the platform to promote ZPD in teaching and learning. On top of that, today's internet connected technologies allow learners to establish networks of friends and resources by generating their own content using social media and collaborating through social and professional networking sites such as Facebook and LinkedIn (Alexander, 2006).

The above can be associated with a study conducted by Weaver (2012) on the effects of metacognitive awareness, strategies and satisfaction in an undergraduate online education course towards leaners' academic achievement. The finding revealed no statistically significant difference for learners' academic achievement in the metacognitive strategies group when compared to the control group. The same study also showed the similar statistical finding in trying to determine that the metacognitive awareness of learners in the metacognitive strategies group will be higher than those in the control group.

Anderton (2006) investigated a similar concept using the term self-regulated learning. Using an online course, the study looks at promoting self-regulated learning through the application of metacognitive strategies among a group of pre-service teachers. The study hypothesized that the use of metacognitive strategies helps to promote self-regulated learning as well as increases their achievement at the end of the course. While the findings did show a significant impact on the application of metacognitive strategies in developing self-regulated learning skills of the pre-service teachers who are taking the online course, students' achievement did not really improve when compared to students who did not develop self-regulating skills. The study indicates that while being in an online environment did help in promoting self-regulated learning, it has no significant impact on the achievement of the students. .

A study by Brown and Liedholm (2002) also demonstrated similar conclusion. They studied 710 learners in a comparative study and found that the learners in traditional classes spent 3 hours a week in class while the learners in an

online course spent less than 3 hours a week on the course. As a result, learners in the online course performed significantly lower on tests than learners in the traditional classroom. Learners in the online course may not have possessed the metacognitive knowledge that allowed them to monitor and evaluate their learning properly.

The above studies illustrate some of the challenges faced by educators in gaining learners' attention, facilitating strategic learning, and sustaining student motivation to learn. In order to do all those, they must not only keep up with new technologies but also learn how to deliberately use them to support learners' development of metacognitive awareness and strategies that will allow them to self-regulate their learning within a constructive environment. Following the current trend of technologies in general, as well as learning technologies specifically, a dedicated and custom-made e-space platform might not be enough to foster the development of metacognition in learners. Issues related to ZPD in creating a constructive environment must first be sorted out before a ZPD mediated e-space platform can be used to effectively develop users' metacognitive strategies towards ICT competencies.

2.8 Research framework

My study focuses on the development of pre-service teacher trainees' metacognitive strategies in learning technologies and is primarily based on Brown's (1987) model of metacognition, particularly focusing on the Regulation of Cognition component. In Brown's model of metacognition, the Regulation of Cognition component categorised these strategies as (1) Planning,

(2) Monitoring and (3) Evaluating. This is illustrated in figure 2.4 below and will be further elaborated in detail in subsequent sections:

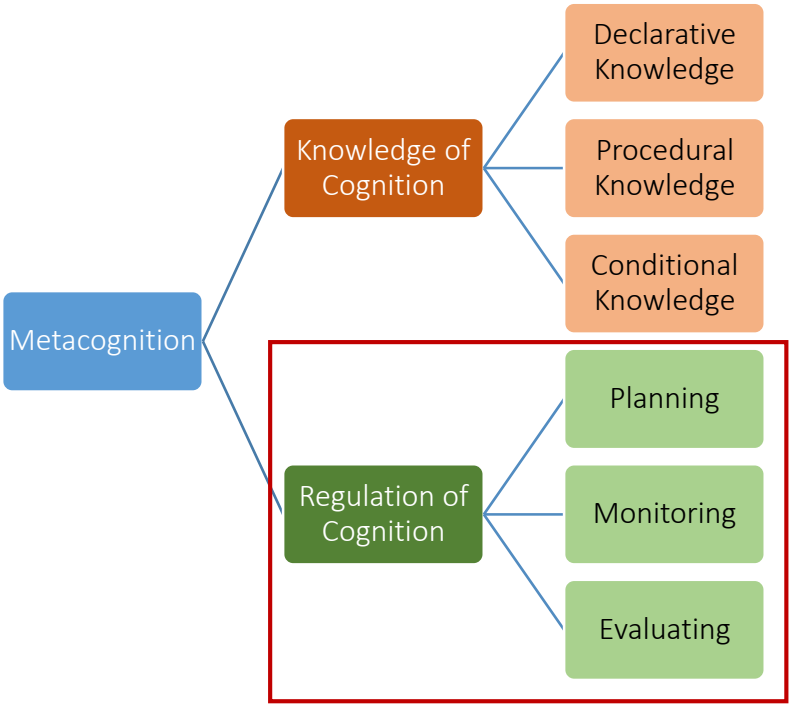


Figure 2.4: Focus of the study

For the purpose of this study, the pre-service teacher trainees are grouped in an e-space environment in order to explore the possibilities e-space in becoming the platform for developing the trainees' metacognitive strategies towards learning technologies. The environment also take into consideration of the overall concept of social constructivism as described by Vygotsky. Any indication of metacognition strategies being developed through the use of e-space during the study will show that e-space has the potential to help the trainees to manage their own learning towards ICT competency in contemporary learning technologies. In essence, I am looking at the effect of e-space upon the pre-service teacher trainees' development of metacognitive strategies in utilising learning technologies.

2.9 Theoretical framework

Researchers commonly associate learning competency to theories such as Flavell's (1976) metacognition and Vygotsky's (1978) social constructivism. Flavell (1976) provided a model of cognitive monitoring that aims at metacognitive awareness while Vygotsky's (1978) Zone of Proximal Development (ZPD) provides the scaffolding that can help learners achieve such awareness. It has been established in studies that metacognitive strategies play a role in addressing the lack of competency in learning and social interactions among peers can help develop such strategies.

In this study, the focus is on developing the pre-service teacher trainees' metacognitive strategies to increase ICT competency in contemporary learning technologies. An e-space community will provide the social element or the ZPD for the development of metacognitive strategies. As such, it requires a theoretical framework that explains the factors involved in achieving the specified aim based on the characteristics discussed from the literature review. Researchers have used the combination of Wenger's (1991) Communities of Practice (CoP) and Rheingold's (1993) Virtual communities (VC) to denote Virtual communities of Practice (VCoP).

Sharing the same approach as Vygotsky's theory of social constructivism, this model provides the framework for the development of an e-space community for this study. Situating social interactions in a virtual setting provides the scaffolding for the pre-service teacher trainees to develop their metacognitive

strategies towards increasing their ICT competency in contemporary learning technologies. I am proposing that by actually being in an element where ICT-based learning technologies is the domain, the pre-service teacher trainees would gain benefits for their own knowledge and practice of ICT-based learning technologies. The theoretical framework for this study is further illustrated in the following figure 2.5:

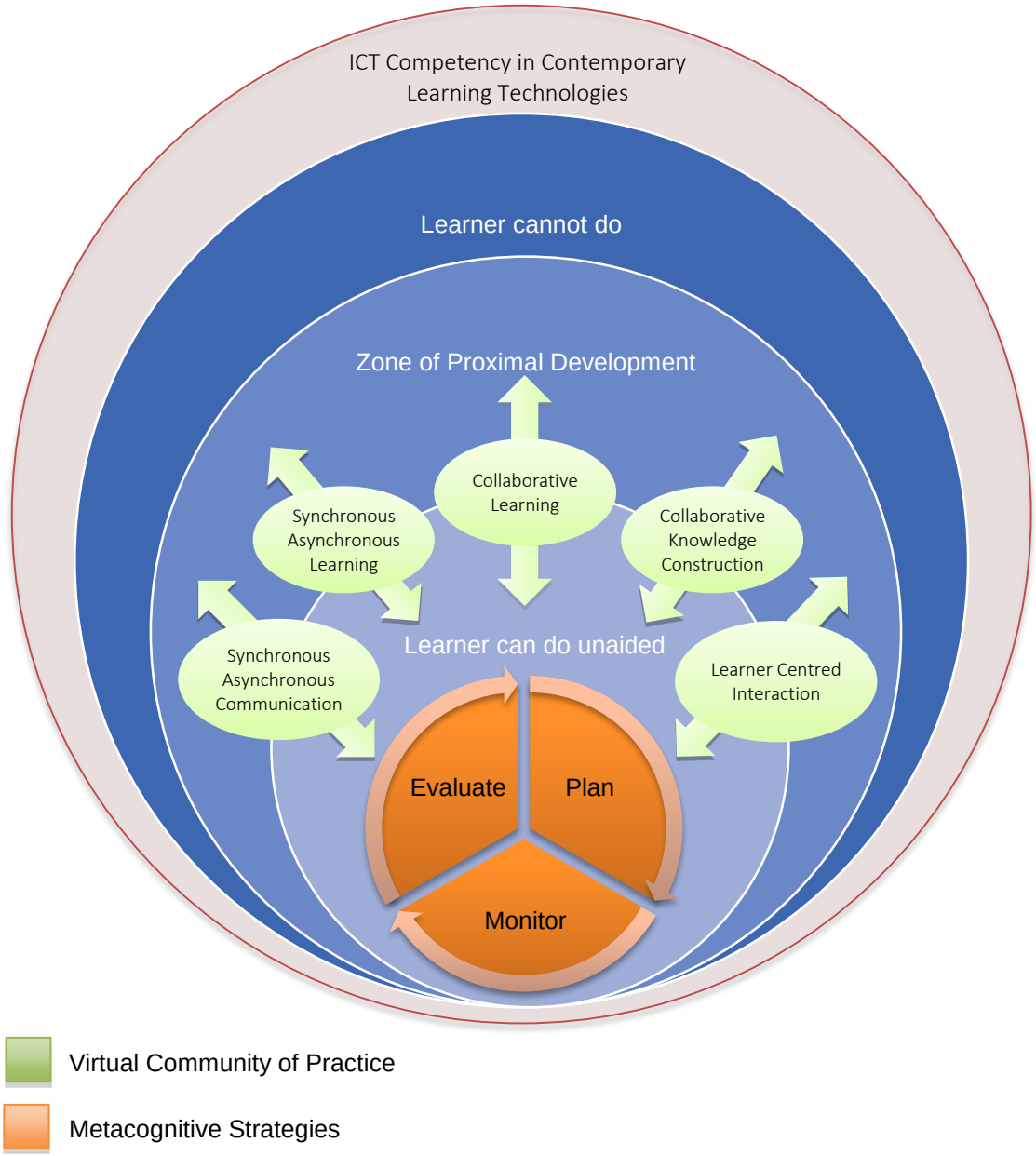


Figure 2.5: Theoretical Framework

2.10 Conceptual framework

For this study, I attempt to find out whether it is possible for pre-service teacher trainees to develop of metacognitive strategies in using learning technologies through an e-space community framework that in turn can help the trainees increase their ICT competency in contemporary learning technologies. Specifically, a group of third year pre-service teacher trainees of the International Islamic University Malaysia is selected to enrol in a learning technologies module. The major part of the module is conducted virtually through Moodle, a learning management system used by the university.

In order to see the possible development of metacognitive strategies upon being involved in an e-space community and how it can lead to the increase of the trainees' ICT competency in contemporary learning technologies, I have developed a conceptual framework that functions as a guideline for the study. The conceptual framework is built upon the combination of Wenger's (1991) CoP and Rheingold's (1993) VC or Virtual communities of Practice (as illustrated by Figure 2.2). The framework puts every pre-service teacher trainee as a learner represented in the form of Vygotsky's Zone of Proximal Development visual concept. The social interactions that occur in the e-space community (Moodle) are represented by elements of virtual communities of practice: 1) synchronous and asynchronous communication, 2) synchronous and asynchronous learning, 3) collaborative learning, 4) collaborative knowledge construction and 5) learner centred interaction. These elements are shown to intersect between the learner's zone of proximal development (what the learner can do aided) and what the learners can do unaided. An exchange of knowledge

occurs between the two areas as learner contribute the knowledge of what he or she already can do unaided to other members of the Moodle community and received in return what they can only do aided in their zone of proximal development. Hypothetically, these exchanges of knowledge will trigger their development of metacognitive strategies (situated in the area of what they can do unaided) and as a result increase their ICT competency in contemporary learning technologies. Figure 2.6 clarifies the theoretical framework discussed in the previous section:

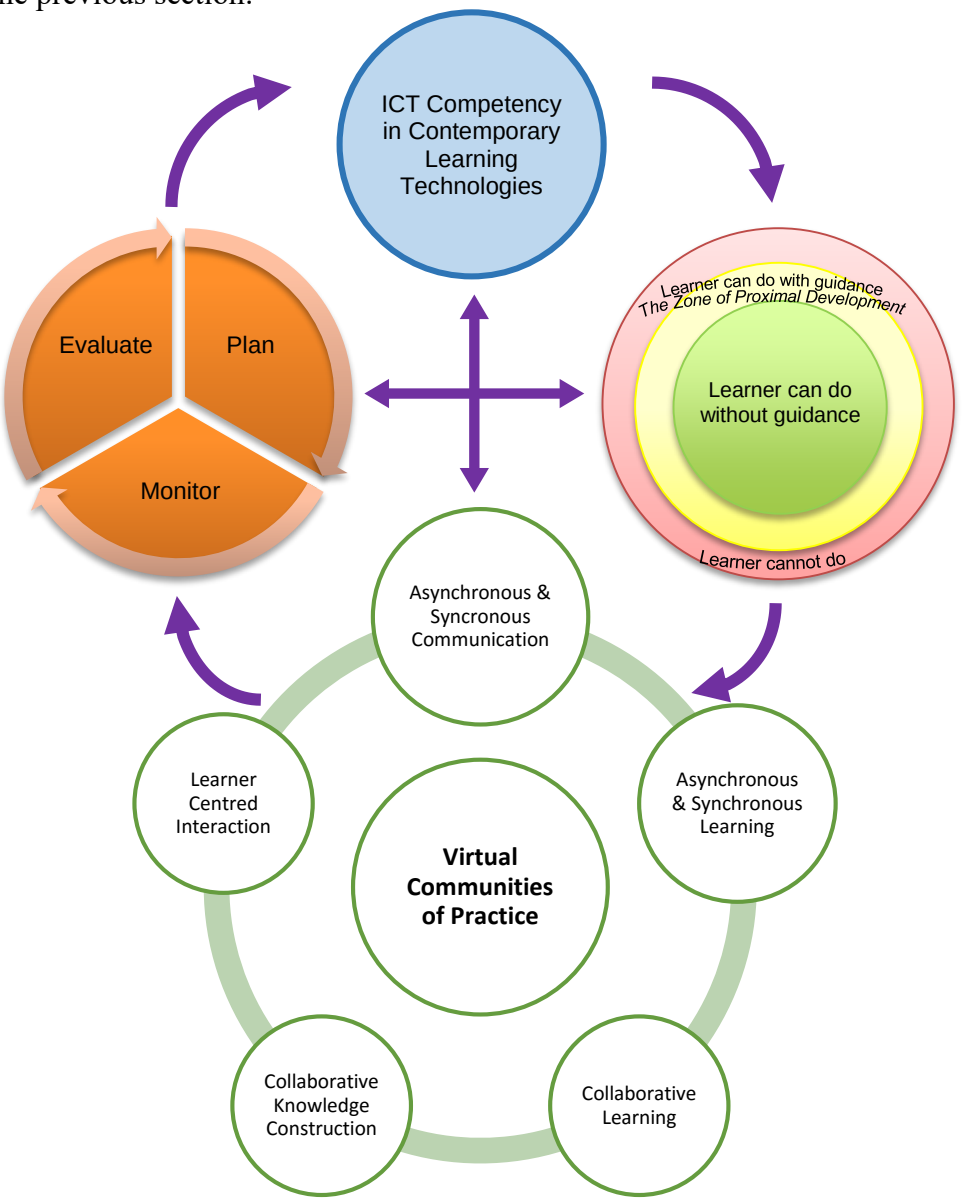


Figure 2.6: Conceptual Framework

2.11 Conclusion

In this chapter I have presented a review of literature focusing on several areas concerning the study. The review first look at the issues faced by pre-service teachers in regards to ICT competency in contemporary learning technologies. Studies reveals that there is a need for teachers to improve their ICT competency in facing the rapid advances of learning technologies today (Meyer et al 2011; Goktas 2009a; Guo 2008; Jorge 2012; Lee et al 2007; Lim & Chan 2007; Prensky, 2009) . The urgency for ICT competencies or digital literacy should start from the level of pre-service teacher trainees as this can prepare them for the future where learning technologies are expected to be more advance that they are today (Lim & Chan, 2007; Lee et al, 2007; The Horizon Report, 2010).

The current initiative by Malaysia's Ministry of Education to push technology enhanced teaching and learning to schools is also the drive that push this study. The Malaysia Education Blueprint 2013 – 2025 has laid out a foundation for the country's education heading towards the future. Teaching and learning technology is certainly one of the agenda in the blueprint and this creates the need to look at the current scenario for teachers' ICT competencies towards contemporary learning technologies in Malaysia. Findings suggest that despite acknowledging that teachers displayed positive attitude towards learning technologies and their usefulness in teaching, measures need to be taken in order to improve ICT competencies in Malaysia (Mohd Nordin, Amin-Embi & Abdul Wahab, 2011; Sa'ari, Luan & Roslan, 2005).

Studies suggest that being metacognitive approach towards learning technologies can be a good measure in improving ICT competencies among teachers (Gama, 2004; Phelps, Graham & Kerr, 2004; Phelps & Graham, 2008). Developing metacognitive strategies can help the pre-service teacher trainees not just for their learning but also in preparing for their future teaching involving learning technologies (Brown; 1979; Flavells, 1979; Gravill, Compeau & Marcolin, 2002; Lewis, 2006; Nat et al, 2011; Shannon, 2008; Wassilow, 2009).

Research also demonstrate that participating in a ZPD mediated e-space environment can assist in developing users' metacognitive strategies in utilising contemporary learning technologies. A constructive VCoP forms a strong theoretical basis for an e-space platform to help a learner learn better (Gannon-Leary & Fontainha, 2007; Rheingold, 1993; Wenger, 2006). It is believed that learners who learn in a VCoP are able to utilise the concept of ZPD in improving their metacognitive strategies towards better learning, individually as well as collaboratively. However, research looking specifically at developing pre-service teacher trainees' metacognitive strategies towards contemporary learning technologies through an e-space environment are still lacking and need to be addressed.

The challenge of the study is to observe whether the e-space environment for this study can have the same effects towards developing the trainees' metacognitive strategies towards learning technologies as compared to findings suggested by the literature review.

Chapter Three:Research design and methodology

3.0 Chapter overview

In the review of the literature, I have gone into details on the needs for teachers to be competence in ICT, especially the contemporary learning technologies. This chapter focuses on the research methodology used for this study in order to look at the potential development of the pre-service teacher trainees' metacognitive strategies upon their involvement in an e-space community. The discussion for this chapter will cover the decision and rational for the research method chosen for this study. The chapter will highlight the key points of the research design and the methodology used to gather the data for this study and how it is analysed. The chapter ends with a brief summary of the whole research design and methodology.

3.1 Purpose of study

The rapid development of learning technologies is making a big impact towards teaching and learning. Teachers especially need to prepare themselves for the future of education where technologies are playing a big role in making teaching and learning more engaging and effective. Literature have proven that having and using metacognitive strategies carry significant impact on ICT competency. It is crucial for the current pre-service teacher trainees to develop and use the right strategies in facing the technological integrated future of education. The primary intent of this study is to investigate the current state of metacognitive strategies awareness among pre-service teacher trainees in using learning technologies as well as to what extent can e-space applications be used to

develop pre-service teacher trainees' metacognitive strategies in using learning technologies. . The objective will be to explore the current state of metacognitive strategies awareness among pre-service teacher trainees in using learning technologies and to what extent can contemporary learning technologies be used as a way to help students plan their learning goals, monitor their own learning processes, and evaluate their learning progress. .

The research design of the study will be an explanatory sequential mixed methods design. The procedure involves collecting quantitative data first followed by an in-depth qualitative data. In the first phase of the study, a survey data will be collected from a group of pre-service teacher trainees at a local university to explore their current state of metacognitive strategies awareness in using learning technologies. In the second phase, qualitative semi-structured interviews will be used as a follow up to the quantitative results by exploring how e-space applications can be used in developing the pre-service teacher trainees' metacognitive strategies in using learning technologies. (Creswell & Plano Clark, 2011). In order to seek answers, the following research questions are proposed:

1. What is the current state of metacognitive strategies awareness among pre-service teacher trainees in using learning technologies?
2. To what extent can e-space applications be used to develop pre-service teacher trainees' metacognitive strategies in using learning technologies?

This study involved a cohort of 38 pre-service teacher trainees who utilised the International Islamic University Malaysia's learning management system called

iTa'LeEM. This chapter explains the design, methodology, analysis plan, and scope and limitations that are involved in this study.

3.2 iTa'LeEM – the e-space community platform

As briefly mentioned in chapter one, the subjects of this study revolved around an e-space community framework and the possibilities of it developing the pre-service teacher trainees' metacognitive strategies towards learning technologies. In order to explore the use of an e-space community or an online environment by the trainees, I have decided to utilise the existing learning management system used in the International Islamic University Malaysia.

The current learning management system offered by the university is part of the blended learning approach solutions for instructors and learners. My study explores a group of the third year pre-service teacher trainees of the International Islamic University Malaysia who participate in an online course created using Moodle, an open sourced Course Management System (CMS). Moodle, community-based learning tools for learning, is also known as a Learning Management System (LMS) as well as a Virtual Learning Environment (VLE). For this study, one introductory course (EDT 1301 – Information Technology in Teaching and Learning) is selected due to the integration of the course with Moodle platform. Taking a blended learning approach, the participants will go through the course for one semester through both offline and online teaching and learning. Moodle is used in this study as the virtual community of practice (VCoP) for the pre-service teacher trainees.

The Moodle platform offered for the university's community is customised and given a new branding entitled iTa'LeEM. It is an abbreviation of the term Innovative Teaching and Learning Environment that refers to the learning management system or the online learning environment for the academic staff and students of the Islamic University Malaysia. It was developed by the Centre for Professional Development of the university with the help of the Information Technology department. It replaces the former in-house developed learning management system that has become too costly for the university to manage and support. Using a customised open source Moodle platform, it provides a better tool that is web 2.0 compliance and has better supports for future customisations and consistence updates. Moodle, a community-based learning tools for learning, is an open sourced Course Management System (CMS) and is also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE). The platform is favoured for being more modern and up to date. It is being used by many academic institutions all around the world.

This customised Moodle platform (from now on will be referred to as iTa'LeEM throughout the study) provides features that are similar to the combinations of Facebook, Dropbox, YouTube and a lot more. For both staff and students, these features include, among others: (a) Assignment submission, (b) Discussion forum, (c) Files download, (d) Grading, (e) Instant messages, (f) Online calendar, (g) Online news and announcement, (h) Online quiz, (i) Wiki, and (j) Gamification. The availability of many third-party plugins enables developers to further extend the platform's functionalities.

In general, iTa'LeEM offers the academic staff and students of the university with tools to extend and enhance teaching and learning beyond the classrooms and lecture halls. This creates a perfect platform for the trainees to be in a virtual community of practice (VCoP) or e-space community for this study. This is where the trainees will practically use learning technologies within their communities and I will look at whether or not the activities that they do on iTa'LeEM lead to the development of their metacognitive strategies towards learning technologies.

The reason for the setting up of a virtual community of practice in this study is to place the trainees in a situation where they are in an actual practical use of learning technologies and not just learning about technologies for education theoretically. The virtual community of practice (VCoP) in this study refers to the e-space community that is formed on iTa'LeEM. The community has the potentials for providing and receiving instant feedback among the members. Theoretically, should they have any issues or problems with learning technologies, they can directly refer to any capable member of the community as well as provide their own advance knowledge should any member is seeking for help. This was already discussed at length in the conceptual framework of the study, referring to the Zone of Proximal Development proposed by Vygotsky (1978). He advocated the collaboration between an individual with more capable peers as one the factors that contribute to one's actual developmental level, separated by what they can achieve independently and what they can achieve with help from others (Vygotsky, 1978).

Approval for conducting the study was obtained from the dean of the faculty and permission was given by the instructor to use the selected module (this will be discussed in details later into the chapter). A group of pre-service teacher trainees who registered for the module were briefed on their participations in the semester-long study. The Participant Information Sheet (see Appendix A) and the Participant Consent Form (see Appendix B) were distributed to the trainees during the briefing.

It is to be noted that the iTa'LeEM was not used a hundred percent during the duration of the study. This was due to the requirement of the module and the rule of the university that no module can be administered 100% online. Any module using iTa'LeEM can only be conducted using a blended approach, mixing online together with offline meeting in classrooms. However, for the module chosen for this study, the online sessions using iTa'LeEM was given more priority and more hours as compared to the offline meetings.

Upon obtaining the participants' consent to the study, they were further briefed on how iTa'LeEM will be utilised during the course of the study. The blended approach of the module, with focus weighing towards the use of iTa'LeEM was clearly explained to the participants, detailing what they should expect from the module during the study. The explanations include how iTa'LeEM, an e-space community, is used as the medium to create the possibilities of metacognitive strategies development towards ICT competency in contemporary learning technologies.

For the blended approach of this study, the participants utilised seventy percent of the course on iTa'LeEM and only thirty percent face to face session. This approach was to ensure that the participants spend most of their time during the course on the e-space environment. For the first stage of the course, the sections on the iTa'LeEM course chosen for this study were divided into fourteen sections. This was according to the number of study weeks for each semester as decided by the university. The next stage was to upload all the relevant notes and documents to iTa'LeEM for the participants to view and download. All news and announcements for this course were also made through iTa'LeEM and participants were reminded to check iTa'LeEM from time to time.

Each section of the course contained topic as according to the breakdown of topics in the course outline and each was slightly different from the others. The consistent features for each section were the notes/documents and forum categories. For the notes/documents category, participants downloaded the relevant notes or documents prior to each week's class. As for each the forum category, a forum topic was initiated for the participants to discuss upon. This was either to have a follow up discussion of the respective week's lesson or to review previous week's lesson and each forum was graded to ensure maximum participation. Other activities conducted through iTa'LeEM included assignment submission, grading, online quiz as well as links to online multimedia resources (video or audio) and any educational tools used for the course. Participants were also encouraged to forward any enquires to the instructor through iTa'LeEM's messaging feature.

The thirty percent face to face session with the participants were reserved solely for discussing their overall progress of the course and to sort out any issues pertaining to the use of iTa'LeEM. They were instructed to solve any issue through iTa'LeEM first, either by forwarding it to the instructor or to other participants of the course. Face to face meeting outside of the class time was taken as a last resort should they fail to solve any problem through iTa'LeEM.

3.3 Rational for choosing mixed methods

In recent years, many researchers to choose mixed methods research designs for their study. Johnson and Onwuegbuzie (2004) pointed out the importance of mixed methods research designs in educational research. Greene, Caracelli and Graham (1989), Creswell (1994, 2003), Tashakkori and Teddlie (1998, 2003) and Creswell and Plano Clark (2011) are some of the most prominent proponents of mixed methods research. However, these researchers differ in their views of mixed methods research where some like Tashakkori and Teddlie (1998) consider mixed methods as a research methodology with philosophical assumptions, while others such as Greene, Caracelli and Graham (1989), Creswell (2003) and Creswell and Plano Clark (2011) focus on the methods used for the collection and analysis of data.

This research utilises a mixed methods approach based on several reasons. The decision is based on the framework proposed by Greene, Caracelli and Graham (1989), listing five broad reasons for choosing a mixed methods approach in research. The reasons are: (1) Triangulation, (2) Complementarity, (3)

Development, (4) Initiation and (5) Expansion. From this framework, two reasons fit the needs for this study by giving the following explanation:

a. Complementarity – seeking elaboration, enhancement, illustration and clarification of the results from one method with the results from the other method.
b. Expansion – seeking to extend the breadth and range of inquiry by using different methods for different inquiry components.

The two reasons compliment both the quantitative and qualitative approaches of this study where the researcher feels that the main qualitative data can be complemented and expanded by the secondary quantitative data.

Bryman (2006) further expanded Green, Caracelli and Graham's framework by providing elaborated and detailed descriptions of the broad reasons. Bryman listed and discussed sixteen reasons and four of the reasons fit the needs for a mixed methods approach chosen for this:

a. Completeness – to produce a more comprehensive outcome of the area of inquiry.
b. Different research questions – to help answer different research questions based on qualitative or quantitative nature of the questions.
c. Credibility – to enhance the integrity of findings by using both approaches.
d. Enhancement or building upon quantitative and qualitative findings – to enhance or augment either quantitative or qualitative findings by gathering data using either approaches.

The above reasons are reflected in Creswell and Plano Clark's (2011) discussion of mixed methods approach using an explanatory design. They stated the suitability of an explanatory design to answer different questions that require different types of data set as well as to enhance the quantitative data with a follow up of a qualitative data set. The explanatory design is suitable for the main purpose of this study, as the two research questions posed do not just complement one another but also require different types of data collection and analysis.

3.4 Research Design

My study uses an explanatory sequential mixed methods research design (Creswell & Plano Clark, 2011) that addresses the development of pre-service teacher trainees' metacognitive strategies towards ICT competency in contemporary learning technologies, through the use of an e-space community framework.

References for research design and methodology for my study are based on the approaches preferred by Creswell and Plano Clark (2011). An explanatory sequential design is used for this study, a sequential two- phase approach in which a research begins with a quantitative phase and is followed by a second qualitative phase (as represented in Diagram 3.1). For the purpose of my study, certain elements from other mixed methods design, namely embedded design, are also incorporated into my research design and methodology. These elements refers to situations in my study where a single data is insufficient, different questions need to be answered, and each type of questions requires

different types of data. Researchers also opt for an explanatory sequential mixed methods design when they need qualitative data to explain quantitative significant (or nonsignificant) results. (Creswell & Plano Clark, 2011).

For the study, quantitative data is used to assess the awareness of pre-service teacher trainees in using metacognitive strategies towards enhancing ICT competency in contemporary learning technologies. For this part of the study, it employs a repeated measures design, in series of three surveys assessing the awareness of using metacognitive strategies: 1) planning, 2) monitoring, and 3) evaluating, in the utilisation of contemporary learning technologies. These are conducted as pre, mid and post surveys during the course of the module taken by the trainees.

Upon the administrations of the three surveys, I selected a number of the pre-service teacher trainees to be interviewed. This qualitative data collection method is used to explore whether participations in an e-space community, such as iTa'LeEM, has the potential to influence the development of metacognitive strategies among the same pre-service teacher trainees at the Institute of Education of the International Islamic University Malaysia.

This mixed methods approach, where the qualitative data (interviews) follows the results of the quantitative data collections, is used to enhance the quantitative data that represents the voices of the participants. The collection of the quantitative data is conducted before, during and after the implementation of e-space environment for the study and is followed by interview sessions.

More specifically, I employed an explanatory mixed methods research design to answer the research questions of this study. The decision for choosing the explanatory design for this study served three purposes: (1) To explain the initial quantitative results using the quantitative results, (2) to answer different types of research questions, thus requiring different types of data for each question and (3) to enhance the quantitative results using the qualitative data.

The overall purpose of an explanatory mixed methods design refers to an approach of using a qualitative strand to explain initial quantitative results (Creswell, Plano Clark, et al., 2003). This approach guided me in preparing for my qualitative phase of the study by referring to the quantitative findings. For the purpose of my study, I also incorporated several elements from other mixed methods design. An embedded mixed method design is an approach that requires different answer to different questions and that each type of question requires different types of data (Creswell & Plano Clark, 2011). I used this element as my study also required different types of data to answer the different research as well as the use of a mixed methods approach helped to enhance the quantitative data by using the quantitative data set (Creswell & Plano Clark, 2011).

The overall premises of this design helps in my study's methodology where a single data set (in this case, quantitative) is not sufficient and need to be supported with a supportive, secondary data set (in this case, qualitative). This is in order to explain the initial quantitative result and also due to the research

questions of this study that require different answer and each type of question requires different types of data (Creswell & Plano Clark, 2011).

The study aims are thus addressed using the following data collection procedures specified: (a) Surveys administered using a repeated measure design to third year pre-service teacher trainees, which aim to describe and explore third year pre-service teacher trainees' metacognitive awareness towards learning technologies. Following the repeated measures design, the same survey is administered three times to the same subjects before, during and after the use of e-space platform, (b) Interviews with selected third year pre-service teacher trainees of the same cohort chosen for the quantitative data collection.

The explanatory design, which aims to use a qualitative component to follow a quantitative component, has been discussed at great length in research literature. Proponents of the explanatory design include Caracelli & Greene (1997), Greene et al (1989), Creswell, Plano Clark, et al (2003) and Creswell & Plano Clark (2011). The explanatory design is one of the most frequently used and well-recognised mixed methods design in research (Creswell & Plano Clark, 2011). Creswell and Plano Clark (2011) also stated that the explanatory design can be considered should the researcher wants to assess trends and relationships with quantitative data and at the same time be able to explain the reasons behind the resultant trends. The explanatory design is usually employed when the researcher wishes to explain the quantitative significant (or nonsignificant) results with a qualitative data (Creswell & Plano Clark, 2011).

According to Creswell & Plano Clark (2011), the most common type of explanatory sequential design found in the literature occurs when researchers utilised qualitative data collection as a follow up of the earlier conducted quantitative data collection. It is used to examine outcomes gathered through quantitative methods and processes by obtaining detailed views from participants through qualitative data (Creswell & Plano Clark, 2011). The above reason, as well as the second aspect (a feature adopted from the embedded design) where different questions require different types of data, are the reasons that influence my decision for choosing the explanatory mixed methods research design for this study.

The design uses a two-phase approach for the explanatory design and the quantitative and qualitative data are used to answer different research questions of the study (Creswell & Plano Clark, 2011). This is illustrated in Diagram 3.1 and the diagram also provides a general overview of the procedures for the implementation of the design for this study. These procedures include (1) Selecting the respondents of the survey, (2) Administering the survey at three different stages of the intervention; pre, mid and post, (3) Analysing the quantitative data of the study, (4) Conducting the qualitative data collection of the study following the outcomes of the primary quantitative survey, and (5) Presenting and discussing both findings, first to look at how the two data set answer the different research questions of the study and second is to look at how the secondary qualitative data set supports the primary quantitative data set.

The mixed methods explanatory sequential model of this study consists of two distinct phases: quantitative followed by qualitative (Creswell, Plano Clark, et al., 2003). In this design, I first collect and analyse the quantitative (numeric) data using a repeated measures design. The qualitative (text) data are then sequentially collected and analysed second and help compliment or explain the quantitative result obtained in the first phase. The second, qualitative, phase supports the first, quantitative, phase and both also answer the different research questions of this study. The rationale of this approach is that the quantitative data and its analysis alone are not sufficient to provide a general understanding of the research problems. The addition of the secondary qualitative data and their analysis helps to support and enhance the statistical results of the primary quantitative data. This is also due to the nature of the research questions that require different types of answering methods (Creswell & Plano Clark, 2011).

The present study is a QUAN → qual two-phase study, giving the quantitative aspects a higher emphasis. The QUAN → qual two-phase study enabled me to use the qualitative data set to explain the result from the quantitative data set. By using the QUAN → qual two-phase study also, I was able to answer different research questions that require different methods while still maintaining the use of the qualitative element to support the quantitative data. By using this approach, I was able to present a more comprehensive and rigorous study, as I was to look at the changes of trends through the survey administered repeatedly in three stages, and conducted in-depth viewpoints of participants through interviews to support the quantitative trends. The rationale for using the QUAN → qual explanatory mixed methods design in this study was to obtain a

complementary and expansive data on the same research issue. The two-phase study ensured efficiency, as I was able to focus on the quantitative part of the study first and sequentially use the qualitative element to enhance the first quantitative data set.

Explanatory design is not the only design available for use in mixed methods research. Creswell and Plano Clark (2013) advocate several other designs that include the convergent design, the exploratory design, the embedded design, the transformative design and the multiphase design. However, not all the elements of the categories mentioned above fit the requirement of this study. The primary reasons for choosing explanatory design for this study over the other designs include: (a) it is not the intent of this study to collect different but complementary data to address the research objectives of the study, which is the aim of the triangulation design, (b) it is not the intent of this study to use the results of the first method to develop the second method, which is the aim of the exploratory design, (c) it is not the intent of this study to use the results of the either method to enhance an experimental design, which the aim of the embedded design, (d) it is not the intent to this study to use the combined results to address issues of social justice for the study's population, which is the aim of the transformative design and (e) it is not the intent of the study to use the results to address a set of incremental research questions that all advance one programmatic research objective, which is the aim of the multi-phase design.

However, I do find that certain elements from other designs can help to achieve my research objectives, such as the need to answer different research questions

using different research methods as proposed by the embedded design approach. This element is adopted during the initial planning of my research design to further enhance the methodology of data collection. Due to these reasons, the best approach to answer the research objectives and research questions of the present study is to use the explanatory mixed methods design, which uses the two-phase sequential model.

Overall, the objective of using the explanatory mixed methods research design is to understand the research issues in the best possible manner. The data collections for the different aspects of the approach is conducted and analysed sequentially. The result of both data sets are then interpreted to answer different types of research questions of the study, as well as to use the qualitative data to enhance the quantitative results. The following section will discuss data collection in mixed methods research and issues associated with the collection and analysis of mixed methods data. Figure 3.1 in the following page illustrates the research design employed for my study:

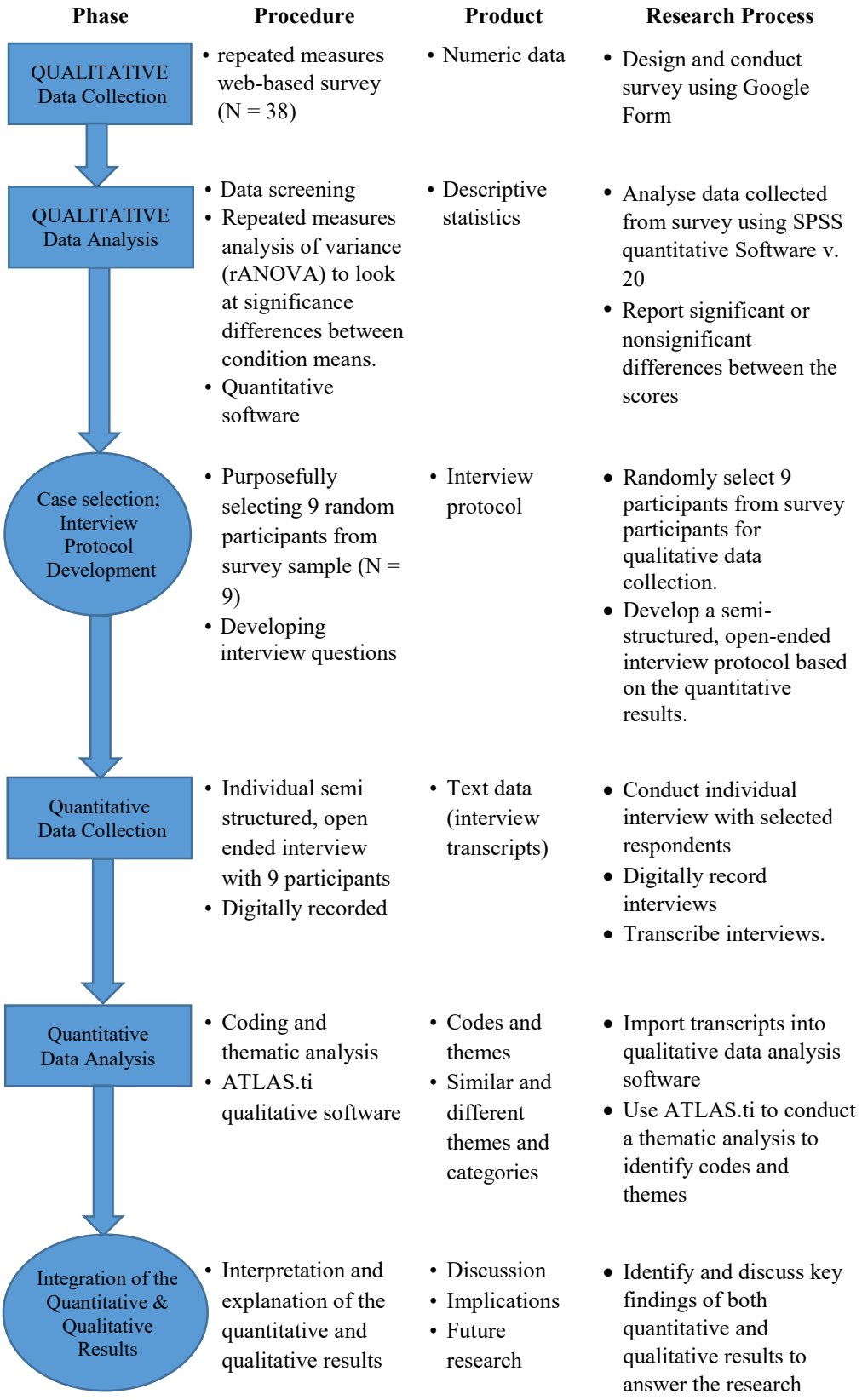


Figure 3.1: Procedural Diagram of the Research Design
Source: Based on Plano Clark & Creswell (2008) & Creswell & Plano Clark (2011)

3.5 Data collection approach

Upon establishing the research design, as well as designing and piloting the relevant research instruments, I proceeded to the data collection stage of the study. Different types of research design (quantitative, qualitative or mixed methods) used in this study require different procedures of data collection. Within the field of the mixed methods design, differences occur based on the varied selections of the mixed methods designs. Creswell & Plano Clark (2011) stated that an approach to conceptualising data collection for a mixed methods design study is to give consideration based on its type, i.e. either concurrently or sequentially.

In different mixed method research designs, the convergent method uses concurrent data collection, while the embedded, transformative and multiphase methods have the benefit of utilising either concurrent or sequential data collections depending on the needs of a research. The explanatory and exploratory mixed methods designs, however, are using primarily a sequential data collection (Creswell & Plano Clark, 2011). In comparison to the concurrent data collection, where both quantitative and qualitative data are collected around the same time, studies that use sequential approach collect either the quantitative or qualitative data first.

There are two ways of using the data collected sequentially in mixed methods designs. One way is to use the results of the first approach to build upon the second data collection approach. Another way is to use the result of the second approach to support or enhance the first data collection approach. This study,

which is an explanatory mixed methods design study, employed both ways of the sequential data collection approach.

3.6 Data collection methods: Surveys and interviews

In this explanatory mixed methods design study, both quantitative and qualitative data were collected to address different research questions of the study and to enhance the quantitative results with the qualitative data. Quantitative data was collected through online surveys while the qualitative data was gathered through individual interviews. The surveys were administered online using the repeated measures design exclusively to the pre-service teacher trainees' respondents.

Interviews were conducted to explore the perspective of the trainees in relation to the results of the surveys. As the study employed a sequential approach, both quantitative and qualitative data were collected separately, with the qualitative being collected after all the surveys were administered.

Table 3.1 illustrates in detail the data collection methods used to answer the research questions of the study. Following the table is a discussion of the two data collection methods used.

Table 3.1: Research Questions vs Instruments

No.	Research Questions	Instrument/s used
1.	What is the current state of metacognitive strategies awareness among pre-service teacher trainees in using learning technologies?	Surveys
2.	To what extent can e-space applications be used to develop pre-service teacher trainees' metacognitive strategies in using learning technologies?	Survey & Interviews

3.6.1 The survey

The mixed methods approach of the study was conducted using quantitative and qualitative methods. The quantitative component of this study was conducted using an online survey, and was targeted only at the trainees' respondent group. The online survey was used for the trainees' respondent group as I wanted to obtain the information I sought for the study to represent a larger population. The online survey was the most suitable tool as it provided me with the opportunity to obtain the information I needed. Fraenkel and Wallen, (2009) stated that survey research is one of the most common methods used in educational research. Survey provides an advantage when opinions of a group

of individuals on a certain issue are needed. The survey used in this study was a directly administered online questionnaire. This was found to be most suitable approach, due to the fact that it enabled a high response rate from the respondents. The decision to use an online also was also a practical one as it was at no cost at all. The online survey was quicker to administer and was in line with the overall technology theme of the study. Lastly, just like a paper based survey, it also presented me with the opportunity to explain and clarify any doubts the respondents had, prior to answering the questions posed in the questionnaire.

The survey for my study was aimed at the pre-service teacher trainees and consisted of a self-reported instrument designed to measure quantitative section of the study, which is the metacognitive awareness of the respondents. The instrument is a 52 items inventory in the form of an online self-reported questionnaire that was adapted from Schraw and Dennison (1994). Referred to as the Metacognitive Awareness Inventory (from now on will be referred to as MAI throughout the study), it was developed for the purpose of measuring the respondents' metacognitive awareness. Metacognitive awareness measured by this inventory refers to one's ability to reflect upon, understand and control his or her learning. Issues explored via the surveys include knowledge about cognition and regulation of cognition, the two main components of metacognition as discussed by mainly by Flavell (1979) and Brown (1979). Details of the MAI used for this study and its adaptation will be further discussed in section 3.6.1.1 of this chapter.

The questionnaire for the survey is administered following a repeated measures design in the process of data collection. While Schraw and Dennison's aim of using the MAI is to go into details of the respondents' metacognitive awareness, the main objective of the survey for this study is to gauge significance changes in the score of the inventory between the three stages of the surveys. This is the main reason for using the MAI as the instrument for this study's survey, as it will help me see whether the respondents' involvement in an e-space community as well as on an online environment will have any possibility in development their metacognitive strategies towards ICT competency in contemporary learning technologies. Another advantage of the repeated measures design is that fewer research participants or respondents are needed. A repeated measures design is preferred when participants are scarce or when it becomes too costly to run each individual in the study. As an example, extensive training of participants is required before the actual study can begin in many research on perception. These are the type of research that often involve only a few individuals who participate in all conditions of the study (Cozby & Bates, 2011).

The sole purpose of conducting the survey for this study was to find out any significant difference between the three sets of data collected from at three different stages during the study. The data obtained from the survey will be used to examine if the participants' involvement in the e-space community has any effects on the development of their metacognitive strategies towards ICT competency in contemporary learning technologies.

3.6.1.1 The Metacognitive Awareness Inventory

In order to measure the metacognitive awareness and strategies of the pre-service teacher trainees, I have decided to use the Metacognitive Awareness Inventory (MAI) developed by Schraw and Dennison (1994). The MAI was developed as a self-report instrument in order to easily administer metacognitive inventory with approach that would make it suitable for adolescents and adults. This was mostly due to problems of finding a measure that researchers can use to quickly and reliably identify metacognitively aware learners. In constructing the MAI, Schraw and Dennison (1994) used the two-component models of metacognition; knowledge of cognition (referring to metacognitive awareness) and regulation of cognition (referring to metacognitive strategies). Works from previous researchers, predominantly Flavell (1987) and Brown (1987), formed the basis of the self-reported measuring instrument.

At present, the MAI is still one of the preferred choice for measuring the two components (knowledge of cognition and regulation of cognition), either adopted (Gasner, 2009; Ke, 2008; Ramirez-Corona, 2013) or adapted (Balcikanli, 2011; Coutinho & Neuman, 2008; Sperling et al., 2002). The adaption usually made some alterations to the items from the original Schraw and Dennison's original inventory while still maintaining the original objective of the instrument, which is to measure one's level of metacognitive awareness. Other researchers' decisions for choosing the instrument were also due to its flexibility, reliability and suitability for adolescents and adults.

The MAI consisted of a 52-item self-report questionnaire designed to assess one's awareness of metacognitive processes. To rate each item, the questionnaire employed a 100-mm, bi-polar scale, where the right end of the each scale indicated the statement was false about the individual and the left end indicated that the statement was true. According to Schraw and Dennison (1994), several reasons highlighted the decision for choosing the continuous scales instead of Likert scales. The first reason favours the continuous scales for providing better approximation to interval data when compared to Likert scales. Second reason looks at the expected increase response variation in scoring responses that should enhance the reliability of the instrument when using a 100-point scale rather than a 5- or 7-point scale.

The MAI is divided into eight scales that include at least four items per scale. The scales are then divided into two main factors of metacognition – knowledge of cognition (metacognitive awareness) and regulation of cognition (metacognitive strategies). While declarative knowledge, procedural knowledge, and conditional knowledge are the scales that measure knowledge of cognition, planning, information management, monitoring, debugging, and evaluation are the scales that measure regulation of cognition. The questionnaire items focus on details about how the respondents plan, organise, and monitor their progress as they complete ordinary academic assignments. Items in the questionnaire are stated in a manner that encourages self-reflection about metacognitive awareness. Several items that measure the same construct are scattered throughout the inventory to promote thoughtful responding and discourage uncharacteristic response patterns.

The result of the instrument is interpreted by looking at its scores, of which higher scores for either factor indicate higher level of corresponding knowledge of cognition or regulation of cognition (Schraw & Dennison, 1994). Statistical analyses of the MAI by conducted in several studies indicate that the MAI is an effective instrument to measure knowledge of cognition and regulation of cognition (Schraw & Dennison, 1994; Pintrich, P. R., Wolters, C. A., & Baxter, G. P., 2000). A factor analysis conducted by Schraw and Dennison (1994) reported a factor analysis that showed .95 coefficient α for both knowledge and regulation of cognition. Findings by Pintrich et al. (2000) supported the previous study with a high internal consistency of .88 for knowledge of cognition and .91 of regulation of cognition. Both sets of researchers found a significant relationship between the knowledge and regulation factors.

Reasons stated above outlined my decision in choosing the MAI to measure the metacognitive awareness of the pre-service teacher trainees in this study. Specifically for this study, the MAI was given a minor adaptation in order to focus on the trainees' metacognitive awareness and strategies towards ICT competency in contemporary learning technologies. While the Schraw and Dennison's original MAI provides an instrument to measure metacognitive awareness and strategies in general, the adaptation made for this study include specific reference to learning technologies (see Appendix C). This was done to bring the respondents' focus on reporting their knowledge and regulation of cognition with regards to learning technologies.

For this study, minor adaptation has been made to the MAI in order to bring focus to the aspect of learning technologies. While the original MAI focuses on the general knowledge of cognition and regulation of cognition, the adapted version used for this study added the elements of learning technologies. This adaptation is deemed necessary to properly and accurately measure the participants' metacognitive awareness towards learning technologies competency. Examples of the adaptation are as stated in table 3.2 below;

Table 3.2: Adaptation samples of the Metacognitive Awareness Inventory

No.	Original version	Adapted version
1	I ask myself periodically if I am meeting my goals.	I ask myself periodically if I am meeting my goals in using learning technologies.
2	I try to use strategies that have worked in the past.	I try to use strategies that have worked in the past in using learning technologies.
3	I pace myself while learning in order to have enough time.	I pace myself while using learning technologies in order to have enough time.
4	I ask myself questions about the material before I begin.	I ask myself questions about the learning technologies before I begin.
5	I ask others for help when I don't understand something.	I ask others for help when I don't understand something about learning technologies.

The ratings system for the original MAI by Schraw and Dennison (1994) used a 100-mm bi-polar continuous scale, where the right end of each scale indicated the statement was false about the individual and the left end indicated the statement was true. The adaptation of the MAI for this study instead employed a close-ended dichotomous questions method using True and False answers for all the 52 items. The score from the survey was calculated with 1 point given for any 'True' statement and '0' for any false statement, making the total score for the fully answered questionnaire as 52. With the scoring method set in such a way, it was easy to gauge the level of metacognitive awareness and strategies for the respondents. A high score would indicate a respondent's high level of metacognitive awareness and strategies. On the opposite, a low score would indicate a respondent's low level of metacognitive awareness and strategies.

In order to collect the quantitative data for this study, I have decided to administer the MAI using an online tool, Google Form. The online MAI was designed so that the respondents must answer each and every question. The respondents would not be able to move to the next question should the current question was not answered. The decision for using an online tool for survey administration was based on Bryman's (2012) descriptions on the advantages of using the internet to collect data from individuals. The advantages are: (a) online surveys are usually more economical with regards to time and money, (b) large numbers of respondents can be reached very easily, (c) respondents can also be reached regardless of distance, as the survey is administered using the internet and (d) the collection and collation of data can be done very quickly.

Bryman (2012) also listed another 8 advantages of online surveys and these also contributed to the decision of using the same approach for collecting quantitative data in this study: (a) lower cost of administering the surveys, (b) the internet can ensure faster response, (c) wide array of online survey formats can make it more attractive, (d) the administration of the survey can be combined with the manual version as an alternative to respondents, (e) online surveys are less restricted by geographical coverage, (f) online surveys tend to produce fewer unanswered questions, (g) respondents give better responses towards open questions when asked online and (h) better data accuracy can be achieved due to the automated nature of online surveys that can reduce human errors.

Two of the above reasons influenced my decision for converting the MAI into an online survey, which are economical in terms of time and money as well as collection and collation of data can be done very quickly. An additional reason that made me choose this approach was to introduce to the pre-service teacher trainees a tool for conducting online survey easily.

3.6.1.2 Pilot study of the questionnaire

Although the MAI was adapted with only minor changes to the items and did not change the structure of the questionnaire, there was still a need to conduct a pilot study of the instrument in order to test its reliability and validity. Conducting the pilot study would me to ensure that the meaning and purpose of each item in the questionnaire was understood by the respondents. It would also

allow me to determine the time required for the actual data collection process as well as the method of which the survey was administered. 44 student respondents were used for the pilot study of the questionnaire and they were not they actual respondents of the study. As this was also an online survey, few issues were brought up to the attention of the pilot study respondents for their comments: (1) clarity of the language used, (2) clarity of the instructions given, (3) unfamiliar terms, (4) internet connection time, and (5) the ease of using an online survey.

3.6.1.3 Reliability and validity

As this is an adaptation of a proven and tested questionnaire, the pilot study of the questionnaire used in this study need to replicate the same outcome of the original. Statistical analyses of the MAI by conducted in several studies indicate that the MAI is an effective instrument to measure knowledge of cognition and regulation of cognition (Schraw & Dennison, 1994; Pintrich, P. R., Wolters, C. A., & Baxter, G. P., 2000). A factor analysis conducted by Schraw and Dennison (1994) reported a factor analysis that showed .95 coefficient α for both knowledge and regulation of cognition. Pintrich et al. (2000), used the same instrument and supported the previous study with a high internal consistency of .88 for knowledge of cognition and .91 of regulation of cognition. Both reliability tests surpassed the generally agreed upon alpha lower limit for Cronbach's alpha, which is .70 as stated by Hair, Black, Babin and Anderson (2009). Both sets of researchers also found a significant relationship between the knowledge and regulation factors.

Prior to determining the reliability of the adapted instrument of the study, I first sought the assistance of an expert in order to establish the validity of the questionnaire items. The expert review was conducted by a professor from the same university where the study was carried out. His vast experience in the field of educational technologies and ICT enabled him to review the questionnaire in relation to metacognition and ICT competencies. In order to review the instrument, he made a comparison between the adapted questionnaire and the original MAI by Schraw and Dennison. His review indicated that the changes made kept the intention and purpose of the original MAI. The adaptation maintained the aim of the original instrument, which is to measure the level of metacognitive knowledge and regulation and should be suitable to be used in exploring metacognitive knowledge and regulation towards ICT competency in contemporary learning technologies.

After seeking the expert's opinion for the validity of the instrument, the same test as the original instrument was replicated in order to determine the reliability of the adaptation. SPSS version 20 was used to run the Cronbach's alpha internal reliability test on the dichotomous data obtained from the pilot study. The reliability test on the two sections of the questionnaire produced Cronbach alpha value of .75 for knowledge of cognition and Cronbach alpha value of .87 for the regulation of cognition. The values were above the .70 cut off point stated by Hair et al (2009) indicating that the questionnaire was reliable. The result of the test was also shown to the same expert for confirmation.

Lastly, despite validation from an expert and the Cronbach alpha values showing a reliable instrument for the study, I decided to use face validity method to further establish the validity of the survey instrument. I achieved this by getting the respondents' feedback on each item of the questionnaire after the pilot study. This was carried out in order to ensure that they completely understood the meaning and purpose of each item on the questionnaire. This was also to make sure that slight changes made to the questionnaire items could still reach the same intention of the original in determining the metacognitive levels of the respondents.

3.6.1.4 Survey preparation

As part of the pre-service teacher trainees' exposure to learning technologies and e-space environment, the decision was made to convert the MAI to an online format (see Appendix B). Google Form, a free online application, was used to convert the MAI into an online survey, as well as to administer the survey for the trainees to respond. Google Form was chosen as it provides a simple and effective tool for the survey's administrations where responses can be collected faster and data are automatically collected in Excel spreadsheet, making the process of data analysis easier and faster. These reasons and the advantages of using an online survey as listed by Bryman (2012) and discussed previously became the factors that decide the choosing of data collection tool for this study.

The questionnaire adapted from the MAI used in my study is divided into two sections. The first section is the demographic section, asking the respondents'

gender, age and expected year of graduation. The second section consists of the 52 items adopted from Schraw and Dennison's inventory. Gender, age group and expected year of graduation were not essential variables in this study as it is not the aim of this study to explore the metacognitive awareness of the pre-service teacher trainees through these various categories. These categories are included in the survey in order to create a demographic database of the respondents.

3.6.1.5 Repeated measures design

For this study, I have decided to employ a repeated measures design to carry out the survey. Taking an element from experimental study designs, a repeated measures design (also known as within-subjects design) refers to a design in which it is more effective as well as practical for a research's subjects to participate in all conditions of the survey and function as their own controls (Shaughnessy, Zechmeister & Zechmeister, 2012). The use of this design provides two major advantages to a study: (1) the statistical power of a survey is increased due to its sensitivity and (2) minimal number of participants is required using such design (Cozby, 2012; Stangor, 2012).

Shaughnessy, Zechmeister, and Zechmeister (2012) expanded the advantages and listed four reasons that explains why the repeated measures design is appropriate to be used for a study: (1) study can be conducted even if the number of participants are very low, (2) study can be conducted more efficiently, (3) the sensitivity of the study can be increased, and (4) participants' behaviour changes can be studied over time.

In relation to this survey, the two of the reasons listed above outlined my decision in choosing the repeated measures design. Given the small number of participants (38 pre-service teacher trainees), the repeated measures design was deemed suitable for the survey. In this situation, such design is often more convenient and efficient to be used in a survey. The design also allows me to monitor how the participants' metacognitive strategies awareness changes over time, as that is the primary objective of study with the intervention of an e-space community. This is to give more reliability and validity for the data set that is collected and analysed from a small number of participants.

3.6.1.6 Survey administration

Following the repeated measures design, the survey was administered at three stages of the study (pre, mid and post) using Google Forms, an online application. Google Forms was used as it is a very efficient tool to administer online survey and was also part of the respondents' exposure to learning technologies in the module that they are registered in. The survey, administered through Google Forms, was conducted at three intervals during the study. Before the trainees were asked to answer the online survey for the first time, they were briefed on the purpose of the instrument to assess knowledge about learning. They were also given a brief overview on the topic of metacognition, focusing on awareness and strategies.

The first interval was conducted before the participants' involvement in e-space community, in this case before the respondents started using iTa'LeEM for their

registered module. This occurred during the first class of the semester where the respondents were first brief on the nature of the study and were given the Research Information Sheet (see Appendix A). After they have all agreed to participate in the study, they were given Participant Consent Form (see Appendix B) to sign. After that process was completed, the respondents were requested to go online and response to the questionnaire through the link I provided. The second stage of the survey was conducted during the middle of the semester where the respondents were halfway through their module. At this juncture, the respondents were already familiar with the process of responding to the survey as well iTa'LeEM. The same procedure was taken where I gave the class the link to the online survey before the start of the class. Finally, the last stage of the survey was conducted during the final session of the module, using the same procedure as the first and the second stages.

As the questionnaire was converted to an online survey (see Appendix B), subjects recorded their responses by clicking on the rating scale radio buttons that best corresponded to how true or false the statement was about them. The quantitative data collection for this study helps to answer the first research question in order to find out the participants' awareness on the application of metacognitive strategies when it comes to ICT competency in contemporary learning technologies. The second research question requires a qualitative research approach in order to go into details as to what extent can e-space applications (such as ITa'LeEM) be used to develop the metacognitive strategies required to improve pre-service teachers' ICT competency in contemporary learning technologies.

3.6.2 Semi structured interviews

For this mixed methods study, interviews were used to acquire the qualitative data. The discussion in this section explains the interview approach used in this study.

Fraenkel and Wallen (2000) discussed the importance of interviews as a method of data collection that allows researchers to determine accuracy, confirm and also counter findings from other sources. Interviews can be used to assist researchers in finding out individual's feelings and thoughts on certain issues. Patton (2002) argued that the goal of interviewing is to allow the researcher to 'enter into the other person's perspective'. He also stated that interviews 'begin with the assumption that the perspective of others is meaningful, knowable and able to be made explicit' (p.341).

In this study, I also attempt to understand the perspectives of the pre-service teacher trainees on their use of an e-space application, involvement in an e-space community and its possibilities to trigger the development of the trainees' metacognitive strategies towards learning technologies. The use of interviews will allow me to understand the perspectives of the trainees better as compared to using solely quantitative data to address the issue

Bryman (2012) states that interviews are the most widely used method in qualitative research. Several types of interviews are available for researchers to use in their study. Some of interview types include structured or standardised

interviews, semi-structured interviews, unstructured interviews or intensive or ethnographic or qualitative interviews, focus group or focused interviews, oral history interviews and life history interviews and retrospective interviews (Spradley, 1979; Lofland & Lofland, 1995; Fraenkel & Wallen, 2000; Mason, 2002; Bryman, 2012). Bryman (2012) however, asserts that the three most commonly used interviews types in research are the structured, unstructured and semi-structured interviews.

In structured interviews, also known as standardised interviews, the process involves the interviewer administering an interviews schedule. The interview schedule usually consists of close-ended questions and is commonly used as a survey research. Structured interview questions are also more focused and normally interviewers read out the questions to the interviewees following the exact manner and order that it is structured. According to Bryman (2012), this allows for aggregation of response by the interviewees. Unstructured interviews refer to researchers' use of guides known as '*aide-mémoire*' (Bryman, 2012. p.471) to explore the topic being investigated. It is also not uncommon for unstructured interviews to contain only one question. This is the opposite of the structured interviews, which usually contain many questions. The nature of this unstructured approach allows the interviewee to respond to the question as to how it suits them. Interviewers follow up on interviewees' responses which they feel are worthy of being further explored, giving the whole the feel of a conversation. (Bryman, 2012).

In contrast, semi-structured interviews are conducted using an interview guide consisting of questions or topics to be covered during the interview process. While the structured interview makes it compulsory for the interviewers to pose their questions in a specific order, semi-structured interviews employs the opposite approach. Such approach allows the interviewers to pose questions that are not in the interview guide, especially if and when the researcher uncovers new issues from the interviewee during the interview process (Bryman, 2012). According to Fraenkel and Wallen (2000), semi-structured interviews have better advantage in acquiring data that can be compared, as participants answer the same questions. In addition to facilitating the organisation and analysis of the data acquired from the interview, interviewer bias can also be reduced by using this approach (Patton, 1990).

For this study, I have decided to utilise semi-structured interviews with open-ended questions to explore the issues being investigated, as opposed to using structured or unstructured interviews. The decision to use semi-structured interviews as the preferred type of interview helps to facilitate a less rigid interviews process. By setting a clear focus of the issues that I wanted to explore in this study, the semi-structured interview process provided me with the possibility of addressing more thorough issues.

In addition to the format of semi-structured interviews, the planning and preparation of the interviews questions also play important roles in determining the success of the interview process. Kvale (1996) described nine categories of interview questions, namely: (1) Introducing questions, (2) Follow-up

questions, (3) Probing questions, (4) Specifying questions, (5) Direct questions, (6) Indirect questions, (7) Structuring questions, (8) Silence questions and (9) Interpreting questions. In comparison, Patton (2002) proposed six categories of interview questions, namely; (1) background or demographic questions, (2) knowledge questions, (3) experience or behaviour questions, (4) opinion or values questions, (5) feeling questions and (6) sensory questions.

The categories of interview questions as proposed by both Kvale (1996) and Patton (2002) serve as my point of reference in setting up the interview questions for this study. Verbal cues were communicated to the interview participants during the interview process in situation where the above questions were not included in the interview guide in written format. During the interview process follow-up, probing, specifying and interpreting questions were used as the common verbal cues.

In this study, interviews conducted served the following reasons: (a) To explore the pre-service teacher trainees' metacognitive strategies that they might or might not use in using learning technologies, (b) to explore the pre-service teacher trainees' involvement in the e-space community, their perspectives towards e-space and how it helps their competency towards learning technologies, (c) to explore the pre-service teacher trainees' usage of e-space applications and how these applications might help their competency towards learning technologies and (d) to explore the pre-service teacher trainees' perspective towards learning technologies that they use as learners. Using the above general objectives of the interview as scaffolding, the interview questions

were developed with focus on the following broad categories explored through the study: (a) learners' involvement in the Virtual Community of Practice (VCoP), (b) indications of learners' metacognitive awareness and strategies towards learning technologies, and (c) learners' ICT competency in contemporary learning technologies.

3.6.2.1 Interview preparation

A well-prepared interview guides is crucial in ensuring minimal disturbance toe interview sessions that follows a semi-structured approach. The interview preparations for this study were done in accordance to conditions proposed by Bryman (2012). The conditions are as follows:

(a) The interview questions formulated from the topic areas were arranged in a certain amount of order to ensure a reasonable flow. However, it has be taken into consideration that order of questions can be altered during the actual interview,

(b) The interview questions were formulated to help answer the research questions of this study. Steps, however, are taken so that the questions were not too specific and become leading questions,

(c) Interview questions were formulated using language suitable for the intended audience namely the pre-service teacher trainees: jargons related to metacognition, e-space and contemporary learning technologies were avoided as much as possible, but should the use for these jargons is unavoidable, the meaning of the terms were explained to the respondents,

(d) Details of the respondents were collected prior to the interview sessions by asking them to fill up respondent background information form, Location and setting for the interview were determined and agreed upon prior to the interview: all interviews were held within the premises of the respondents place of study, locations selected were usually my own office or an empty class room,

(e) I familiarised myself with the interviewer qualities as proposed by Kvale (1996) and Bryman (2012), namely, knowledgeable, structuring, clear, gentle, sensitive, open, steering, critical, remembering, interpreting, balanced and ethically sensitive,

(f) Digital audio recorder was used to record all interview sessions, with a secondary recorder used as backup and a laptop was also used during the interview sessions to write notes, and

(g) Pilot interviews were also conducted prior to the actual interviews in order to familiarise myself with and to test the interview guides. This is also to clarify and rectify any issues with the interview guides. This step is further explained in the following section.

3.6.2.2 Pilot study: Interview Guide

Prior to the actual interview sessions, pilot interviews were conducted with the pre-service teacher trainees. The pilot interviews enable me to assess the clarity and appropriateness of my interview questions, to determine the suitability of the language used to formulate the questions, to time the length of the interview session, as well as to practice my own interviewing skills. A total of two interviews were conducted for the pilot study, one individual interview and one

group interview. The 30 minutes each pilot interviews were recorded using a digital audio recorder. The sessions went on well and feedbacks from the pre-service teacher trainees who took part in the pilot interviews indicated that understood the questions posed during the sessions with no difficulties. While respondents commented that the language used in the interview guide was also simple and easy to understand, there were some terms used that needed clarification. The terms were explained to the respondents and this information was added to the interview guide. Repetitive questions were also removed from the interview guide based on the responses

However, from these pilot interviews sessions, I discovered that an individual interview session worked better in comparison to the group interview. During the group interview session, it was observed that sometimes when one respondent were saying something, another would interject or jump into the conversation mid-way to talk about the same issue. This would more often than not cause the first interviewee to lose focus on he or she was saying and disrupt the flow of ideas. It was also noted that in a group interview session, some respondents tend to be rather quiet and passive, letting others do most of the talking, resulted in imbalance responses between respondents. Taking these issues into consideration, I decided to go with the semi-structured individual interviews approach for the actual data collection process.

3.6.2.3 Validity and credibility

In order to ensure that the final interview guide finalised from the pilot study is reliable and valid. I first sought the assistance of a professor from the same

university where the study was conducted for an expert review. Taking into consideration of his vast experience in the qualitative research methodology, this was to confirm that my instrument for the qualitative strand of this study was conducted according to the correct qualitative methodology. After receiving confirmation that my instrument was in order and followed all the procedure of a qualitative research, I proceeded with the next approaches described in this section to further enhance the validity and credibility of the interview.

In accessing the quality of study, a qualitative research set validity as a primary criterion as opposed to reliability. Cohen, Manion and Morrison (2007) refers to validity in qualitative research as 'the honesty, depth, richness, and scope of the data achieved, the participants approached, the extent of triangulation and the disinterestedness or objectivity of the researcher' (p. 133). Others researchers, such as Lincoln and Guba (1985) prefer using credibility of research findings and some researchers termed it as trustworthiness. In enhancing the credibility of study, several measures have been suggested and these include respondent or member validation, triangulation, the use of thick description, the use of audit trails, and prolonged engagement in the field and researcher reflexivity (Bryman, 2012, Guba and Lincoln, 1989; Silverman, 2001).

In order to establish the validity and credibility in this study, I decided to supplement the interviews with survey findings for the purpose of triangulation. Triangulation refers to a method commonly used by qualitative researchers to

ensure and establish validity in their studies. This is achieved by analyzing a research question from multiple perspectives. Cohen, Manion and Morrison (2007) defined triangulation as "the use of two or more methods of data collection in the study of some aspect of human behavior" as well as a technique that "attempt to map out, or explain more fully, the richness and complexity of human behaviour by studying it from more than one standpoint and, in so doing, by making use of both quantitative and qualitative data" (p. 141). Patton (2002) reflected the same view, advocating that "qualitative and quantitative data can be fruitfully combined to elucidate complementary aspects of the same phenomenon.

Patton (2002) proposed four types of triangulation that can contribute to verification and validation of qualitative analysis, namely (1) Methods triangulation, (2) Triangulation of sources, (3) Analyst triangulation, and (4) Theory/perspective triangulation:

1. Methods triangulation is conducted by investigating the consistency of findings generated by different data collection methods. This procedure often involves "comparing and integrating data collected through some kind of qualitative methods with data collected through some kind of quantitative methods." (Patton, 2002)

2. Triangulation of sources is achieved by investigating the consistency of different data sources within the same method. Often involving time, space and persons, this approach compares and cross-checks the

consistency of information obtained at different times and by different approaches within qualitative methods.

3. Also known as investigator triangulation, analyst triangulation uses multiple analysts or investigators in order to review findings. This approach of triangulating or using several investigators or interviewers helps reduce the potential bias coming from a single individual conducting all the data collection. In effect, this approach provides more direct ways of assessing the consistency of the data gathered.

4. Theory/perspective triangulation refers to the use of multiple perspectives or theories in order to interpret the same data. The purpose of this approach is to understand how different assumptions and premises influence findings and interpretations.

Out of these four types, methods or methodological triangulation is the approach most frequently used and the one that possibly has the most to offer to a researcher (Cohen, Manion and Morrison, 2007). From a mixed methods research point of view, Patton (2002) stated that "it is common that quantitative methods and qualitative methods are used in complementary fashion to answer different questions that do not easily come together to provide a single, well-integrated picture of the situation" (pg. 556-557). The use of the interviews together with the questionnaire added a depth to the result that would not have been possible using a single method approach, therefore increasing the validity and credibility of the findings.

Based on the advantages of triangulation described, this study used methods triangulation by means of supplementing interviews with survey findings to establish validity and credibility. Results from the survey and findings from the interviews were compared to find similarities. In accordance to the methods triangulation, finding similarities between each methods would ensure that validity is established.

3.7 Minimizing threats to mixed methods research validity

Tashakkori and Teddlie (2003) addressed validity as one of the major six issues in mixed methods research as well as the core aspect of any research project. Onwuegbuzie and Johnson (2006) associated validity of mixed methods study to stages in the process of research. This was also reflected by Teddlie and Tashakkori who addressed validity in relation to the design and the interpretation stage of research. Tashakkori and Teddlie referred to validity using the term 'inference quality', while Onwuegbuzie and Johnson chose to use the term 'legitimization'.

On the other hand, Creswell & Plano Clark (2011) retained the term 'validity' due to the universality of the language to both quantitative and qualitative researchers. It is also a term most commonly used by many researchers. They also advocated that validity could not be adequately or specifically addressed as a procedure unless the researcher could conceptualise it within a research design. Creswell and Plano Clark asserted that combining quantitative and qualitative methods raised additional possibilities for validity issues beyond the

validity concerns following separate quantitative or qualitative research methods. This created the need to discuss validity from the perspective of the overall design.

Creswell & Plano Clark (2011) defined mixed methods research validity 'as employing strategies that address potential issues in data collection, data analysis, and the interpretations that might compromise the merging or connecting of the quantitative and qualitative strands of the study and the conclusions drawn from the combination' (p. 239). Creswell and Plano Clark proposed several strategies during the processes of merging and connecting data to minimise these potential issues or threats to the validity of a mixed methods research.

Several strategies proposed by Creswell and Plano Clark were taken in order to address any arising threats to the study's validity during the merging and connecting of data. Among the strategies are: (a) extracting quantitative and qualitative samples from the same participants for comparable data, (b) using separate data collection procedures and data are collected at the end of the study, (c) addressing the same research question for both quantitative and qualitative data collection, (d) identifying qualitative quotes that match the quantitative findings, (e) choosing the same individuals who participated in the first quantitative phase for the qualitative follow up, and (f) considering the reasons for using qualitative data in an intervention. On top of these strategies, to further contribute to the validity of the study, I also employed the triangulation validity

approach proposed by Creswell and Plano Clark, in which different data sets were used as opposed to just a single data set.

The use of these strategies could minimise the potential threats to the validity of this explanatory design study as well as enhance the accuracy and consistency of the study.

3.8 Research site

The present study was conducted at the International Islamic University Malaysia, a public Malaysian university located in Selangor from September 2013 to June 2014. Specifically, the study focuses on the pre-service teacher trainees of the university under the faculty of education. The university's faculty of education is called the Kulliyyah of Education (henceforth, will be referred to as KOED), where 'kulliyyah' is an Arabic word for faculty.

At the beginning, the faculty was known as the Department of Education and was established on July 16, 1987. The establishment carries the intention of assisting the country in meeting the need for graduate teachers. Initially, it only offered the Diploma of Education as a preparatory programme for teachers to teach in secondary schools. Starting May 1997, the Department began offering a limited Bachelor of Education Programme in Arabic Language and Literature for teachers from the Ministry of Education Special Diploma Programme.

Beginning 2003, the Department's status was upgraded to an institution and became the Institute of Education (INSTED). The institute began conducting a

twinning programme with the Ministry of Education to upgrade the qualification and skills of in-service and pre-service teachers to Bachelor Degree in five programmes. In-service teachers were able to choose four of these programmes, namely:- (B.Ed) Teaching of English as a Second Language (TESL), B.Ed Teaching of Arabic as a Second Language (TASL), B.Ed Counselling and B.Ed Moral Education. The last programme, B.Ed TESL, was offered as a pre-service teacher training.

In July 2007, Malaysia's Ministry of Education requested all IPTAs to help produce graduate teachers and this included the International Islamic University Malaysia. As a result, INSTED began to offer 4 B.Ed programmes for students coming through the mainstream. The 5 B.Ed programmes, each for a duration of 4 years, are as follows: - B.Ed TESL, B.Ed TASL, B.Ed Counselling and B.Ed Islamic Education.

As of 2013, the institute upgraded its status once again to become a faculty or kulliyyah. It is now known as the Kulliyyah of Education (KOED), offering the same undergraduate programmes as well as Master of Education and PhD in Education programmes.

3.9 Gaining entry to the research site

In order to start the process of data collection for this study, gaining access to the research site is the next important step. Before I started my data collection process, I first went and spoke in person to the dean of the faculty of education of the university. It is to seek her permission for me to conduct my research in

the university, specifically the faculty. The purpose of the research and the manner in which the data would be collected was explained clearly to the dean.

Upon getting her verbal permission that allowed me to start my data collection in the faculty, I was instructed by the dean to communicate with the Head of the Curriculum and Instruction department as well as the lecturer who was going to teach the cohort selected for my study. The module in which the pre-service teacher trainees used the e-space platform for their learning was taught by the said lecturer and also part of the department. I was also given verbal permissions to conduct the data collection process with the potential research participants who were also students of the faculty. This was obtained after I had clearly explained the process of the data collection and the purpose of the study to both the head of department and the lecturer. It was also made clear to the relevant personnel that all data obtained would not be disclosed and that confidentiality would be maintained at all times.

Upon getting permission from relevant parties, the research participants were approached for the initial step of the data collection. Prior to the data collection process, the purpose of the study and the data collection procedure were explained to the participants. They were also informed on the benefits of participating in the study as well as assuring them serious measures would be taken in order to ensure the that confidentiality of the participants. I also explained to all participants that their names will also remain confidential and all of them would be given pseudonyms to safeguards their anonymity. In accordance to the university's research policy, the participants were informed

that, should they feel unsure and had second thoughts, they had the choice of withdrawing from the study at any point of time. After this verbal explanation, they were given the Research Information Sheet to read and the Participant Consent Form to sign. These procedures were also taken in order to help me gain the trust of the participants.

3.10 Ethical issues

In order to proceed with the data gathering, ethical clearance documentation was first submitted to the University of Nottingham, School of Education Research Co-ordinator for approval on July 2013. Upon securing the ethical approval, I had to wait for the new semester to start in the International Islamic University of Malaysia where the pre-service teacher trainees will be using the e-space platform for the chosen module of the study. The data collection began in September 2013 at the start of the semester. Before initiating the process of data collection, all participants were briefed clearly on what was the purpose of the research, how it would be conducted as well as what were the risks that may be involved during the data collection process. These were done both verbally and also by giving a research information sheet for them to read. These followed the standard procedure of the University of Nottingham where the research information sheet must include the title of the research, a summary of the research and the researcher's contact details. Upon getting confirmation that they had read through and understood the research information sheet, written consent was obtained from them. All the participants were given a participant consent form each to read and sign. The participant consent form included several statements regarding data collection, confidentiality and data

protection. Once the participants agreed to be part of the research they were asked to sign the participant consent form.

3.11 Summary

This chapter described in detail the mixed research methodologies used for this study involving fifteen pre-service teacher trainees. The underlying explanatory mixed method research design employed for this study was discussed together with the research instruments, the pilot study phase, the research site as well as the ethical considerations related to data gathering. The following chapter presents the analysis and results of the data gathered for this study.

Chapter Four: Research Findings

4.0 Chapter overview

Chapter 4 focuses on the findings of the study. The chapter is divided into two parts, (1) Part 1: Analysis of Data and (2) Part 2: Findings of Analysis. The first part of the chapter discusses the information on the respondents of the study, as well as the approach taken in the analysis of the surveys and interviews. These are followed by the presentations of the data analysis findings in the second part. These findings are later discussed and merged in Chapter 5 for the purpose of answering the research questions.

PART 1: ANALYSIS OF DATA

4.1 Introduction

The purpose of this study was to explore the development of pre-service teacher trainees' metacognitive strategies towards contemporary learning technologies through the use an e-space application. To accomplish this task, an overview of the major variables of interest in the study, namely metacognitive strategies development towards contemporary learning technologies and the use of e-space application, was captured in Chapter 3 through a mixed method approach. This chapter elaborates on the processes of data analysis according to the different component of this mixed methods study, starting with the quantitative component and followed by the qualitative component. The findings of the data

analyses were then organised and presented based on the research questions that were raised in Chapter 1:

1) What is the current state of metacognitive strategies awareness among pre-service teacher trainees in using learning technologies?
2) To what extent can e-space applications be used to develop pre-service teacher trainees' metacognitive strategies in using learning technologies?

Prior to discussing the results of data analysis, I will first present information on the respondents of the study as well as the approach I chose to analyse the survey and interviews.

4.2 The respondents of the study

The participants of the study were the students of the International Islamic University Malaysia, with an age range of nineteen to twenty one year old. The respondents were made up of third year pre-service teacher trainees from the faculty of education of the university. These trainees are students of the Teaching of English as Second Language (TESL), a bachelor degree programme under the faculty of education.

The instructional module chosen for the purpose of this study is of a blended learning approach. Students who registered for this module will have both offline and online sessions with the lecturer with priority given to the online

session. The whole module was divided into thirty percent (30%) offline or in class sessions and seventy percent (70%) online sessions using the learning management system of the university, iTa'LeEM. This provided an ample environment for the study to explore the respondents' involvement in an e-space community.

The decision for choosing the third year cohort also took into considerations the characteristics of a Community of Practice (CoP) as discussed in Chapter 2. *The practice*, referring to the last characteristic as proposed by Wenger (2006) is required for a community to be considered as a CoPs. The occurrence of this characteristic takes time and develops over sustained interactions between the community members. The participants of this study fit this requirement as they have been within the same CoP for more than two years and would have already developed the shared repertoire of resources between the members.

Before starting the data collection process, respondents were first briefed on the intent of the study and how their views would assist the intent of this study. The concept of metacognition and how it helps learning were also explained. Participants were also given assurance that their true identities will be kept confidential at all times. Once these terms of data collection were made understood, accepted and agreed upon, all the participants signed a consent form indicating their agreement to be respondents of the study.

4.3 Survey respondents

The present study used purposive sampling for selecting the respondents for both surveys and interviews. Purposive sampling is a common method in choosing a study's respondents for a mixed method research. This gives the opportunity for a researcher to be specific about choosing the respondents of the study that suit the needs for the research. It was not the aim of this study to sample participants on a random basis. This was due to the specific nature of the study referring only to specific group of people. The research questions posed for early on had pre-set the criterion for sampling the respondents of the study. Purposive sampling is suitable for this set of conditions where the sampling considerations are based on the study's research questions and some predetermined criterion (Cozby & Bates; Bryman, 2010).

In accordance to Plano Clark and Creswell (2014), other than purposely selecting the participants due to the appropriateness for the study, it was also because they were available, convenient, and meet some criteria or characteristics that I wanted to investigate. The reasons were also supported in Patton and Patton (2002), stating that this approach ensures that the selected individuals are "information rich". However, it is to be noted that in some situation this approach may be deemed as convenience sampling, which bear some similarities to purposive sampling and require reference to a bigger population.

Due to the above reasons, the decision for choosing the third year students was made due to the availability of the instructional technology module offered in

the semester chosen for the data collection process. Instructional technology modules are among the compulsory components that the students in this course have to complete as part of the graduation requirements. The module was specifically chosen to enable the study to seek for in depth perspectives of the respondents' ICT competency towards contemporary learning technologies. The university's faculty of education is a very small faculty and it is normal for only a single group to register for any instructional technology module offered for a particular semester. An instructional technology module was also chosen for the study, as it will provide a more comprehensive environment and community for the respondents to utilize and be exposed to learning technologies as compared to other modules.

Based on the purposive sampling method, a total of 38 third year pre-service teacher trainees were selected to participate in the survey. Representing the sample size, these trainees form a group who took the compulsory instructional technology module offered for the semester at the present study. The rationale for conducting the survey with the third year students of the faculty is due to the availability of the module, which is offered only when a sufficient number of students registered for the module in a particular semester. At the time the study was conducted, there was a population of 68 students in their third year of the undergraduate Teaching of English as Second Language programme and a total of 402 students for the whole programme from first to final year.

Given the availability of the module for that particular semester chosen for the study and number of students who registered for the module, not all 402 students

qualified to be respondents. The final year students, at the time of proposed data collection, were doing their practicum in schools and were not available to be respondents. The first and second year students were also excluded from the study as the requirements of the programme do not allow them to register for this module before completing other compulsory modules of lower levels.

In order to track the respondents for the data collection as describer earlier, I sought help from the Undergraduate Study Unit for the list of students who registered for the module used for the present study. Upon getting the list, I discussed with the lecturer assigned for the module to arrange for administrations of questionnaires. Due to the small number of respondents, a repeated measures design was used for the study. This measure ensures that the variance of estimates of treatment-effects is reduced and in turn, allows statistical inference to be made using fewer subjects. The design also allows me to monitor how the participants' metacognitive strategies awareness changes over time, as that is the primary objective of study with the intervention of an e-space community.

As described earlier in chapter 3, the survey was administered at three stages during the use of iTa'LeEM (pre, mid and post) using Google Forms. This approach was in accordance to the repeated measures design chosen for this study. Google Forms provided a very efficient and convenient tool to administer an online survey. At the same time, this exercise became part of the respondents' exposure to learning technologies following the requirement of the module. For each of the survey, the respondents were requested to go online

and response to the questionnaire at the beginning of a chosen class session. For all the three stages of surveys, all 38 respondents responded to the questionnaire, giving it a 100% response rate.

The 38 respondents of the study consisted of 5 male and 33 female pre-service teacher trainees, all agreed to participate and respond to the survey. Even though the numbers showcased a gender imbalance, it was a reflection of the overall male-female student ratio of the university as a whole, of which the majority of the education programme population consisted of the female gender. All respondents were Malaysian students of within 21 – 25 age range.

4.4 Interview respondents

A total of 9 respondents were interviewed for this study. The pre-service teacher trainees respondents were again purposively selected for the interview sessions based on the purposive sampling method. All 38 respondents were first asked whether they would be prepared to be interviewed in order to probe deeper into the issues addressed in the survey as well as to explore other issues not addressed in the survey. However, stating a common issue in a qualitative research, it is difficult to establish early on how many people should be interviewed in a study that is based on theoretical ground before reaching the point of saturation (Guest et al, 2006). The decision was made to first ask among the survey respondents who would volunteer to be interviewed. As such, these 9 respondents were the first to volunteer. The decision also took into considerations that "sample sizes in qualitative research should not be so small

as to make it difficult to achieve data saturation, theoretical saturation, or informational redundancy" (Onwuegbuzie and Collins, 2007, p. 289).

In accordance to the method of purposive sampling, the following criteria were set for the selection of the trainees respondents:

a) Must be a pre-service teacher trainee of the Kulliyyah of Education, International Islamic University Malaysia.
b) Must register for the instructional technology module chosen for the present study.
c) Must participate in iTa'LeEM as the chosen e-space platform of the study.
d) Must first answer the questionnaire at all the three stages administered for the present study.

Interviews with the students were conducted to the point of saturation. In the research information sheet and at the beginning of the data collection process, the participants were notified that they would be called at random for the interview. All the 38 trainees who took part in the surveys agreed to be interviewed. However, interview saturation had been attained with the fifth interview respondent. A brief profile of the interview respondents is a presented in Table 4.1.

Table 4.1: Interviewee Profile

THIRD YEAR PRE-SERVICE TEACHER TRAINEES			
INTERVIEWEE ID	GENDER	AGE	PROGRAMMME
R1	Male	22	B.Ed. TESL
R2	Female	21	B.Ed. TESL
R3	Female	22	B.Ed. TESL
R4	Female	21	B.Ed. TESL
R5	Female	21	B.Ed. TESL

The next section discusses the approach used in the analysis of the data obtained from the surveys and interviews.

4.5 Data analysis approach

The process of data analysis for this study involved the examination of the data collected during the process of data collection. The process first followed the basic procedures for data analysis as outlined by Creswell & Plano Clark (2011, p.204), involving primarily six steps. These steps are (1) the preparation of the data sets for analysis, (2) exploring data, (3) analysing the data, (4) representing the data analysis, (5) interpreting the results and (6) validating the data and findings. These six steps are discussed in relation to this study. Quantitative data refers to the data gathered from the survey, while qualitative data refers to the data gathered from the interviews. The analysis for this study was conducted using the procedures prescribed by Creswell & Plano Clark (2011).

Step 1: Preparation of the data sets for analysis

Quantitative data: Coding the data by assigning numeric values, preparing the data for analysis with a computer application, cleaning up the database, recording or computing new items for analysis and establishing a codebook

Qualitative data: Organising the audio data, transcribing interviews into word files and preparing the interview transcripts for data analysis

Step 2: Exploring data

Quantitative data: Examining the data visually, performing descriptive analysis, inspecting for trends and distributions

Qualitative data: Reading through the data, writing memos and developing a qualitative codebook

Step 3: Analysing the data

Quantitative data: Conducting repeated measures analysis of variance for a descriptive statistic and multivariate tests, determining the mean, standard deviation and Wilks' Lambda distribution, analysing the results to answer the research question and using a quantitative statistical software application. Details for the technique of quantitative data analysis can be found in section 4.6 of this chapter.

Qualitative data: Coding the data, labeling the codes, grouping the codes into themes or categories, interrelating themes and using a qualitative data analysis

software application. Details for the technique of qualitative data analysis can be found in section 4.7 of this chapter.

Step 4: Representing the data analysis

Quantitative data: Representing findings in the form of mean scores, statement of results and providing results in tables

Qualitative data: Representing the findings in the form of discussions using codes and themes

Step 5: Interpreting the results

Quantitative data: Explaining how the findings address the research questions and comparing the findings with past literature and theories.

Qualitative data: Assessing how the research questions were answered, comparing the findings with the literature, exploring how the qualitative findings support or enhance the quantitative findings and reflecting on the personal meaning of the findings.

Step 6: Validating the data and findings

Quantitative data: Using external standards, validating and checking the reliability of scores from past instrument use, establishing validity and reliability of current data.

Qualitative data: Using researcher, participant and reviewer standards, employing validation strategies such as triangulation, member validation and researcher reflexivity.

Secondly, details of the data analysis process for this study can also be explained following the explanatory design of a mixed methods research. Taking the sequential approach for an explanatory design, the data analysis consisted of three major steps; 1) the analysis of primary data (qualitative), 2) the analysis of secondary data (quantitative), and 3) the mixed methods analysis to determine how the secondary quantitative data support the primary qualitative data (Creswell, 2011).

For the primary data (the quantitative phase of the study), the statistical analysis of the data was reported in the form of scores derived from a descriptive repeated measures analysis of variance (rANOVA), consisting of a descriptive analysis and a multivariate test. The scores were used to show the current state of participants' metacognitive awareness and strategies and also to find out if there were any significant differences in participants' understanding of metacognitive strategies before and after using the e-space platform. The statistical analysis of the primary quantitative data was conducted using the IBM SPSS Statistics version 20, a statistical analysis software formerly known as SPSS (Statistical Package for Social Sciences) and PASW (Predictive Analytics Software).

For the secondary data (the qualitative phases of the study), all the text data obtained through the interviews were coded and analysed for themes. The generated themes are then used to draw conclusion and verify the research questions posed for this study. The qualitative analysis of this secondary data was conducted using the help of a Computer Assisted Qualitative Data Analysis Software (CAQDAS), ATLAS.ti version 7, a qualitative data analysis application.

The third major step of the study's data analysis involves the connecting of both qualitative and quantitative results in order to see to what extent do the secondary qualitative data support, confirm, as well as enhance the primary quantitative data. In order to connect the results, the key findings of the qualitative data were presented in the form of a discussion and used to explain and support the study outcomes (Creswell & Plano Clark, 2011).

As my study used the sequential approach, the quantitative and qualitative data were analysed separately and were later connected to one another. The key decision in this connection between the two findings was to see how the qualitative data helped in explaining and supporting the quantitative findings (Creswell & Plano Clark, 2011). In this study, this connection was used to draw conclusions or inferences that in turn answered the research questions. This was achieved by looking at how qualitative results, using quotations or explanation of the category/theme, either 'confirms or disconfirms the quantitative results' (Creswell & Plano Clark, 2007). The section that follows

discusses the data analysis approach for the different data sources used in this study, namely the survey and the interview.

4.6 The Survey

The questionnaire for the survey in this study was administered using a repeated measures design during the process of data collection. The original questionnaire by Schraw and Dennison (1994), from which I have adapted, was aimed at having an in depth study of the respondents' metacognitive awareness. In comparison, the main objective of the survey for this study was to gauge whether there were any significance changes in the MAI score between the three stages of the surveys. The data obtained from the survey was used for the purposed of measuring whether there were any significant changes in their levels of metacognitive knowledge and regulation after participating in the e-space platform chosen for the study. This section will discuss the findings from the surveys conducted for the quantitative part of the study.

4.6.1 Findings of the pilot study and expert review of the metacognitive awareness inventory

A pilot study for the questionnaire used in this study was conducted using 44 student respondents chosen at random and were not the actual respondents chosen for the study. The Metacognitive Awareness Inventory (MAI) used for this study consisted of two sections, 1) knowledge of cognition and 2) regulation of cognition. These sections are also known as metacognitive awareness and strategies. A reliability analysis was conducted for all the items from both

sections of the questionnaire in order to compare the results and with the original MAI as intended by Schraw and Dennison.

For this study, the reliability analysis of the pilot study produced Cronbach alpha values for the two sections in the questionnaire as listed below:

a) Knowledge of cognition - .75
b) Regulation of cognition - .87

The values obtained were above the .70 cut off point stated by Hair et al (2009) giving the indication that the questionnaire was reliable. This gave me the confidence to proceed with the actual data collection and analysis processes. The data obtained from the survey administered at three stages during the study was used to quantitatively explore the pre-service teacher trainees' development of metacognitive awareness and strategies in ICT competency towards contemporary learning technologies. In accordance with the explanatory design of the study, the qualitative findings of the interviews were later used to support the quantitative survey results to form the overall understanding of the data analysed for the study.

Prior to establishing the reliability of the instrument, I decided to seek an expert's opinion in order to further establish the validity of the questionnaire items. An expert review was conducted by a professor from the same university where the study was carried out. His vast experience in the field of educational technologies and ICT enabled him to review the questionnaire in relation to metacognition and ICT competencies. He made a comparison between the adapted questionnaire and the original MAI by Schraw and Dennison. His

review indicated that the changes made kept the intention and purpose of the original MAI, which is to measure the level of metacognitive knowledge and regulation and should be suitable to be used in exploring metacognitive knowledge and regulation towards ICT competency in contemporary learning technologies.

4.6.2 Quantitative analysis procedure

Due to the small number of participants, I have decided to use the repeated measures design approach for my study. In order to statistically analyse the data collected from the repeated measures design approach for the present study, a repeated measures analysis of variance (rANOVA) was used. The analysis process was conducted using the SPSS (version 20) computer application.

Before the analysis was conducted using the SPSS application, all the three survey results were downloaded from Google Forms and converted to Excel format. From the Excel format, the data was imported into SPSS and the overall scores for each test were used for the repeated measures ANOVA.

Before proceeding with a multivariate test and descriptive analysis of the rANOVA, the Mauchly's test was conducted in order to check that the assumption of sphericity is met.

4.7 The interview

In order to further explore the issues discuss in this study, the views of the pre-service teacher trainees are seen as important to understand the extent of e-space

community's possibilities in developing the trainees' metacognitive strategies in learning technologies. These views, gathered from the qualitative data of this data, are crucial support the result of the quantitative component of the study. In Chapter 3, I have described in detail the processes of using quantitative and qualitative methods for the data collection of this mixed methods study. The survey analysis method used in this study as well as the results have been discussed in the previous section. This section will proceed to the discussion of this study's interview analysis method and its result.

4.7.1 An overview of the interview aims and respondents

This section will focus on the method used to analyse the qualitative data gathered during the interview sessions. As described earlier in Chapter 3, all interviews that were conducted for this study took place from December 2013 to April 2014. The interviews lasted between 30 minutes to 45 minutes on average. Interviews were the main qualitative data collection method used in this study. The purpose for conduction the interviews were to: (a) explore the extent of e-space possibilities in developing pre-service teacher trainees' metacognitive strategies in learning technologies and if any, (b) explore the strategies used by the trainees when utilising learning technologies for their learning.

The interview questions developed for the qualitative data collection were focused upon participants' views on metacognitive awareness and strategies used towards learning technologies in education and their utilisation of e-space

community in improving their ICT competency towards contemporary learning technologies.

4.7.2 Preparation of interview data for analysis

There were a total of 9 interviews transcribed. All interviews were transcribed verbatim using Microsoft Word format. Transcription symbols were used in the transcripts to indicate the interviewer, respondent, pauses, and inaudible word or phrases. The symbols used are as listed below:

I	Interviewer
R	Respondent
…	Pauses
()	Inaudible, i.e. words or phrases that could not be made sense of or heard clearly

The respondents were briefed on and had agreed that all interviews were to be conducted in English. There were, however, instances where respondents used languages other than English. In such instances, these words, phrases and expressions were transcribed in its original form. This was to preserve the essence of the expression but translations were provided in parentheses, next to the original words, phrases and expressions.

4.7.3 Qualitative analysis procedure

The purpose of coding for themes in the qualitative component of this study is to capture the existence or emergence of metacognitive strategies among the pre-service teacher trainees towards ICT competency in contemporary learning

technologies upon their involvements in the e-space community. The metacognitive strategies that I seek out the qualitative data are based on the model of metacognition as proposed by Brown (1979), namely: (1) Planning, (2) Monitoring and (3) Evaluating. Based on the review of literature discussed earlier in Chapter 2, any occurrence of these strategies will indicate that the e-space community is affecting the teacher trainees in their development of metacognitive strategies towards learning technologies competency.

To begin with, a set of priori codes, based on the literature review and the interview questions, were created for the thematic analysis of the qualitative data. These pre-set codes, derived from conceptual framework developed from the literature review and the interview questions, seek to explore the interviewees' development of metacognitive strategies upon participating in an e-space community. These also include codes that looked into the interviewees' perception on the e-space community instrument used for the study in relation to their experience in using learning and the virtual communities of practice (VCoP) that they were in. Focus on these categories were based from the conceptual framework drawn from the literature review of this study and helped my coding decisions by looking for particular themes.

During the process of analysing, emerging codes were also discovered and added to the list. These codes emerged from the category looking to support the results gathered from the online surveys. These codes and the themes derived from them helped to support the outcome of the quantitative data analysis.

Upon finishing all the interview sessions, I personally transcribed all the interviews using two applications. First of all, the application Express Scribe, version 5, was used to make the transcribing process easier and faster. All the digital audio files in MP3 format were transferred from the digital audio recorder unto a computer. Express Scribe provides very convenient shortcuts to handle audio file such as slowing, pausing and rewinding. These shortcuts help a lot in making the transcribing process more efficient. Microsoft Word 2013 is then used to digitally record and store all the transcription scripts typed while listening to the audio.

For this study, the Computer Assisted Qualitative Data Analysis Software (CAQDAS), ATLAS.ti version 7, was used to analyse all the transcripts. Once the transcribing process was done, all the transcripts were loaded unto ATLAS.ti for the coding process and theme analysis. The purpose of utilising the ATLAS.ti software was to speed up the process of coding and also to ease the process of categorising the codes as well adding any emerging codes to the list of priori codes. The function of linking codes was also utilised to see any connected codes and to look for emerging themes.

4.7.4 The interview coding process

In this section, I explain the interview coding process used to analyse the interviews conducted with the 9 respondents. The interviews questions focused on broad categories that relate to community of practice, virtual community of practice, metacognitive awareness and strategies used, knowledge of e-space

technologies and knowledge of learning technologies. I also noted all emerging broad categories and sub-categories discovered while reading through all the transcripts. Some of these emerging categories were found to be overlapping with the existing categories and were later merged within the broad and sub-categories.

In choosing the right coding process for the interviews, I referred to several coding approaches from existing literature. These literature highlighted several considerations for coding process and development of codes from interviews. Charmaz (2002) suggested that several questions need to be asked when starting the process of coding. These questions are 'What is going on? What are people doing? What are the people saying? What do the activities and statements undervalue? How do the structure and context support, preserve, hinder or vary these actions and statements?' (p.675-694). Mason (2002), however, proposed three levels data analysis, namely; literal, interpretation and reflexive. During the literal level, words, dialogues used, actions, setting and systems are identified. At the interpretation level, the analysis should focus upon the implicit norms, values and rules and also the manner in which respondents make sense of the phenomena. The last level, reflexive, observes the researcher's role in process and how this intervention affects data generation.

My interview coding process was based on Creswell's (2003) six steps approach to qualitative data analysis. Creswell's proposed steps are 'organisation and preparation of data for analysis, reading through the data to obtain a general sense of the information and reflecting on its overall meaning, coding, using the

coding process to develop a description of the setting, the people and the themes, explaining the manner in which the themes would be represented in the write up, interpreting ore giving meaning to the data' (p.191-195). Another approach came from Bryman (2008) who recommended several stages to the coding process. These recommendations include reading the transcript as a whole, rereading the text and identifying the labels for codes, coding the text and reviewing the codes and finally relating the general theoretical ideas to the text (Bryman, 2008: p.550-552).

In addition to the above approaches to coding process, I also referred to Bryman's (2008) thematic analysis approach to analyse my interview data. According to Bryman, thematic analysis is one of the most common approaches in analysing qualitative data, despite the fact that the approach lacks an 'identifiable heritage' (p.554) similar to the grounded theory of critical discourse analysis approaches.

I have also looked at Ryan and Bernard's (2003) theme identification recommendations to guide me in developing themes from the interview data. They suggested looking for repetitions, indigenous typologies or categories, metaphors and analogies, transitions, similarities and differences, linguistic connectors, missing data and theory related material (Ryan and Bernard, 2003).

Reference to code to theory approach as described by Saldana (2009) was also made to further enhance the process flow of analysing my interview data for themes. She proposed a very streamlined approach in analysing interview data,

starting from defining codes and categories to theory. Even though the end goal of the study was not to develop an original theory, Mason (2002) pointed out to using the approach to acknowledge preexisting theories that motivate a research.

Saldana (2009) also recommended that a researcher should predetermine a provisional list of codes in order to harmonize with a study's conceptual framework or paradigm. This will also enable an analysis that can directly answer a study's research questions and goals. Following this recommendation, I had prepared a set of priori codes in order to guide me in the interview analysis.

Priori codes created for the thematic analysis included codes looking at the interviewees' perception on the e-space community instrument used for the study. This was in relation to their experience in using learning and the virtual communities of practice (VCoP) that they were in. Focus on these categories were based from the conceptual framework drawn from the literature review of this study and helped my coding decisions by looking for particular themes.

My interview codebook consisted of all of the priori codes as well as emergent codes that were recorded and kept using ATLAS.ti 7, as mentioned in previous section. This codebook or also known as code list in ATLAS.ti, gave me an organised, efficient and systematic database of my codes that allowed me to very conveniently access and retrieve my codes and themes analyses.

The analysis of the interview data for my study was based on Creswell and Bryman's approaches to qualitative data analysis as well as Saldana's code to theory approach. The process began with the preparation of each interview's full transcription into a Microsoft Word document. Each Word document was then entered as a primary document in the ATLAS.ti 7 application as part of one Hermeneutic Unit (HU). Priori codes where then entered into the application and any relevant segments of the interview were marked and assigned to these codes. Along the way, any emerging codes from the reading of the interview transcriptions were also noted and added to the existing codes.

The next step was to go to a second cycle of coding where all the available codes were further analysed to look for any redundancies and similarities. For such instances, these codes were combined to reduce the number of codes. The remaining codes were then categorised into categories and sub-categories. These are then analysed for themes that helped me answer the issues raised in my study.

4.7.5 Interview analysis results overview

This section presents an overview of the result of the interview. The following section presents a detailed explanation of the codes and themes derived for each broad category.

4.7.5.1 Overview of codes and themes for each broad category

This section presents an overview of the codes and themes for the four broad categories explored qualitatively in this study. Table 4.2 illustrates the total number of codes and themes that emerged from the thematic analysis process.

Table 4.2: Total number of codes and themes derived

Broad Category	Sub-category	Codes Total	Number of themes	Themes total by broad category
Learners' involvement in the Virtual Community of Practice (VCoP)	Synchronous & asynchronous communication & learning	8	4	9
	Collaborative learning & knowledge construction	14	4	
	Learner centred interaction	6	1	
Indications of learners' metacognitive awareness and strategies towards learning technologies	Regulation of own learning	6	2	3
	No regulation of own learning	6	1	
Learners' ICT competency in contemporary learning technologies.	The knowledge of learning technologies	2	1	15
	The usage of learning technologies	14	6	

	The perception of learning technologies	9	4	
	The preference for learning technologies	7	4	

A total of 72 codes were obtained from the 9 transcripts representing the pre-service teacher trainees group. These codes were then grouped into 28 emerging themes in accordance to its broad categories. A total of 9 themes emerged from the broad category *Learners' involvement in the Virtual Community of Practice (VCoP)*. 3 themes emerged for the *Indications of learners' metacognitive awareness and strategies towards learning technologies* category, while *Learners' ICT competency in contemporary learning technologies* had 15 emerging themes. The section that follows will present the themes that emerged from the analysis of the interviews.

4.7.5.2 Overview of the interview results by broad category

This section presents the results of the interview conducted with the respondents of this study. The results of the interviews will be presented in accordance to the broad categories and sub-categories listed. The following table lists the themes that emerged from the interview analysis. The emerging themes are presented in accordance to the 3 broad categories and 9 sub-categories explored in this study.

Table 4.3: Emerging themes according to broad and sub-categories

Broad Category	Sub-category	Number of themes	List of themes
Broad category 1 Learners' involvement in the Virtual Community of Practice (VCoP)	Synchronous & asynchronous communication & learning	4	1. Preferences for communicating and learning outside of official VCoP 2. Preferences for communicating and learning using mobile applications 3. Constant online connection with peers only for communication purposes 4. Preferences for face-to-face interaction with peers in regards to learning
	Collaborative learning & knowledge construction	4	1. Preferences for face to face collaborative learning and knowledge construction 2. Preferences for collaboration with peers outside of official VCoP platform 3. Preferences for using mobile applications for collaborative learning and knowledge construction 4. Limitations of official VCoP platform as collaborative tool
	Learner centred interaction	1	1. Occurrences of learner centred interaction outside of official VCoP

Broad category 2 Indications of learners' metacognitive awareness and strategies towards learning technologies	Regulation of own learning	2	1. Minimal indicators of using metacognitive strategies 2. Unaware of using any particular strategies for learning technologies
	No regulation of own learning	1	1. Lack of strategies in utilising learning technologies
Broad category 3 Learners' ICT competency in contemporary learning technologies.	The knowledge of learning technologies	1	1. Aware of own capabilities or lack of capabilities in using learning technologies
	The usage of learning technologies	6	1. Usage of learning technologies only for educational requirement 2. Usage of learning technologies as per instructors' instructions only 3. Utmost preference to seek peers' assistance in using learning technologies 4. Lack of motivation to use learning technologies 5. Reluctance in utilising learning technologies 6. A trial and error approach in utilising learning technologies

	The perception of learning technologies	4	1. Impracticality of official learning technologies 2. Limitations of official learning technologies 3. Lack of visual appeal in attracting to the use of learning technologies 4. Cumbersomeness of official learning technologies
	The preference for learning technologies	4	1. Preferences for mobile technologies for learning 2. Preferences to seek peers' assistance in problems related to learning technologies 3. Preferences to seek online resources in problems related to learning technologies 4. Preferences for using unofficial e-space or online applications

The themes listed in table 4.3 will be discussed in further details, represented by evidence in the form of quotations from the various respondents, in the following segment of the chapter. Chapter 5 will merge these findings with the quantitative findings in accordance to the study's research questions.

PART 2: FINDINGS OF ANALYSIS

4.8 Findings of data analysis

This section presents the findings of the data as analysed. The findings are presented in accordance to the research questions posed for this study. Table 4.4 illustrates the source of the data analysis findings against the research questions to be answered for this study. The "X" represents the source of the findings for the research questions answered.

Table 4.4: Research questions answered vs. source of findings

RESEARCH QUESTIONS	FINDINGS	
	Survey	Interview
1. What is the current state of metacognitive strategies awareness among pre-service teacher trainees in using learning technologies?	X	
2. To what extent can e-space applications be used to develop pre-service teacher trainees' metacognitive strategies in using learning technologies?	X	X

4.8.1 Findings for Research Question 1

In this section, the survey results for this study were used to answer the first research question, *What is the current state of metacognitive strategies awareness among pre-service teacher trainees in using learning technologies?*

Following the analysis methods in a repeated measures design, the data were analysed using a repeated measures ANOVA with a within-subjects factor of subscale Pre-Test, Mid-Test, Post-Test).

First of all, before a repeated measures ANOVA can be conducted, the design requires some assumptions to be made in order to justify the use of the test and to prevent violations that can moderately to severely affect the findings. This is in accordance with all statistical analyses and the repeated measures design requires the Mauchly's Test of Sphericity to be conducted in order to meet the assumptions. Upon conducting the Mauchly's Test of Sphericity, the results showed that it was not significant, $\chi 2(2) = 2.564$, $p = .278$, indicating that the assumption of sphericity had not been violated. Since the sphericity assumption was not violated, a descriptive statistical analysis and a multivariate test were conducted as the next course of action in a repeated measures design data analysis

From the two tests conducted upon the quantitative data gathered through the study, the descriptive statistic was used to answer research question 1. The results from the descriptive statistic described the changes in the mean scores of the respondents' MAI tests over the course of the study. As shown in Table

4.2, the descriptive statistics for all three tests indicated a mean score of above 40 for all respondents for the results from all three tests; the Pre-Test (M = 44.47, SD = 5.386), Mid-Test (M = 44.63, SD = 7.239) and the Post-Test (M = 45.63, SD = 8.192).

Table 4.5: Descriptive analysis of the surveys

Descriptive Statistics

	Mean	Std. Deviation	N
Pre-Test Overall Score	44.47	5.386	38
Mid-Test Overall Score	44.63	7.239	38
Post-Test Overall Score	45.42	8.192	38

The mean scores for all the three surveys conducted at three different stages of the study revealed that the respondents scored high in the surveys administered to identify their level of metacognitive awareness and strategies. These results indicated current state of the respondents' metacognitive strategies awareness and suggest that they already possess knowledge of cognition and regulation of cognition prior to the study. However, it should be noted that there were no significant difference between the tests' mean scores based on all the three surveys administered during the study. This finding will be discussed in the next section as it is related to the answer for research question 2.

4.8.2 Findings for Research Question 2

This section will answer the second research question, *To what extent can e-space applications be used to develop pre-service teacher trainees'*

metacognitive strategies in using learning technologies? using both the survey results and the findings from the interview.

4.8.2.1 Research Question 2 – Surveys results

The second research question of the study was answered using both quantitative and qualitative data. Firstly, a repeated measures ANOVA was conducted for the three dichotomous quantitative data sets to compare the possibilities of e-space community effecting the pre-service teacher trainees' metacognitive strategies development before, during and after the intervention. As shown in Table 4.2, the analysis indicates that there are no significant difference between the Pre-Test (M = 44.47, SD = 5.386), Mid-Test (M = 44.63, SD = 7.239) and the Post-Test (M = 45.63, SD = 8.192). From the analysis also, it is discovered that there was not a significant effect of the e-space community upon the pre-service teacher trainees' development of metacognitive strategies, Wilks' Lambda = 0.989, F (2.36) = 0.20, p = .818.

These suggest that the participants' involvement in the iTa'LeEM as their e-space community did not have any effect on their development of their metacognitive strategies towards ICT competency in contemporary learning technologies. The quantitative findings also suggest that the similarities between the tests' mean scores from pre to post could mean that their metacognitive awareness and strategies in using learning technologies were not directly due to their involvement in the e-space platform chosen for this study.

4.8.2.2 Research Question 2 – Interview results

The interviews were conducted in order to further support the finding of the quantitative data analysis in answering Research Question 2. This was deemed necessary, as the quantitative findings alone were found insufficient to see the extent of e-space application in possibly developing pre-service teacher trainees' metacognitive strategies in using learning technologies. A secondary data set was required to further explore the outcome of the quantitative part of the study. This explains the need for a mixed methods approach and the qualitative method was introduced as a mean to support and enhance the quantitative findings.

The interview sessions were conducted in order to look into three broad categories discussed in this study. These were (1) Learners' involvement in the Virtual Community of Practice (VCoP), (2) Indications of learners' metacognitive awareness and strategies towards learning technologies and (3) Learners' ICT competency in contemporary learning technologies. *Learners' involvement in the Virtual Community of Practice (VCoP)* focused on understanding the pre-service teacher trainees' views on their involvements in the official platform for e-space used in this study, iTa'LeEM. This category was further divided into three sub-categories, namely (a) synchronous & asynchronous communication & learning, (b) collaborative learning & knowledge construction and (c) learner centred interaction.

The second category, *Indications of learners' metacognitive awareness and strategies towards learning technologies*, focused on the respondents' views of

their metacognitive awareness and strategies in utilising learning technologies. This category looked for any signs of the pre-service teacher trainees' knowledge and regulation of cognition or the lack thereof. This category was divided into two sub-categories, (a) regulation of cognition and (b) no regulation of cognition.

Learners' ICT competency in contemporary learning technologies is the final category addressed in the interview sessions. It focused on the pre-service teacher trainees' views of their own ICT competency in contemporary learning technologies. The category explored the interviewees' strengths and weaknesses in utilising technologies for their academic achievement. It was then divided into four sub-categories and these were (a) the knowledge of learning technologies, (b) the usage of learning technologies, (c) the perception of learning technologies and (d) the preference for learning technologies. Themes that emerged out of these categories are as presented in Table 4.3.

4.9 Discussion of findings

Chapter 5 discusses the major findings that are discovered from the results of the study. The theoretical framework discussed in Chapter 2 is used to support the major findings and relevant references will be made to literature and previous studies quoted in Chapter 2. The research questions developed for this study will provide the scaffolding structure for the discussion. The use of the research questions will enable discussion of the findings to be conducted in alignment to the way the results are presented in Chapter 4. The discussion focuses on these research questions:

1) What is the current state of metacognitive strategies awareness among pre-service teacher trainees in using learning technologies?
2) To what extent can e-space applications be used to develop pre-service teacher trainees' metacognitive strategies in using learning technologies?

Following the mixed methods design approach, the discussion will focus on the key findings of the quantitative results first, followed by the key findings of the qualitative results and at the end both findings will be merged in a discussion that illustrates how the qualitative findings supports the quantitative findings in answering the research questions.

4.10 Key findings of the survey in regards to the current state of metacognitive strategies awareness among pre-service teacher trainees in using learning technologies.

The results of the analysis of the survey helped in answering both research questions of this study. This section will discuss the key findings of the survey in answering the first research question of the study, where it is to identify the current state of metacognitive strategies awareness among pre-service teacher trainees in using learning technologies.

Firstly, in answering research question 1, the results revealed that the respondents scored high in the MAI. The mean scores of above 40, from a full score of 52, showed this for all the three tests. This suggests that even before participating in iTa'LeEM, the official e-space community of the university and

the platform used for this study, the pre-service teacher trainees already possess a certain level of metacognitive awareness and strategies towards ICT competency in contemporary learning technologies. These evidences of metacognitive awareness and strategies among the pre-service teacher trainees were found throughout the study as documented by the three surveys administered to the respondents. Prior to the start of the study, result of the pre-test survey with a mean score of above 40 had already shown evidence of existing metacognitive awareness towards contemporary learning technologies. This, again, suggests that the pre-service teacher trainees are indeed aware of their knowledge and regulation of cognition. Similar findings were obtained from the following two tests during the study, the mid-test and the post-test. All the respondents scored above 40 for the MAI during the mid-test and the post-test, indicating similar levels of metacognitive awareness and strategies among the pre-service teacher trainees upon comparison with the pre-test.

4.11 Key findings of the survey in regards to the extent of e-space community in developing pre-service teacher trainees' metacognitive strategies towards learning technologies.

The second research question of the study was answered using both quantitative and qualitative data. Firstly, quantitative data analysis was used to find out if there if there is significant difference between three tests administered throughout the study. Using this approach, I will be able to statistically confirm or disconfirm that the use of e-space community in this study is having any effect on the pre-service teacher trainees' development of metacognitive strategies towards ICT competency in contemporary learning technologies.

To help me statistically answer the second research question, a repeated measures ANOVA was conducted for the three quantitative data sets for the purpose of comparing the possibilities that an e-space community might or might not have in effecting the pre-service teacher trainees' metacognitive strategies development. These possibilities were to be tested before, during and after the intervention.

When the same survey was conducted through a repeated measures design and administered at the three stages of the intervention, the findings for the pre-test, mid-test and post-test showed no significance difference between the results of the three surveys. These findings seemed to suggest that the trainees' participations in iTa'LeEM did not have any significant effects in their development of metacognitive strategies towards ICT competency in contemporary learning technologies. Their involvement in the e-space community did not in any way increase their awareness of metacognitive strategies in learning technologies.

As shown in Table 4.2 from the previous chapter, the analysis indicated that there were no significant difference between the Pre-Test (M = 44.47, SD = 5.386), Mid-Test (M = 44.63, SD = 7.239) and the Post-Test (M = 45.63, SD = 8.192). From the same analysis, it was also discovered that there was not a significant effect of the e-space community upon the pre-service teacher trainees' development of metacognitive strategies, Wilks' Lambda = 0.989, F (2.36) = 0.20, p = .818.

Using the SPSS software version 20, the repeated measures ANOVA (rANOVA) conducted gave an indication that there was no statistically significant difference between the three test scores acquired at three different stages of the study. It could also be concluded that the differences between condition Means were most likely due to chance and not likely due to the Independent Variable manipulation. These again gave an indication that e-space community really did not have an effect on the pre-service teacher trainees' development of metacognitive strategies in learning technologies. Specifically, the study's results suggested that when the pre-service teacher trainees spent their time within an e-space community, it did not significantly help in developing their metacognitive strategies towards learning technologies.

In summary, it could be said that the results of the quantitative data analysis was neither statistically significant (via a multivariate test) nor practical substantial (via a descriptive statistic). The sample size chosen for this study was found to give a replicable result and was stable across sample. This finding will be discussed in the next section as it is related to the answer for research question 2.

4.12 Key findings of the interviews in regards to the extent of e-space community in developing pre-service teacher trainees' metacognitive strategies towards learning technologies

This section discusses the key findings of the interviews in answering Research Question 2. In order to find whether it was possible to develop pre-service

teacher trainees' metacognitive strategies towards ICT competency in contemporary learning technologies through e-space, the discussions are in accordance to the main categories and the sub-categories that follows.

4.12.1 Learners' involvement in the Virtual Community of Practice (VCoP)

This category was to look at how the pre-service teacher trainees view their involvement in the e-space platform used in this study. They were asked about activities that they do with their peers within the e-space environment and whether those contribute in improving their competency in using learning technologies.

From this main category, the interview focused on three sub-categories in order to find out the respondents' views on the e-space community platform that they were using for the study. These sub-categories highlighted (1) synchronous and asynchronous communication and learning, (2) collaborative learning and knowledge construction and (3) learner centred interaction.

4.12.1.1 Synchronous and asynchronous communication & learning

Four themes were derived from the first sub-category, synchronous and asynchronous communication and learning. These themes pointed out to two major factors in relation to the pre-service teacher trainees' communication and learning within iTa'LeEM as the e-space platform chosen for their module. The first factor indicates that the trainees were indeed online with their peers all the time. However, this was only due to communication purposes only. R2

commented on this factor when asked how long did she spend being online with her peers by simply saying, *Mm 24 hours (laughing)* (R2, D.U. 192) and R4 gave the same short answer, *Uhmm 24/7 (laughing)* (R4, D.U. 92). R1 elaborated by saying, *most of the time mmm mmm we're always on the phone, you know, Whatsapp and everything* (R1, D.U.165)

Yet, these consistent online interactions with their peers were not done through the official university's platform iTa'LeEM. They preferred using mobile applications on their smartphone such as WhatsApp, as indicated by R4, *Online.. okay. Yeah because…uhh.. ins... instead of Facebook, we use WhatsApp because uhh that's… that's the best solution for us to uhh..to discuss in a group* (R4, D.U. 102) and R3 *Every time. Using WhatsApp* (R3, D.U. 329), when asked their choice of tool for online communication with their peers. These responses gave the indication that even though they were always online with their peers, the interviewees revealed their preferences for being online outside of the official e-space platform (iTa'LeEM).

The second factor derived from themes from these sub-categories refers to the aspect of learning. It can be said that not much synchronous or asynchronous learning have occurred between the respondents and their peers from within the official VCoP, iTa'LeEM. They preferred to communicate and learn outside of the official platform, using mobile application. When asked about why they prefer to use mobile applications as well as on their actual usage of iTa'LeEM, R3 gave short answers such as, *We just use it with our lecturer (laughing)…that's very formal…because*

it's not inside our phone…yeah we need to log in (R3, D.U. 342-346) and R4 responded with, *Yeah just in the class (laughing)* (R4, D.U. 44 & 46).

Learning also was still preferred to be done through face to face interaction. This was mostly due to the convenience of meeting their peers physically, rather than using the official e-space platform. Even though they are mostly online with their peers using mobile applications such as WhatsApp, socialising was for the most part the only reason for the usage. R1 responded to the question asking whether the social mobile application was used for learning by saying, *Mmm...not really...with friends…social...purpose* (R1, D.U. 172-177). R4 gave a clearer explanation on the preference for not using iTa'LeEM for learning,

> *Uhmm I don't think so. I don't agree much because I prefer the face to face interaction between your friends because it, it is uhh different when you are typing something but the friend didn't know, the friend doesn't know your real intention of uhh saying that.*
>
> (R4, D.U. 68)

4.12.1.2 Collaborative learning & knowledge construction

The next sub-category looked at the collaborative aspect of learning and knowledge construction that might or might not occur from the learners' involvement in iTa'LeEM. Four themes, much similar to the previous sub-category, were derived and pointed out at three factors that refrained the learners from fully maximising the official VCoP platform.

These factors, i.e. preference for face to face interaction outside of the official platform, preference for using mobile platforms as well as the limitations of the official platform, affected the learners' decision in using the iTa'LeEM to the fullest of its capabilities. R1 agreed that learning in a group is better than on his own, *well, obviously in a groups.* (R1, D.U.129). However, whenever the learning involves e-space environment, he explained that mobile social applications gave a better option, mostly due to privacy.

> *Well, some points I think there are things that can be discussed in a WhatsApp group, in a Facebook group. So in a Moodle no... Lecturer, our instructor will will always ah can can they can like…monitor our conversations so there are things that we want we didn't want our lecturers to see so we prefer to use other social networks…*
>
> (R1, D.U. 187-189)

R2 pointed out the instability of iTa'LeEM as another reason for not choosing the platform as the collaborative tool with peers, *Mmm I think we still need traditional classroom until e-space is stable* (R2, D.U. 466).

The above reason also became a factor that directs learners' preference for face to face interaction as pointed out by R4 upon being asked if there is any collaborative learning and knowledge construction that occurs between peers, *There is, but I prefer to see the face...to see the facial expression* (R4, D.U.74-76). R1 gave a similar answer, *Face to face* (R1, D.U.235), indicating preference for a physical presence whenever there is a need for academic discussion.

4.12.1.3 Learner centred interaction

The last sub-category for the learners' involvement in the official VCoP refers to learner centred interaction. This looked at whether there are any occurrences of learner centred interaction inside iTa'LeEM. The findings from the survey resulted in a theme indicating that any learner centred interaction inside the official platform was very minimal and mostly formal in nature. Most of the learner centred interaction during the course of this study happened from outside iTa'LeEM. R1, R2, R3 and R4 acknowledged this factor where they pointed out that any online learning interaction occurred mostly from outside the formal platform. As noted by R2, *because if this is a formal platform, then we'll only access Moodle only for assignment and note taking* (R2, D.U. 434) and R3, *because it's not inside our phone* (R3, D.U. 345). The same factor was also pointed out by R4, who reiterated the preference for other platform, *We use Whatsapp because uhh that's… that's the best solution for us to uhh..to discuss in a group.* (R4, D.U.102)

4.12.2 Indications of learners' metacognitive awareness and strategies towards learning technologies

The second category looked into any indications of learners' metacognitive awareness and strategies towards learning technologies upon their participation in the official e-space platform of the university. The interview focused on two sub-categories with the aim of investigating for any sign of the respondents' metacognitive awareness and strategies employed upon their interactions with

learning technologies. These sub-categories seek clarifications from the respondents on whether or not there was (1) regulation of own leaning or (2) no regulation of own learning.

4.12.2.1 Regulation of own learning

This sub-category, regulation of own learning, revealed two themes that helped explained the respondents' awareness or strategies towards using learning technologies. There were very minimal indicators, if any, showing the application of metacognitive strategies in the utilisation of learning technologies in the respondents' learning. When R5 was asked about her strategies towards learning strategies, she explained:

> *First, hmm…Do some research on the internet; find some like ehmm ehmm what is all about. I mean in terms of the application then, maybe we can ask the teachers or someone expert. Just keep on, you know, do whatever we can to understand that.*
>
> (R5, D.U. 118)

R1 did not sound really sure of the strategies he used in approaching learning technologies, I only ask, seek my friend, my...my friend, someone who knows better about it (R1, D.U.51), while R4 commented that her only strategy is to do some study on her own before discussing any learning technologies with her peers for better understanding.

> *Okay... uhh usually before uhh a discussion we have to prepare ourselves reading uhh…reading about...uh the topic and then we meet to discuss uhh about it, so, uhh I have to study by myself first.*
>
> (R4, D.U. 130)

The second theme of this sub-category pointed out to the awareness of the respondents in using any particular strategies for learning technologies. Most respondents showed very minimal indicators towards this awareness. When asked whether or not he was awareness of any learning strategies employed towards learning technologies, R1 responded, *uh yeah I don't really actually realise when did I master this thing.* (R1, D.U.97).

R3 stated that she usually did what comes naturally to her, which is to search for information on any topic that she does not know and that includes learning technologies. However, she was unaware whether that can be called a strategy, *Yes, but I don't really call that my strategies. It's just naturally. Like when I did not know something I go to find it, search for it* (R3, D.U. 464) while R5 simply said, *just explore* (R5, D.U. 176) when asked what did she do upon instructed to use any learning technologies.

4.12.2.2 No regulation of own learning

The next sub-category for the indications of learners' metacognitive awareness and strategies towards learning technologies looked at the lack of regulation of own learning and the responds from the interviewees pointed out to a single theme which indicated that the respondents did not employ any specific strategies in utilising learning technologies. Almost all the respondents replied that they never refer to the manuals that usually accompany every technology, regardless for learning purposes or general purposes. R2 stated, *I rarely read the manual* (R2, D.U. 50), R1 claimed,

Oh no, I never read the manual (R1, D.U.49) and R4 simply replied, *No I don't read the manual* (R4, D.U.118).

Similar responds indicating the lack of regulation of their learning were recorded when the respondents were asked on what course of action taken upon being asked to present on or using learning technologies. When R3 was asked to clarify this matter, she replied, *so when I need to present that thing I just go back to that thing* (R3, D.U. 243) and what she usually does is to *go through the slides* (R3, D.U. 269). Respond from R4 also portrayed similar lack of preparation or regulation, *hmm…to be frank I don't usually prepare myself* (R4, D.U. 114)

From this category, the findings revealed that any signs of metacognitive strategies that indicated regulation of learning, namely planning, monitoring or evaluating were very minimally displayed and in most situation the respondents seems not aware of the said strategies or applications of them in their learning. Most respondents chose the action or approaches that they felt were necessary in helping them with learning technologies. These were done without much planning in advance, monitoring or evaluating the progress of learning during or after.

4.12.3 Learners' ICT competency in contemporary learning technologies.

The last category that helped answer the second research question looked into the pre-service teacher trainees' ICT competency in contemporary learning technologies. For this category, the interview protocol focused the trainees'

attention on four aspects in relation to contemporary learning technologies; (a) their knowledge, (b) usage, (c) perception and (d) preference.

These aspects were expanded into four sub-categories that guided the preparation of the interview protocol. These sub-categories were (1) the knowledge of learning technologies, (2) the usage of learning technologies, (3) the perception of learning technologies and (4) the preference for learning technologies.

4.12.3.1 The knowledge of learning technologies

The first sub-category looked into the pre-service service teacher trainees' knowledge of contemporary learning technologies. A singe theme emerged from the interview responses that indicated the respondents' awareness of their own capabilities or lack of capabilities in using learning technologies.

Almost all respondents gave similar statement stating that they usually will seek help from peers who are more knowledgeable in contemporary learning technologies. R1 stated;

> *Most of the time, I will seek my…seek consultations from my friends, err…my friends, err, some of my friends, they tend to know a lot of new things, kan (right)? So I tend to seek for their help from them.*
>
> (R1, D.U. 36)

R2 responded similarly, *and then emmm what I did was untuk (to) understand how that work emmm I ask my friend and then he explains and I tried* (R2, D.U. 62).

These statements suggested that the respondents most usually did not make any effort to learn or discover about contemporary learning technologies on their own. It was much easier for them to seek help from more knowledgeable peers.

4.12.3.2 The usage of learning technologies

The next sub-category aimed at understanding the pre-service teacher trainees' usage of contemporary learning technologies. Out of this sub-category, six themes were derived based on the interview findings. From all the respondents interviewed, all of them clarified the use of iTa'LeEM strictly for educational requirement and as instructed by the lecturers only. They mostly think that the official platform is too formal as stated by R2, *because if this is a formal platform, then we'll only access Moodle only for assignment and note taking* (R2, D.U. 434) and *... because it is required in the subject so whether I like it or not I must know how to use it so...*(R1, D.U. 105). R3 responded with similar statement, *we just use it with our lecturer. (laugh). That's very formal.* (R3, D.U. 342 & 343). The formal nature of the platform seems to deter users away from using it extensively and they seem to use merely for a particular course that requires the use of iTa'LeEM.

Another factor that influences the respondents' usage of learning technologies is their preference to seek help from their peers. Almost all of the respondents preferred to get assistance from peers whenever they came across problems regarding learning technologies. According to R4, *I just asked my friends, because if I read the manual it will take for days* (R4, D.U. 120) and R5 stated,

as for me, I'll ask my friends first. If they know and then I'll ask them to teach me. If both of us do not know and we go to the teacher. (R5, D.U. 120). R4 once again reconfirmed her statement on the same issue by simply saying, *Ask friends* (R4, D.U. 178). This factor seems to point out that the respondents would rather ask their friends to help learning about technologies rather than discover themselves, which would otherwise indicates a metacognitive process. Instead of searching for solutions themselves such as on Google, they took the simplest way and asked their peers.

The lack of knowledge and usage of the official e-space platform indicated a lack of motivation towards its utilisation. When the respondents were asked in regards to this lack of motivation, most respondents replied similarly to answers from previous categories. R2 stated, *ah too formal* (R2, D.U. 430) and R4 was asked on why she was not really interested in using the official platform, she replied;

> *... because I prefer the face to face interaction between your friends because it, it is uhh different when you are typing something but the friend didn't know, the friend doesn't know your real intention of uhh saying that.*
>
> (R4, D.U. 68)

Similarities of iTa'LeEM to other existing internet applications also contributed to the lack of motivation, as indicated by R2, *I could, I could collaborate in using Moodle with my friends...but emmm that...it's just...actually it's just the same as using emails* (R2, D.U. 336). The respondents did not really see the

need to utilise the official platform when there are already other existing applications that makes it easier for them to collaborate.

Some of the applications were already on their smartphone and were accessible at all times. This factor also contributed to the lack of motivation among the respondents towards the iTa'LeEM, as clarified by R3, *because it's not inside our phone…we need to log in* (R3, D.U. 345). This is also true in regards to using learning technologies for sharing digital documents between their communities of practice. While iTa'LeEM offers digital sharing functionality, by comparison the official platform lost due to ease of use of unofficial e-space applications, *but in terms of sharing the things...it's, it's not our main choice* (R1, D.U. 215)

In effect, this lack of motivation had resulted in the respondents' reluctance to use iTa'LeEM. As all courses require the utilisation of only official e-space platform of the university, few lecturers ventured out and used unofficial platform. The translated into learners not being exposed to many technologies targeted specifically for teaching and learning. Some students still referred to the library when looking for specific information involving their study and this was reflected by R4 when asked of her reluctance to use learning technologies for information seeking.

> *Uhmm…. I… don't use… the other initiative I don't use technology to study. But I use..uhh… the traditional way. I go to the library, and find some books and take hours to read*

it. And then uhh I go back to my room and then uhh then i only uhh search about the topic in the internet.

(R4, D.U. 152)

R2 raised the concern for iTa'LeEM's instability as one of the reasons for her being reluctance in using it, *it's just that we use Moodle but…however… when the Moodle itself is not stable...* (R2, D.U. 338)

However, despite the lack of motivation and reluctance of using iTa'LeEM, some courses still require the learners to utilise the official e-space platform. These pre-service service teacher trainees had no choice but to use the platform for mostly courses requirement or whenever their lecturers instructed them to. Some lecturers, by extension, would also require them to use other learning technologies related to courses being taught. When they were asked on the approach taken in utilising the learning technologies, all the respondents of the interview preferred a trial and error approach in learning how to use technologies dedicated for teaching and learning.

When of such approach towards learning technologies, R2 gave a direct answer, *haaa yes trial and error* (R2, D.U. 72) and when asked why he opted for such approach, R1 stated, ...*easier than reading the manual* (R1, D.U. 54). The same answer was recorded from R3, *I just play around with the medium first…trial and error* (R3, D.U. 237 – 239). R2 described in detail of her approach towards learning technologies and how she preferred the trial and error approach first before seeking help from online sources.

By...by...apa (what)...by getting familiar with it la...contohnya...for example...I never use an iPhone

before...amm macam (like) we, we get ourself familiar with this first and we emmm discover benda tu (the thing) one by one…but sometimes when, sometimes macam (like) I don't know aaa macam (like) something tiba-tiba ada macam (suddenly there are like) glitches and everything, I macam (like) just google, google helps a lot la.

(R2, D.U. 28-38)

4.12.3.3 The perception of learning technologies

In order to get the respondents' views on current learning technologies that they have or are using, the interviews focused on the next sub-category, which is the perception of learning technologies. Four themes were derived from the interviews' findings that highlighted several factors on how the respondents perceived learning technologies.

One of these factors is the respondents' perception on the impracticality of the official learning technologies. As stated by R2, *emmm depends because Moodle, we need a stable internet connection just like any other social website and everything...* (R2, D.U. 334). R2 once again reaffirmed her earlier statement in line 340, *then of course la we would prefer to use any other stable applications* (R2, D.U. 340).

The impracticality of the official e-space platform in effect limits the use of it for the pre-service teacher trainees in this study. Despite acknowledging the useful functions of iTa'LeEM, R3 explained that those functions are limited and are not good enough to be used extensively.

> *I think the use of forum is quite good but is just like to discuss our own opinion or views on certain matters. Like something urgent or maybe our lesson. But our lesson when we need immediate responds so Moodle is not good enough for us.*
>
> (R3, D.U. 442)

Another factor that gave iTa'LeEM a negative perception for the respondents was its lack of visual appeal. According to the respondents, the official platform was not attractive enough for them to use. Apparently, to some learners, the visual look of a platform or application plays an important role in attracting usage. This was noted by R2, *in order to attract students to use Moodle a lot, aaaa the interface of the Moodle itself must be eye-catching...you know informal...not like...aaaa...it doesn't have to be like a government portal* (R2, D.U. 426) and R4, *uhmm no... Because, if you arrange it nicely, then it would be easier for the students*. (R4, D.U. 60).

The final factor in regards to the respondents' perception towards the official learning technologies is the cumbersomeness of iTa'LeEM itself. Themes generated pointed out to how difficult it was for some respondents to access the platform. This factor in effect also contributed to the lack of motivation and reluctance of the users in using the platform as mentioned previously. R4 suggested that improvements are needed to make the official platform easier to access and appeals to users, *it need to be improved little more because uhh there's one semester I couldn't even get* (R4, D.U.54). R3, however, gave a general statement that technologies are difficult, *technologies troublesome* (R3, D.U. 115). This statement was also reflected by most of the respondents who found that most learning technologies are not easy to master.

4.12.3.4 The preference for learning technologies

After the respondents were asked questions regarding their knowledge, usage and perception of learning technologies, the last sub-category obtained views on their preferences towards learning technologies. The interview questions tried to find out what would the pre-service teacher trainees prefer when they are required to utilise learning technologies.

These findings from the interview highlighted four themes indicating the respondents' preferences in getting the best out of technologies for their learning. One major factor that can be derived from the themes is the respondents' preference for choosing mobile technologies over the official e-space application, iTa'LeEM. This is understandable as in the current digital trend, mobile devices are the most chosen devices for staying connected and consuming digital contents. Users have vast choices for the said purposes and would not go to the trouble of finding or going to a static device in order to access or manipulate digital content. As stated by R3, applications readily accessible on their mobile devices made it much easier for them to access digital content and environment, *using Whatsapp…to communicate…BBM* (R3, D.U. 329 – 333). R1 responded that iTa'LeEM did not help him much and whenever there was a requirement for e-space applications, he would prefer other mobile applications, *To be honest, it doesn't help much because yeah just like I said what I can see is that err I personally prefer to use other things than Moodle...* (R1, D.U.203).

In relation to preference towards learning technologies also, the findings showed that most respondents interviewed chose to seek peers' help upon facing problems related to learning technologies. This approach, as discussed in previous category, was preferred as it was much easier as compared to reading the manuals or finding online solutions. This was confirmed by R1, stating his preference for getting assistance from his more knowledgeable friends in regards to learning technologies.

> *Most of the time, I will seek my…seek consultations from my friends, err…my friends, err, some of my friends, they tend to know a lot of new things, kan? So I tend to seek for their help from them.*
>
> (R1, D.U.36)

However, the interview findings also suggested that online resources were the next preferred approach whenever the respondents faced problems with learning technologies. A few respondents would first go with trial and error approach, followed by peers' help and if both did not succeed they would seek solutions from online resources such as Google or YouTube. The most common approach, however, would be to go straight to friends who knew more about a particular learning technology and should their friends were not able to help, online resources would be the next solution.

R2 and R5 noted that they would just Google for information on learning technologies, *Just google, Google helps a lot* (R2, D.U. 38), *I get information easily, like Google* (R5, D.U. 202). R5 also would go to YouTube and find

related tutorials about specific learning technologies, *For me, I go to YouTube and watch the tutorial* (R5, D.U. 153).

Lastly, the interviews discussed about the respondents' preference for using unofficial e-space or online applications. This was another contributing factor for the pre-service teacher trainees' refusal to use iTa'LeEM. Despite the fact that they found iTa'LeEM to be useful in terms of learning, online applications such as popular social networks were still the preferred options, as stated by R1, *This is very useful but I think emmm most of the time we didn't use it that much as compare too other social networks* (R1, D.U.191) and R4 replied *Always* (R4, D.U. 64) when asked whether she used Facebook for group discussions.

4.13 Discussion of key findings

For the discussion of the key findings of this study, both gathered from the quantitative and qualitative data analysis, I will refer back to the conceptual framework of this study discussed in Chapter 2. These discussions of the findings will look at how the survey was used to answer the first research both research questions and how the interview was used to answer the second research question as well as to support the survey findings. The discussion will be approached from two perspectives, (1) the development of the respondents' metacognitive strategies towards learning technologies and (2) the effectiveness of the official e-space platform in developing the strategies.

4.13.1 Development of metacognitive strategies towards learning technologies

First of all, the conceptual framework elaborated on several elements that can help pre-service teacher trainees on e-space to develop their metacognitive strategies towards ICT competency in contemporary learning technologies. Some of these elements included (1) synchronous and asynchronous communication, (2) synchronous and asynchronous learning, (3) collaborative learning, (4) collaborative knowledge construction and (5) learner centred interaction. From the review of literature, it was found that these element when used within the trainees' zone of proximal development (ZPD) can help develop or increase each other's regulation of cognition, making them plan, monitor and evaluate their learning better. As stated by Shabani, Khatib and Ebani (2010), any task collaboratively performed by learners or guided by instructors will later be performed independently by each learner.

As a result, this process promotes the development of metacognitive strategies towards their learning. This is also in line with Vygotsky's (1978) notion of ZPD where it will help to define a learner's immediate, future learning. Within the ZPD, the trainees will contribute to each other's knowledge construction, adding to what others do not know and taking from what others already know (Awbi, Whalley & Philpott, 2015). This newly acquired knowledge will be added to existing schemata of a learner and this occurrence is a good evidence of both cognitive and social constructivism (Piaget, 1952; Vygotsky, 1978).

Evidences of Vygotsky's (1978) proposed Zone of Proximal Development (ZPD) can be seen from both, survey and interviews findings, where the respondents would prefer to work with peers concerning utilisation of learning technologies. This is in accordance with Vygotsky's theory of social constructivism where the ZPD placed peer interaction as an effective factor in learners' skill development. The occurrence of such interaction within the zone is crucial and act as the scaffoldings to shape learners' ability in achieving specific task (Vygostky, 1978; Wood, Bruner & Ross, 1976).

Schraw and Dennison's (1994) MAI allowed a study to gauge an individual's level of metacognitive awareness and strategies by interpreting the scores upon completing the survey. The higher the score, the higher is an individual's metacognitive awareness (knowledge of cognition) and metacognitive strategies (regulation of cognition). Based on the scores obtained from the surveys administered for this study, it can be intepreted that most respondents were only moderately aware of the strategies they employed upon using learning technologies. However, in practical, the interview disclosed that the use of metacognitive strategies towards learning technologies were very limited and restricted to only the same strategies, trial and error approach, peers' assistance and online resources. These strategies were also employed not in accordance to what was described by Flavell (1979) and Brown (1987) as metacognitive strategies. Schunk (2012) supported both Flavell and Brown in arguing that metacognitive activities or strategies include planning, monitoring and evaluating; behaviours employed to initiate self-regulation of learning.

The findings suggested that the respondents of the study did not display correct metacognitive strategies. The respondents' strategies in utilising learning technologies were taken out of a hunch and not planned ahead of using any particular technology. Without much planning, even as simple as reading the manual, they would simply try to use the technology and would then seek help from friends or online resources upon coming across obstacles in using the technology. This fact took away any indicator that the respondents were showing metacognitive awareness of their knowledge in learning technologies.

According to Schraw and Dennison (1994), any individual who possess the knowledge of cognition (metacognitive awareness) should then be able to regulate the said cognition (metacognitive strategies) by means of planning, monitoring and regulating. The two factors were strongly intercorrelated, indicating the ability to work in unison in helping an individual self-regulate their own learning (Schraw & Dennison, 1994). In order to improve performance, these strategies will enable the individual to plan, sequence and monitor their learning experience. By using a mixed method approach, this study was able to identify and confirm specifically any occurrence of metacognitive strategies upon participating in iTa'LeEM. Should the trainees use any of these strategies in iTa'LeEM, it could be an indicator that the e-space platform for this study did help develop the users' metacognitive strategies. However, these strategies were very minimally displayed by some of the participants and almost none existence to some others.

Phelps, Graham, Brenan and Carrigan (2006) outlined six strategies of using metacognition to potentially help boost educators' confidence and capability towards ICT. The metacognitive strategies proposed are 1) embedding discussion in staff meetings, 2) reflection sheets and scaffolds, 3) reflective journals, 4) visual displays and graffiti boards, 5) informal discussions and 6) video reflecting. These are strategies proposed based on the general metacognitive strategies; planning, monitoring and evaluating. However, except for informal discussions, the respondents of the study did not display other strategies to help increase their confidence and capability towards learning technology competency.

Findings of the survey had indicated no development of metacognitive awareness or strategies towards contemporary learning technologies such as were discussed and proposed in the literature review. While the scores obtained from the use of Schraw and Dennison's (1994) MAI indicated signs of moderate metacognitive awareness among the respondents, these were not due to the use of the e-space platform chosen for this study. Across the duration of the study, there were no significant increases in the development of the respondents' metacognitive awareness and strategies towards contemporary learning technologies were detected.

These findings were also supported by the qualitative findings from the interviews analysis. All the respondents agreed that the official e-space platform of the university where the study took place did not give any significant impact in increasing their ICT competency towards contemporary

learning technologies. In fact, any indications of metacognitive knowledge and regulation occurring happened from outside iTa'LeEM via unofficial e-space platforms as well as social networking and mobile applications. These were the environment where the respondents used the most to create their own VCoPs for collaborative learning.

4.13.2 Effectiveness of iTa'LeEM in developing metacognitive strategies

As discussed previously, the survey results did show evidences of metacognitive awareness among the subjects of the study, however, the awareness did not occur or resulted from the involvement of the subjects with their peers within the e-space community, which in this case is ITa'LeEM. From the repeated measures design analysis of the questionnaires answered by the subjects, it was found that the analysis was neither statistically significant (via a multivariate test) nor practical substantial (via a descriptive statistic). The sample size for the study also gave a replicable result and was found to be stable across sample. These quantitative findings were backed up by the themes generated from the qualitative analysis of the interviews.

Cohen (1998) argued that the stimulation of a learner's cognitive processes, taking it to a higher metacognitive awareness, can be the catalyst to the learners' ability to manage his or her own learning, reducing dependency on instructors. In the case of technology integration and metacognitive awareness, Wassilow (2009) pointed out that an effective implementation of technology in teaching and learning has the potential in helping today's educators becoming more metacognitive. Wassilow further explained that this approach can help boost

technology integration in teaching and learning by overcoming educators' feeling that they lack the skills and resources to utilise technology.

This was the aim of using iTa'LeEM as the e-space tool for this study. To create a VCoP from within the official e-space platform that in turn would potentially develop the subjects' metacognitive awareness and strategies in contemporary learning technologies. The respondents, despite help from their peers within the same community, experienced very little metacognitive awareness within the e-space community created specific for this study. Any occurrence of metacognitive strategies development happened mostly from outside of the e-space community in this study. In short, this seems to indicate that iTa'LeEM, as the official e-space platform of the university, was not effective in developing the subjects' metacognitive strategies towards contemporary learning technologies.

There were several factors that contributed to this conclusion. First of all, while evidences from the qualitative data had shown that there were CoP or VCoP activities going on, they were not happening within iTa'LeEM. The pre-service teacher trainees were more comfortable being on other external e-space platforms, such as Facebook and WhatsApp. This was especially true with WhatsApp, which is the preferred choice of communication between the trainees. To the trainees, iTa'LeEM was too formal, too cumbersome and too rigid to be used at all times. This evidence pointed out to the preference of using social networking applications that they can use and engage with their peers at

any time and applications that are always ready to be used without going through the process of login in like iTa'LeEM.

From this evidence also, it showed e-space applications, in general, did help in creating a community where the trainees can interact and engage in meaningful communication with their peers and this could lead to development of their metacognitive strategies awareness. However, the same manner of engagement, as what was happening when they were using Facebook or WhatsApp, did not occur on iTa'LeEM being the chosen e-space platform of the university. In the case of this study, the respondents had no choice but to use iTa'LeEM but only for formal or official uses of their studies. For other uses, including seeking peers' help in tackling issues with ICT competency and learning technologies, they would immediately go to their preferred e-space platform.

iTa'LeEM, the chosen e-space platform for the university and evaluated for this study, was found to be too rigid and detrimental to create an engaging virtual community of practice that would be crucial to the development of the pre-service teacher trainees' metacognitive strategies. This led the trainees to choose a different path by using social network applications a way around the rigidness of iTa'LeEM. It goes to show that e-space does work in developing their metacognitive strategies but instead of iTa'LeEM, they prefer a more liberal and flexible e-space platform such as Facebook or WhatsApp.

In regards to platform for collaborating, smartphones and their vast library of mobile applications played a very important role in shaping the respondents' mind set towards e-space. With the rapid development of mobile technology, users are no longer restricted to be in front of a desktop or laptop computer in order to access virtual environment. The Horizon Report (2010) illustrated how this new segment of computer technology is changing the way people deal with computing tools. The ability to be connected to a network wirelessly from virtual anywhere has attracted more and more people to embrace mobile computing. It is no longer a machine that has to be plugged in, switch on or log in. With mobile computing, access to internet and thousands of applications are readily available and this has created a tremendous appeal to consumers.

This fact, among others, was a huge contributing factor that push the pre-service teacher trainees away from the official e-space platform provided by the university. As an example, mobile computing reduced the number of steps it took for these trainees to access the internet or virtually collaborating with their peers, as compared to using iTa'LeEM. Together with the mobile applications simplicity and ease of use, these accumulated into mobile advantages that very rapidly overshadowing the disadvantages of the computer based nature of the official e-space platform.

In this study, it was likely that both internal and external factors had high influence on the development of the trainees' metacognitive strategies towards ICT competency in contemporary learning technologies. The internal factors, referring to the constraint and rigidness of iTa'LeEM, seemed to drive the VCoP

elsewhere. Due to these factors, members of the VCoP for this study (the pre-service teacher trainees) became reluctant to use the official e-space platform. Most of them found no strong motivation to fully utilise iTa'LeEM to their own advantage.

On the other hand, the external factors such as the flexibility of liberal social network applications and ease of use of mobile applications seemed to draw the VCoP away from iTa'LeEM. They found it easier to utilise the advantages of unofficial e-space platforms to collaborate with other members of the VCoP. These factors created a push and pull phenomenon from within the VCoP created by the module that the trainees were registered in, resulted in the official platform becoming ineffective as a medium to develop the pre-service teacher trainees' metacognitive strategies in learning technologies competency.

In conclusion, it can be summarized that e-space does has the potentials or possibilities to develop metacognitive strategies in learning technologies, however the choice of e-space platform as a tool to develop regulation of cognition must be taken into greater considerations. The wrong choice of e-space platform will have implications on learners' motivation in using the chosen platform as well as in creating an active virtual community of practice (VCoP) that can foster the development of metacognitive strategies among members.

Failure to take into considerations the right elements of an e-space platform needed to foster metacognitive awareness and strategies can result in users'

reluctance to use the targeted e-space platform. Choosing the right e-space platform that can be used to effectively develop users' metacognitive awareness and strategies towards ICT competency should take into considerations users' perceptions and preferences. This is to ensure a prolong use of the platform that in turn will create an effective VCoP where members are highly metacognitive.

4.14 Summary

This chapter focused on the discussions of the findings of this mixed methods study. The objective of the chapter was to first present the findings of the quantitative component first and to be supported by the qualitative component, following the order of the research questions posed for this study. This chapter then discussed the discussion of the findings using evidence in the form of quotations obtained from the interviews. The findings of Research Question 1 and Research Question 2 are the second focus of this chapter. The discussion of key findings for this chapter were compared to existing research and interpreted in accordance with the theoretical framework of the study. The following Chapter 5 concludes the study.

Chapter Five: Conclusion and recommendations

5.0 Chapter overview

This chapter represents the final part of this thesis. The chapter will first highlight on the significance of the study in understanding the effects of an e-space community towards teacher's ICT competency in learning technologies and its implications to the use of e-space in teaching and learning in Malaysia, Secondly, the chapter will also highlight the limitations of the study as well as the directions for future research.

5.1 Summary of the study

The primary intent of my study was to find out whether it is possible for an e-space community to develop metacognitive strategies in learning technologies among pre-service teacher trainees. The study involved a cohort of pre-service teacher trainees who used an e-space learning platform in their instructional technology module. Using an explanatory mixed methods research design, the study focused on how being in e-space community might or might not influence the teacher trainees in developing their metacognitive strategies towards ICT competency in contemporary learning technologies.

The core issues of this study revolve around these research questions:

1) What is the current state of metacognitive strategies awareness among pre-service teacher trainees in using learning technologies?

2) To what extent can e-space applications be used to develop pre-service teacher trainees' metacognitive strategies in using learning technologies?

These research questions originated from the general aim of the study in training future teachers who could possess the digital wisdom as proposed by Prensky (2001). This digital wisdom is crucial in ensuring that these future teachers are ready in teaching the future generations of learners who will be surrounded with far more advanced technologies for teaching and learning. As technologies now are seen as part of the requirement in enhancing teaching and learning, it is thus important for the pre-service teacher trainees of this study to independently master future technologies as extension of their teaching skills and not as a hindrance for their teaching.

In this study, I was exploring the steps that could be taken in order to instil digital wisdom into these future teachers. Based on my experience and extensive literature review, I discovered that possessing metacognitive awareness and strategies could make one's learning easier and structured. This includes learning about technologies used in education. Prior to the start of the study, I was confident that the result would show a significant difference in the respondents' MAI scores due to their involvement in iTa'LeEM. Based on the literature review, most studies would show that virtual learning environments could bring a significance effect to their users in the development of their metacognitive awareness and strategies.

Findings from the quantitative part of this mixed method study suggested that generally e-space applications did assist in the creation of a community in which the participants can interact and engage in meaningful communication. The findings also revealed that this approach seemed to provide a way for the participants to develop their metacognitive strategies awareness towards ICT competencies in contemporary learning technologies. However, upon further exploration in the qualitative part of the study, it was found that the interactions observed to indicate development of metacognitive strategies in learning technologies did not occur from within iTa'LeEM as the official e-space platform of the university.

The study used the qualitative part of the study to further support and expand the findings of the quantitative part and the qualitative findings managed to explain why there was no significant difference in the development of metacognitive strategies of the trainees upon using iTa'LeEM. The findings revealed external factors that played a role in developing and expanding different e-space communities outside of the scope of this study. The findings also revealed that the use of iTa'LeEM were only limited to formal or official use of the participants as they had no choice due to the module's requirement. For other uses not required by the module to use iTa'LeEM, the participants would immediately use their preferred e-space platform which they found more convenient to be used for the same purpose that iTa'LeEM offers. These include getting help from their peers in regards to issues with ICT competency and learning technologies.

The findings pointed out that this was mostly due to the rigidness and limitation of the university's official e-space platform. These factors hindered the development of an engaging virtual community of practice that was crucial to the development of the pre-service teacher trainees' metacognitive strategies. As an alternative, the trainees seek a different platform to counter the rigidness and limitation of iTa'LeEM. On the other hand, this indicated that e-space does work in developing their metacognitive strategies but instead of iTa'LeEM, users prefer a more liberal and flexible e-space platform such as Facebook or WhatsApp.

In general, the study observed that both internal and external factors played a significant role in the development of the trainees' metacognitive strategies towards ICT competency in contemporary learning technologies. The internal factor, the limitation and constraint of iTa'LeEM, drove the VCoP elsewhere while the external factor, the flexibility and openness of social network applications drew the VCoP away from the official e-space platform. In effect, both factors created a push and pull phenomenon from within the VCoP created by the module registered by the pre-service teacher trainees.

5.2 Pedagogical implications of the study

The following sections looks at the implications of the study on several aspects based on the outcome of the study. Starting with pedagogical implications, I believed that in order for an e-space platform used in any teaching and learning environment should place an emphasis on the use of metacognition as proposed by Flavell (1979) and Brown (1979).

The scope of the study focused only on the possible development of metacognitive strategies upon participating in an e-space environment. Despite the ability of the instrument used in this study to identity metacognitive awareness and strategies, neither specific nor explicit instruction of metacognitive strategies were introduced into the module material. Instructions that can lead to learners' use of metacognitive strategies within the e-space environment should be included to help them become good learners.

Specific or explicit instructions are important, as not every learner is automatically a good learner who has the ability to self-regulate their learning. Metacognitive instructions can help learners to develop deeper and better understanding of the module materials. A guide or a scaffolding towards knowing how to use metacognitive strategies will help the leaners in planning, monitoring and evaluating their own learning. When they actually apply the strategies in their learning, they may discover aspects of their own learning that they do not understand and will adapt by choosing the right strategies to help them understand.

The study implied that putting learners on an e-space platform to observe possible development of metacognitive strategies towards ICT competencies in contemporary learning technologies might not be sufficient. An approach where metacognitive instructions are explicitly included into the module would have better outcome and allows a researcher to get analyse more data for better findings.

5.3 Practical implications of the study

This chapter also looks at the practical implications of the study in relation how the outcome can be applied in practice. Data analysis of the study revealed that external factors have affected the pre-service teacher trainees' use of the intended e-space platform for this study. Even though this was not originally the scope of the study, it should be taken into consideration as the said factor played a significant role in the trainees' utilisation of the e-space platform meant for the possible development of metacognitive strategies.

Technologies for teaching and learning, especially for e-space environment are advancing so rapidly and making choosing one for the sole purposely of education a chore. This emphasise the need for digital literacy or wisdom as proposed by Higgins (2009), Prensky (2009) and Underwood (2009). In developing an e-space environment for any particular module, instructors or designers should take into consideration current and popular e-space platforms that are being used by any virtual communities of practice (VCoP). Any platform commonly or collaboratively being used by a VCoP, together with the current trend of utilising educational online applications, should be integrated into a module. This could create a better and deeper collaborative environment for learning as the learners are not forced to use any platform not preferred by them.

The proposed measure would be in line with the concept of constructivism as proposed by Piaget (1976) and Vygotsky (1978) for both cognitive and social constructivism. According to Vygotsky (1978), a better collaboration creates

stronger scaffolding towards enhancing learners' knowledge construction with the help of both their peers and instructors.

It is also proposed that the instructor plays the role of a moderator more in the e-space environment. As a follow up of the metacognitive instructions into the module as suggested in the pedagogical implications section, the instructors should provide better scaffolding to the learners as compared to their peers. By playing the role of a moderator, an instructor will be able to closely monitor the use or development of metacognitive strategies among the learners. This will provide better learning experience for the learners as the instructor is collaborating with them at a more personal level.

5.4 Limitations of study

There will always be limitations with every research conducted and the same goes for this study. Firstly, this study was limited to exploring the possible effects of an e-space community framework towards the development of metacognitive strategies in learning technologies among pre-service teachers. This is in order to see the possibilities of metacognitive strategies development at the end of the study and would it be able to increase the ICT competency in contemporary learning technologies among the subjects. The subjects' metacognitive awareness will not be assessed and the study will only look at the possible outcomes of metacognitive strategies development via their participation in the e-space community and the outcome of such development in terms of the increase of ICT competency in contemporary learning technologies.

Subjects of this study consist of pre-service teacher trainees who are required to enrol in instructional technology modules offered by the Institute of Education in the International Islamic University of Malaysia. The modules are compulsory as part of the requirement for the trainees to complete their bachelor degree in education. One module concerning learning technologies is selected for the purpose of this study. Several experts in selected fields will be involved in the study. In such case, generalisation will only be limited to the same study context.

The use of e-pace applications in the study only involves the creation of a virtual community in order to develop metacognitive strategies in learning technologies. This is to be achieved by incorporating the core metacognitive strategies (planning, monitoring, evaluating) into the current instructional technology syllabus via the virtual community and to see whether such move has any effect on the subjects' ICT competency in contemporary learning technologies. However, the researcher will not be able to control any internal or external factors that might or might not affect the subject's development of metacognitive strategies in learning technologies. It is also to be noted that I have no control over the module and it was used as is. It was also the requirement of the faculty that the module could only be carried out in a blended mode and not a hundred percent virtual or online. .

5.5 Directions for future research

For future research, the research design needs to be tweaked further to find significance. The e-space platform itself or the design of the program itself may need to be reviewed. Given the nature of this blended program, it is difficult to determine where the improvement come from, whether from the e-space community itself or from the participants' interaction with their peers, either in the classroom or outside of the e-space environment altogether. It is suggested that the study is to be replicated on a full virtual or online module to eliminate influence from external factors such as peers' interaction in the physical classroom.

Methodologically, instead of just conducting an explanatory research to explore the development of metacognitive strategies, similar research in the future should be conducted as a mixed method experimental study with longer timeframe and larger sample for a richer and more extensive data for evaluation. This should allow a research to better observe the participants and provide a control group for point of comparison.

Institutions also need to look at different ways of implementing and utilising official e-space platform such as Moodle so that learners' metacognitive awareness and strategies can be developed more effectively. It is suggested that metacognitive instructions are included into modules utilising e-space platforms and also to include metacognitive elements into e-space communities. It is hopeful that this metacognitive scaffolding is able produce positive or more comprehensive findings in future research.

5.6 Summary

The five chapters in this thesis explained the development of pre-service teacher trainees' metacognitive strategies towards ICT competency in learning technologies through the use of an e-space community framework. The study was conducted using a mixed methods research methodology and was guided by two research questions to explore the issue involving a group of pre-service teacher trainees as the respondents.

As an educator and researcher, this study has helped me understand the nature metacognitive awareness and strategies development involving e-space community and the limitations of e-space platform as a tool to develop metacognition. It is hoped that the findings of this study would provide educators and educational technologists in teacher training institutions in Malaysia as well as in the world useful insights to properly plan e-space technologies integration in order to maximise their capabilities in developing metacognitive awareness and strategies towards ICT competency in contemporary learning technologies.

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APPENDICES

The University of Nottingham
School of Education

PARTICIPANT INFORMATION SHEET

Project title Developing Metacognitive Strategies in Learning Technologies among Pre-Service Teacher Trainees through an E-Space Community Framework

An evaluation of developing metacognitive strategies in learning technologies among pre-service teacher trainees through an e-space community framework

You are being invited to take part in a research study to evaluate the development of metacognitive strategies in learning technologies among pre-service teacher trainees through an e-space community framework. The reason we have contacted you is because you have been selected to take part in the experiment for the above-mentioned evaluation. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Please ask Mohd Shukri Nordin if there is anything you do not understand or of you would like further information.

This study is designed to find out:

1) What is the current state of metacognitive strategies awareness among pre-service teacher trainees in using learning technologies?

2) To what extend can e-space applications be used to develop pre-service teacher trainees' metacognitive strategies in using learning technologies?

You will be asked to be part of an experiment that will be divided into 2 parts:

1. Online questionnaire – This will be created and conducted using Google Doc and a link to the questionnaire will be emailed to you. You will be asked to answer 52 items, assessing your metacognitive awareness towards your use of learning technologies. The questionnaire will be administered three times; at the beginning, middle and end of the semester.
2. Interview – Should you be selected, you will be asked to participate in two interviews. We will conduct the interview at the beginning and the end of the semester. The interviews will be digitally audio recorded.

All information obtained during the study will be confidential.

We hope that you feel able to help us with this study. If at any time you decide that you do not want to continue to take part in the study, you are free to withdraw.

If you would like to discuss anything further, please contact me at +60126920675 or via this email, kabx1msi@nottingham.edu.my.

Yours sincerely

Researcher's name Mohd Shukri Nordin

Supervisor's name Assoc. Prof. Dr. Ganakumaran Subramaniam

The University of Nottingham
School of Education

PARTICIPANT CONSENT FORM

Project title Developing Metacognitive Strategies in Learning Technologies among Pre-Service Teacher Trainees through an E-Space Community Framework

Researcher's name Mohd Shukri Nordin

Supervisor's name Assoc. Prof. Dr. Ganakumaran Subramaniam

- I have read the Participant Information Sheet and the nature and purpose of the research project has been explained to me. I understand and agree to take part.
- I understand the purpose of the research project and my involvement in it.
- I understand that I may withdraw from the research project at any stage and that this will not affect my status now or in the future.
- I understand that while information gained during the study may be published, I will not be identified and my personal results will remain confidential.
- I understand that I will be audio recorded during the interviews.
- I understand that data will be stored in the form of mp3 audio files, electronic copies of transcripts, Google Docs and Moodle logs. These are stored in the researcher's laptop and accessible by him and his supervisor only.
- I understand that I may contact the researcher or supervisor if I require further information about the research, and that I may contact the Research Ethics Coordinator of the School of Eduction, University of Nottingham, if I wish to make a complaint relating to my involvement in the research.

Signed ..... (research participant)

Print name ..... **Date** .....

Contact details

Researcher: Mohd Shukri Nordin
+6 (012) 6920675, kabx1msi@nottingham.edu.my,

Supervisor: Assoc. Prof. Dr. Ganakumaran Subramaniam
+6 (03) 8924 8691, Ganakumaran.Subra@nottingham.edu.my

School of Education Research Ethics Coordinator:
educationresearchethics@nottingham.ac.uk



Edit this form

Metacognitive Strategies for Learning Technologies

This form is to test the awareness towards metacognitive strategies in using learning technologies.

* Required

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Background Information

Gender *

This is a required question

Age *

When do you expect to graduate as a candidate teacher? (Year and number of month) *

(Year and number of month - YYYYMM)

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Metacognitive Strategies for Learning Technologies

* Required

Metacognitive Awareness Inventory

Please check True or False where appropriate

1. I ask myself periodically if I am meeting my goals in using learning technologies. *

- ☐ True
- ☐ False

2. I consider several alternatives to a learning technologies problem before I decided on a solution. *

- ☐ True
- ☐ False

3. I try to use strategies that have worked in the past in using learning technologies. *

- ☐ True
- ☐ False

4. I pace myself while using learning technologies in order to have enough time. *

- ☐ True
- ☐ False

5. I understand my intellectual strengths and weaknesses in regards to learning technologies. *

- ☐ True
- ☐ False

6. I think about what I really need to learn before I begin using learning technologies. *

- ☐ True
- ☐ False

7. I know how well I did once I finish using a learning technology. *

- ☐ True
- ☐ False

8. I set specific goals before I begin using learning technologies. *

- ☐ True
- ☐ False

9. I slow down when I encounter important information in learning technologies. *

- ☐ True
- ☐ False

10. I know what kind of information is most important to learn in learning technologies. *

- ☐ True
- ☐ False

11. I ask myself if I have considered all options after I solve a problem in using learning technologies. *

- ☐ True
- ☐ False

12. I am good at organizing information in regards to learning technologies. *

- ☐ True
- ☐ False

13. I consciously focus my attention on important information

in regards to learning technologies. *

- ☐ True
- ☐ False

---

14. I have a specific purpose for each strategy I use for utilising learning technologies. *

- ☐ True
- ☐ False

---

15. I learn technologies best when I know something about the learning technologies. *

- ☐ True
- ☐ False

---

16. I know what the teacher expects me to learn in regards to learning technologies. *

- ☐ True
- ☐ False

---

17. I am good at remembering information concerning learning technologies. *

- ☐ True
- ☐ False

---

18. I use different learning strategies depending on the situation when I utilise learning technologies. *

- ☐ True
- ☐ False

---

19. I ask myself if there was an easier way to do things after I finish using a learning technology. *

- ☐ True
- ☐ False

---

20. I have control over how well I learn in regards to learning technologies. *

☐ True
☐ False

21. I periodically review to help me understand important relationships in learning technologies. *

☐ True
☐ False

22. I ask myself questions about the learning technologies before I begin. *

☐ True
☐ False

23. I think of several ways to solve a problem involving learning technologies and choose the best one. *

☐ True
☐ False

24. I summarize what I've learned after I finish using learning technologies. *

☐ True
☐ False

25. I ask others for help when I don't understand something about learning technologies. *

☐ True
☐ False

26. I can motivate myself to learn learning technologies when I need to. *

☐ True
☐ False

27. I am aware of what strategies I use when I study on how to use learning technologies. *

☐ True
☐ False

28. I find myself analyzing the usefulness of strategies while I use learning technologies. *

- ☐ True
- ☐ False

29. I use my intellectual strengths to compensate for my weaknesses in understanding learning technologies. *

- ☐ True
- ☐ False

30. I focus on the meaning and significance of new information on learning technologies. *

- ☐ True
- ☐ False

31. I create my own examples to make information on learning technologies more meaningful. *

- ☐ True
- ☐ False

32. I am a good judge of how well I understand learning technologies. *

- ☐ True
- ☐ False

33. I find myself using helpful learning strategies for learning technologies automatically. *

- ☐ True
- ☐ False

34. I find myself pausing regularly to check my understanding of learning technologies. *

- ☐ True
- ☐ False

35. I know when each strategy I use will be most effective in using learning technologies. *

- [ ] True
- [ ] False

36. I ask myself how well I accomplish my goals once I'm finished using learning technologies. *

- [ ] True
- [ ] False

37. I draw pictures or diagrams to help me understand while learning about learning technologies. *

- [ ] True
- [ ] False

38. I ask myself if I have considered all options when solving a learning technologies problem. *

- [ ] True
- [ ] False

39. I try to translate new information on learning technologies into my own words. *

- [ ] True
- [ ] False

40. I change strategies when I fail to understand learning technologies. *

- [ ] True
- [ ] False

41. I use the organizational structure of the learning technology to help me learn. *

- [ ] True
- [ ] False

42. I read instructions carefully before I begin using learning

technologies. *

☐ True
☐ False

---

43. I ask myself if what I'm using (a technology) is related to what I already know. *

☐ True
☐ False

---

44. I re-evaluate my assumptions on a learning technology when I get confused. *

☐ True
☐ False

---

45. I organize my time to best accomplish my goals in using learning technologies. *

☐ True
☐ False

---

46. I learn more when I am interested in any particular learning technology. *

☐ True
☐ False

---

47. I try to break understanding a learning technology down into smaller steps. *

☐ True
☐ False

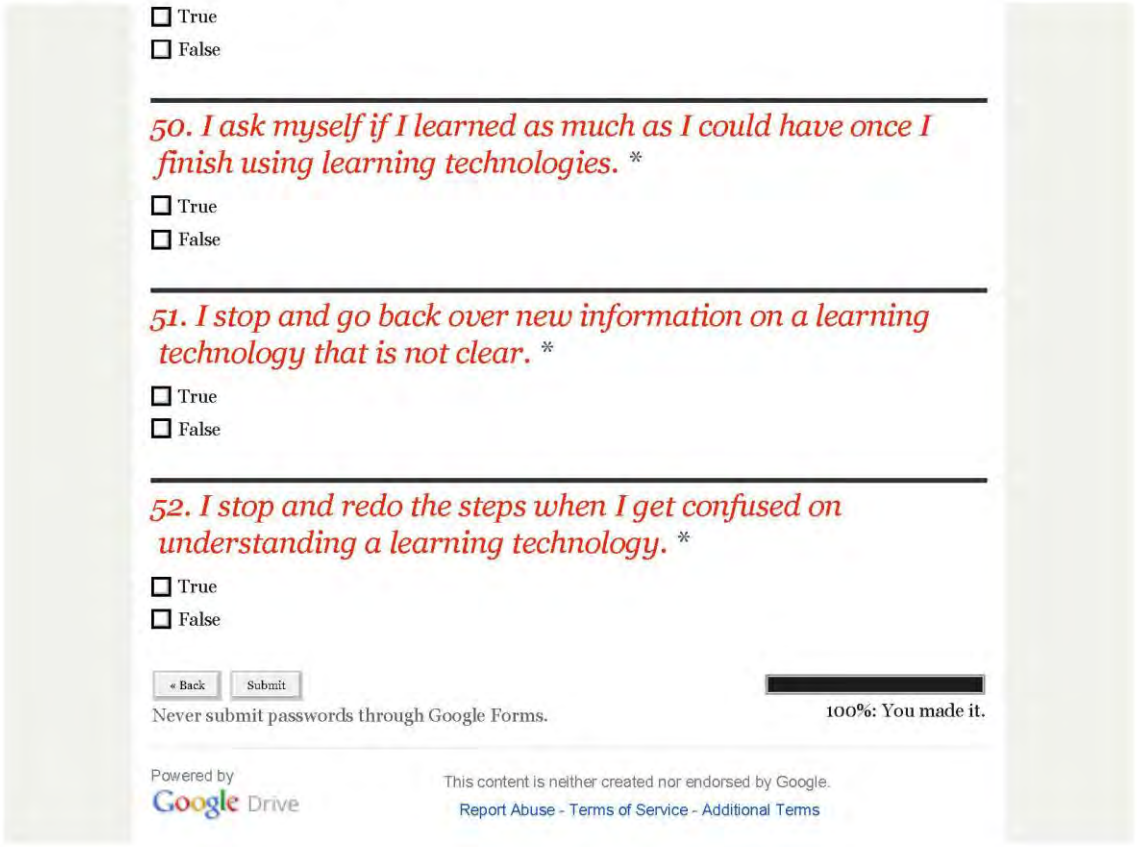
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48. I focus on overall meaning of a learning technology rather than specifics. *

☐ True
☐ False

---

49. I ask myself questions about how well I am doing while learning something new about learning technologies. *



☐ True
☐ False

50. I ask myself if I learned as much as I could have once I finish using learning technologies. *

☐ True
☐ False

51. I stop and go back over new information on a learning technology that is not clear. *

☐ True
☐ False

52. I stop and redo the steps when I get confused on understanding a learning technology. *

☐ True
☐ False

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Interview Protocol

Project:	Interview for the development of pre-service teacher trainees' metacognitive strategies in using learning technologies through the use of e-space applications.
Time of interview:	
Date:	
Place:	
Interviewer:	Mohd Shukri Nordin
Interviewee:	

I. Description of research project including issues of confidentiality, process of the data gathering, and participant ability to withdraw at any point. Consent form.

II. Questions:

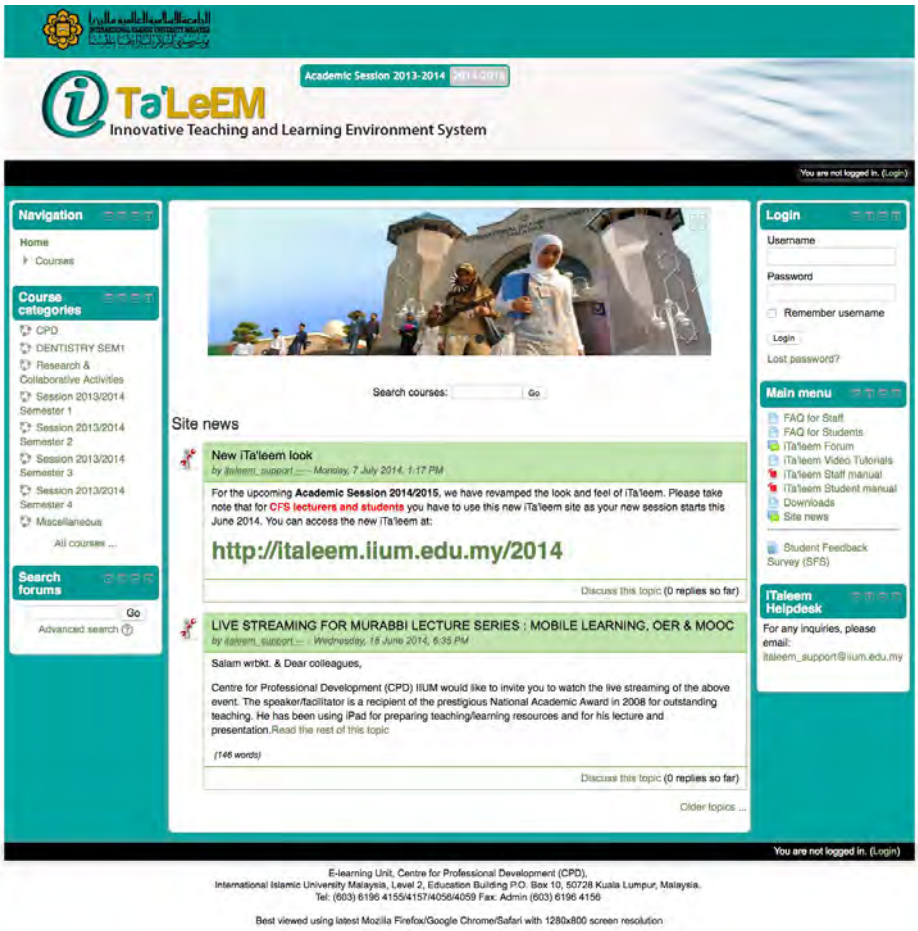
Learning Technologies:

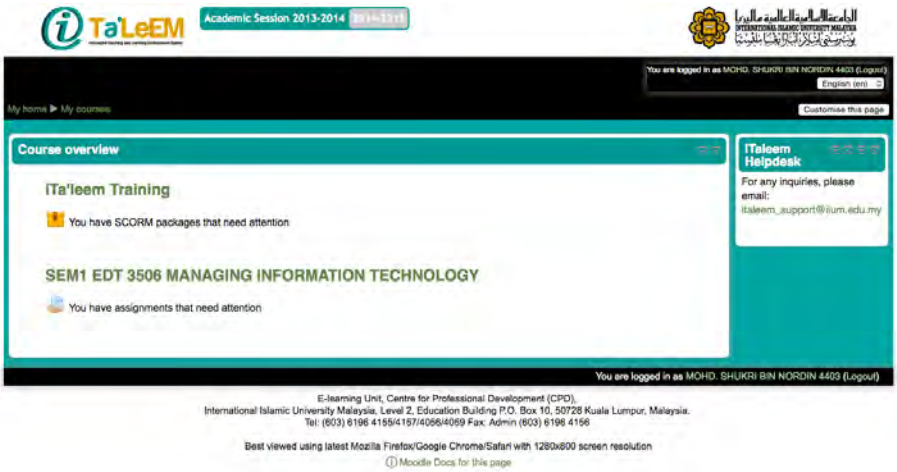
1. Tell me a little about yourself. [What kind of background in learning technologies do you have, especially in computer use or Internet?]
2. So far, what do you like best, or what has been easiest for you? [In regards to learning technologies]
3. How do you prepare to use learning technologies?
4. What helps you learn technologies best?
5. What are some of the things you do in order to learn new learning technologies?
6. If a learning technology seems difficult, what steps do you take to understand it?
7. How do you know if or when you are learning something?
8. How do you know if you have learned it?
9. How do you start to study when you have been given an assignment involving learning technologies?

10. How do you study for learning technologies tests?
11. Do you find learning new learning technologies challenging? Could you explain?
12. Do you find discovering about learning technologies easier on your own or together with your peers?
13. How do your peers help you in regards to learning technologies?

eSpace Applications:

1. How many hours do you roughly spend online?
2. How many hours do you roughly spend online with your peers?
3. Do you discuss about learning technologies with your peers online?
4. Have you used any online applications before? [Prezi, Google Drive, Dropbox]
5. Have you used any e-space applications before? [such as LMS, Moodle, WebCT, Blackboard]
6. If yes, do you think such e-space applications such as Moodle makes it easy for you to discuss learning technologies?
7. Do you find being online makes it easier for you to discuss and share resources with your peers?
8. Do you think using Moodle can help you be better at learning technologies?
9. Do you think using Moodle with your peers makes your use of learning technologies better? How so?
10. What is your opinion on collaborative work using Moodle?
11. Do your interactions with peers in Moodle help you in strategizing your use of learning technologies?
12. Compare between the start of the class and now, do you think you've improved your knowledge on learning technologies through Moodle?

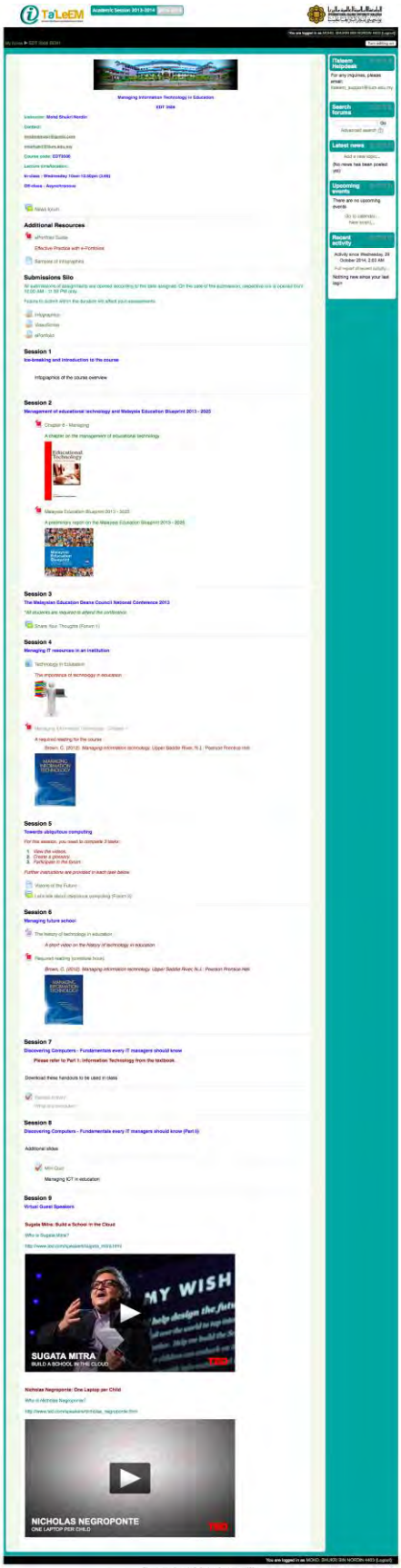

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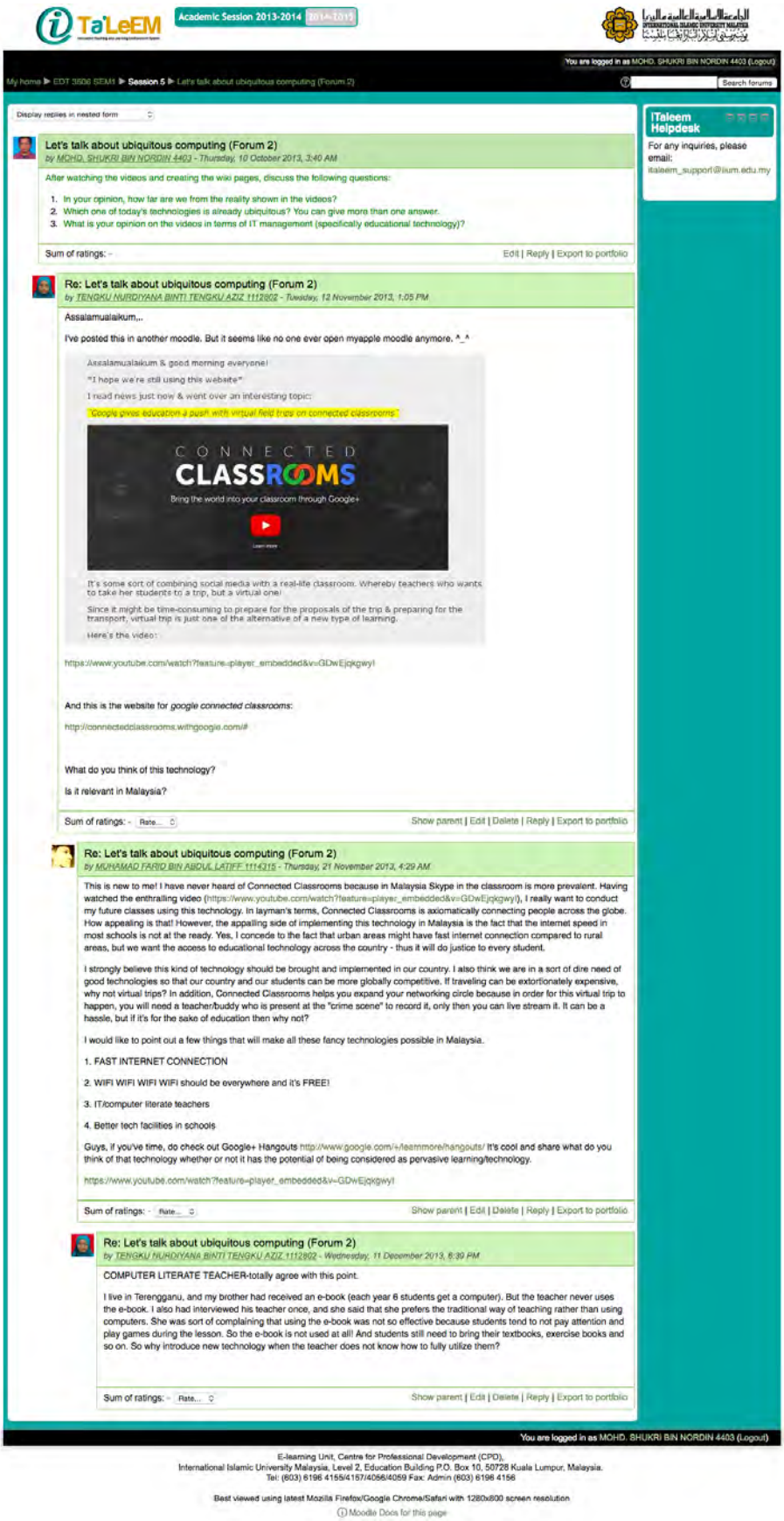


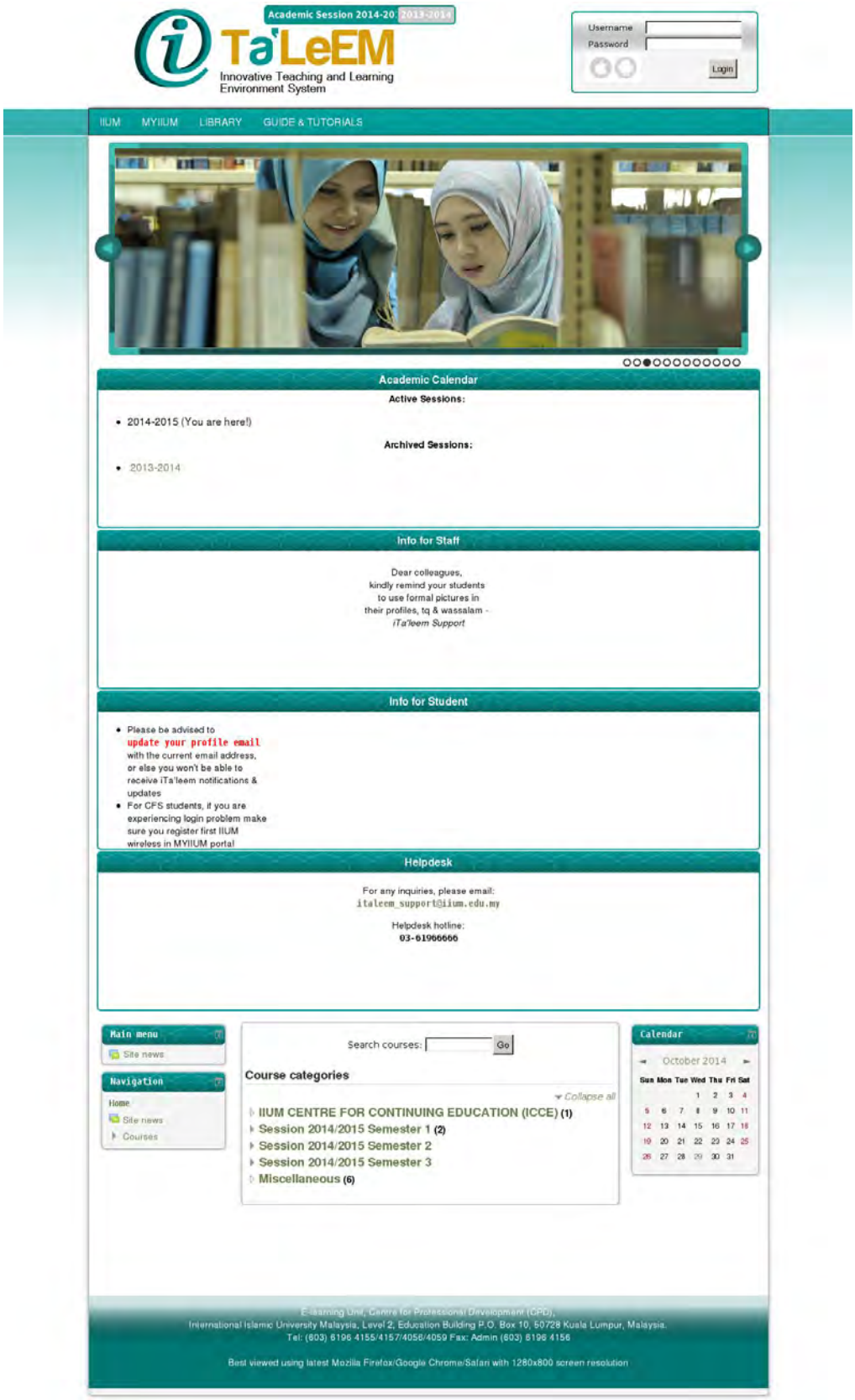
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Session 2
Management of educational technology and Malaysia Education Blueprint 2013 - 2025
Session 3
The Malaysian Education Deans Council National Conference 2013
Session 4
Managing IT resources in an institution
Session 5
Towards ubiquitous computing
Session 6
Managing future school
Session 7
Discovering Computers - Fundamentals every IT managers should know
Session 8
Discovering Computers - Fundamentals every IT managers should know (Part II)
Session 9
Virtual Guest Speakers
Sugata Mitra: Build a School in the Cloud
SUGATA MITRA
BUILD A SCHOOL IN THE CLOUD
Nicholas Negroponte: One Laptop per Child
NICHOLAS NEGROPONTE
ONE LAPTOP PER CHILD


Ta'LeEM
Academic Session 2013-2014
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Let's talk about ubiquitous computing (Forum 2)
by MOHD. SHUKRI BIN NORDIN 4403 - Thursday, 10 October 2013, 3:40 AM
After watching the videos and creating the wiki pages, discuss the following questions:
1. In your opinion, how far are we from the reality shown in the videos?
2. Which one of today's technologies is already ubiquitous? You can give more than one answer.
3. What is your opinion on the videos in terms of IT management (specifically educational technology)?
Sum of ratings: -
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Re: Let's talk about ubiquitous computing (Forum 2)
by TENGKU NURDIYANA BINTI TENGKU AZIZ 1112802 - Tuesday, 12 November 2013, 1:05 PM
Assalamualaikum,..
I've posted this in another moodle. But it seems like no one ever open myapple moodle anymore. ^_^
Assalamualaikum & good morning everyone!
"I hope we're still using this website"
I read news just now & went over an interesting topic:
"Google gives education a push with virtual field trips on connected classrooms"
CONNECTED
CLASSROOMS
Bring the world into your classroom through Google+
It's some sort of combining social media with a real-life classroom. Whereby teachers who wants to take her students to a trip, but a virtual one!
Since it might be time-consuming to prepare for the proposals of the trip & preparing for the transport, virtual trip is just one of the alternative of a new type of learning.
Here's the video:
https://www.youtube.com/watch?feature=player_embedded&v=GDwEjqkgwyI
And this is the website for google connected classrooms:
http://connectedclassrooms.withgoogle.com/#
What do you think of this technology?
Is it relevant in Malaysia?
Sum of ratings: - Rate...
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Re: Let's talk about ubiquitous computing (Forum 2)
by MUHAMAD FARID BIN ABDUL LATIFF 1114315 - Thursday, 21 November 2013, 4:29 AM
This is new to me! I have never heard of Connected Classrooms because in Malaysia Skype in the classroom is more prevalent. Having watched the enthralling video (https://www.youtube.com/watch?feature=player_embedded&v=GDwEjqkgwyI), I really want to conduct my future classes using this technology. In layman's terms, Connected Classrooms is axiomatically connecting people across the globe. How appealing is that! However, the appalling side of implementing this technology in Malaysia is the fact that the internet speed in most schools is not at the ready. Yes, I concede to the fact that urban areas might have fast internet connection compared to rural areas, but we want the access to educational technology across the country - thus it will do justice to every student.
I strongly believe this kind of technology should be brought and implemented in our country. I also think we are in a sort of dire need of good technologies so that our country and our students can be more globally competitive. If traveling can be extortionately expensive, why not virtual trips? In addition, Connected Classrooms helps you expand your networking circle because in order for this virtual trip to happen, you will need a teacher/buddy who is present at the "crime scene" to record it, only then you can live stream it. It can be a hassle, but if it's for the sake of education then why not?
I would like to point out a few things that will make all these fancy technologies possible in Malaysia.
1. FAST INTERNET CONNECTION
2. WIFI WIFI WIFI WIFI should be everywhere and it's FREE!
3. IT/computer literate teachers
4. Better tech facilities in schools
Guys, if you've time, do check out Google+ Hangouts http://www.google.com/+/learnmore/hangouts/ It's cool and share what do you think of that technology whether or not it has the potential of being considered as pervasive learning/technology.
https://www.youtube.com/watch?feature=player_embedded&v=GDwEjqkgwyI
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Re: Let's talk about ubiquitous computing (Forum 2)
by TENGKU NURDIYANA BINTI TENGKU AZIZ 1112802 - Wednesday, 11 December 2013, 8:39 PM
COMPUTER LITERATE TEACHER-totally agree with this point.
I live in Terengganu, and my brother had received an e-book (each year 6 students get a computer). But the teacher never uses the e-book. I also had interviewed his teacher once, and she said that she prefers the traditional way of teaching rather than using computers. She was sort of complaining that using the e-book was not so effective because students tend to not pay attention and play games during the lesson. So the e-book is not used at all! And students still need to bring their textbooks, exercise books and so on. So why introduce new technology when the teacher does not know how to fully utilize them?
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Session 2014/2015 Semester 1 (2)
Session 2014/2015 Semester 2
Session 2014/2015 Semester 3
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