MONASH University

UNDERSTANDING HOW TEACHERS LEARN TO INTEGRATE DIGITAL TECHNOLOGIES THROUGH COMMUNITIES OF PRACTICE

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Declaration

This thesis contains no material that has been accepted for the award of any other degree or diploma in any educational institution and, to the best of my knowledge and belief, it contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

This research has received the approval from the Monash University Human Research Ethics Committee (MUHREC) for project number CF10/3003-2010001652.

Siti Nazuar Sailin 8 January 2018

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Abstract

Teachers in Malaysian schools are expected to meaningfully integrate digital technologies in their teaching. Nevertheless, despite considerable funding for over a decade, integration of digital technologies in the classroom continues to be limited. This qualitative case study has investigated this problem using a socio-cultural framework, namely Communities of Practice, to understand how ten teachers in a Malaysian Smart School learn to integrate digital technologies. This thesis focuses on how teachers' participation in school's communities of practice (CoP) influences their digital technologies integration in the classroom. In particular, this study explores the roles of mutual engagement, joint enterprise and shared repertoire in mediating teachers' integration of digital technologies. This study also explores the role of identity formation in shaping teachers' digital technologies integration and the role of brokers for improving teachers' digital technologies integration within the school's CoP.

Analysis of data confirmed that teachers, in their negotiation of joint enterprise, were involved in mutual engagement and developed a shared repertoire of strategies within their localised CoP. However, membership in CoP is not homogeneous, therefore, social and cultural factors, such as teachers' beliefs and values, institutional needs and pressures have caused variations in their response and how they reified their actions towards the negotiated enterprise of integrating digital technologies. The findings also revealed multiple factors that influenced teacher's identity formation in the school's CoP for integrating digital technologies. These include teacher's trajectories of learning and their negotiated experiences. Teacher's learning trajectories and experience shaped their attitudes, values and beliefs towards digital technologies, as well as their motivation to integrate digital technologies. In their identity formation, teachers built upon their competency and knowledge about digital technologies. These factors shaped their identity in becoming teachers who are capable of integrating digital technologies successfully in teaching and learning. The role of ICT leaders in a school's CoP is very important in brokering practices. It was found that ICT leaders were able to empower teachers' mutual engagement, joint enterprise and shared repertoire to integrate digital technologies. They were able to broker practice across communities such as by introducing new knowledge and skills related to digital technologies to teachers from

different departments within the school. This was shared and developed with other teachers' CoP through a range of training programmes and informal discussions.

The findings reaffirm Wenger's (1998) conception of mutual engagement, joint enterprise and shared repertoire as important elements to sustain learning within a situated environment. In this study, it was found that teacher's negotiation of the joint enterprise, their mutual engagement and shared repertoire of strategies for integrating digital technologies shaped their identity for successfully integrating digital technologies in the teaching and learning practice. By using the sociocultural theory of Communities of Practice that centres on social participation and identity formation (Lave & Wenger, 1991; Wenger, 1998), we can better understand how teachers negotiate their technology integration practices. The findings of this study highlight the importance of community learning in a situated environment to develop and sustain social practices and focused learning. This study has found that participation in school's CoP and teachers' localised CoP can provide the necessary support to improve teacher's learning to integrate digital technologies. Despite the barriers that teachers faced in integrating digital technologies, through mutual engagement and negotiated joint enterprise, teachers develop a shared repertoire of strategies, tools and ways of doing things through participation in the school's CoP. These consequently contributed to their digital technologies integration practices and learning. In addition, issues related to teachers' technology integration such as barriers and conditions for integrating digital technologies, teachers' attitudes towards digital technologies and teacher's pedagogical beliefs also emerged within these theoretical perspectives.

The findings of this study add to the literature on teachers' digital technologies integration. Theoretically and methodologically, Situated Learning (Lave & Wenger, 1991) and Communities of Practice (Wenger, 1998) are valuable in understanding teacher's practice and learning to integrate digital technologies within the Malaysian context. Although the findings cannot be generalised to other contexts, this study shows that future studies seeking to understand teacher's learning to integrate digital technologies could consider Situated Learning and Communities of Practice as the theoretical lens. These findings are relevant to Malaysian schools as well as international education communities. For instance, funding digital technologies in schools, mandating digital technologies integration (e.g. national curriculum, ICT policy), and providing staff

professional learning, is necessarily mediated by the teachers' communities of practice. Consequently, technology interventions such as the Malaysian Smart Schools project need to shift from structured professional development programs designed for the whole school or individual teachers to focus on the communities of practice. It is also crucial to consider designing teacher's professional learning using CoP approaches within the online technology environment to improve teachers' digital pedagogy and digital technologies integration in today's digital settings.

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List of Abbreviations and Acronym

British Educational Communications and Technology Agency (BECTA)

Communities of Practice (CoP)

English for Teaching Maths and Science (ETeMS)

Information and Communication Technology (ICT)

International Society for Technology in Education (ISTE)

Malaysian Smart School (MSS)

Malaysian University English Test for Malaysian (MUET)

Multimedia Super Corridor (MSC)

Teaching English as Second Language (TESL)

Southeast Asian Ministers of Education Organization (SEAMEO)

United Nations Educational Scientific and Cultural Organization (UNESCO)

Chapter 1 Introduction to the study

This chapter introduces the research problem and provides the rationale and justification for conducting this study. This is followed by the research aims and research questions guiding the study. Next, the scope, limitations and significance of the study are discussed. The context of the study is introduced and an outline of the thesis is presented.

1.1 The research problem

The integration of digital technologies (hereafter also referred to as technology or ICT) in teaching and learning has been claimed as a critical issue for school education for the 21st century (Kolderie & McDonald, 2009; Oigara, 2013). In particular, the lack of digital technologies integration in teaching and learning has received considerable attention internationally, such as from the British Educational Communications and Technology Agency (BECTA, 2009), International Society for Technology in Education (ISTE, 2010; 2017), United Nations Educational Scientific and Cultural Organization (UNESCO, 2010) and the United States Department of Education (2017).

In 2003, UNESCO conducted a meta-survey to investigate the use of digital technologies in primary and secondary education throughout Asia and the Pacific. It reported that the strategy of Information and Communication Technology (ICT) integration was well written in most national policies, and many initiatives were being invested in, such as providing technology infrastructure and increasing national technology funding. Nevertheless, the report concluded that the majority of countries in the Asia Pacific region, including Malaysia, "are still at an early stage in the process of adopting ICTs into their education systems" (UNESCO, 2003, p. 272). In 2010, a report produced by the Southeast Asian Ministers of Education Organization (SEAMEO) indicated that countries in the South East Asia, including Singapore, Brunei and Malaysia were still not fully integrating digital technologies in their education system. Within the Malaysian literature, it was found that teachers

minimally integrate digital technologies in their teaching. Several studies reported that digital technologies integration in Malaysia had not improved since the introduction of the Malaysian Smart School policy in 2000 (Abu Ziden, 2017; Bakar, Wong, Wong, & Hamzah, 2013; Ghavifekr & Rosdy, 2015; Halim et al., 2005; Jaafar, 2008; Mahmud & Ismail, 2010; Majeed & Yusoff, 2015; Umar & Hassan, 2015; Wan Ali et al., 2009; Zain et al., 2004).

Like many other developing countries, technology integration in teaching and learning has become an important educational agenda in the Malaysian education system. The Ministry of Education Malaysia introduced the Malaysian Smart School (MSS) project in 1997, which aimed to provide technology-rich teaching and learning systems. It was intended to be one of the major reforms in the Malaysian education system (Hamzah, Ismail, & Embi, 2009). The Malaysian Smart School has been defined as "a learning institution that has been systemically reinvented in terms of teaching-learning practices and school management in order to prepare children for the Information Age" (Smart School Project Team, 1997, p. 20).The MSS policy emphasises creative teaching and learning processes. In this regard, technology is seen as an enabler in making the teaching and learning process easier, fun and effective (Multimedia Development Corporation, 2005).

Teachers' professional learning in digital technologies integration is critical to the success of the Malaysian Smart School project. It was highlighted in the Smart School's blueprint that teachers need "to learn to facilitate and encourage students in taking charge of their own learning ... these teachers will need to augment their skills regularly, and remain confident in their application of the technology" (Smart School Project Team, 1997, p.13). However, teachers in Malaysian Smart Schools lacked exposure and competency in using digital technologies applications for teaching and learning (Abdul Razak & Embi, 2004). Consequently, teachers' lack of knowledge and competency has resulted in minimal use of digital technologies in Malaysian Smart Schools' classroom (Bakar et al., 2013; Wan Ali, Mohd. Nor, Hamzah, & Alwi, 2009).

Wan Ali et al's, (2009) study on the conditions that facilitated and hampered the implementation of digital technologies integration in the Malaysian Smart School

found two sets of facilitating conditions. The first includes the availability of technology resources and teachers' knowledge of digital technologies. The second set is the supporting conditions which include accessibility of technology resources, the existence of administrative support, teachers' desire to change school practices, influence of external forces and teacher's commitment to the innovation. Within these two sets of conditions, time, course content and technical malfunction were found to be the main problems that teachers faced to successfully integrate digital technologies in the classroom (Wan Ali, et al., 2009).

Mahmud and Ismail (2010) contended that "although Malaysia has a long history of bringing technology into the classrooms, teachers are not optimizing on what technology has to offer" (p. 6).The frequently cited factors related to the success or failure of technology integration in Malaysian schools based on Mahmud and Ismail's (2010) summary of the literature on teacher's technology integration are as follows:

i) Teachers' knowledge and skills in integrating technology.
ii) Teachers' attitudes, perceptions, beliefs and commitment towards integrating technology.
iii) The gender, age and experience in using technology.
iv) Access to computers, training, and support.

A study conducted by Bakar et al. (2013) among 400 teachers in Malaysia also found that digital technologies skills and knowledge, attitudes towards digital technologies, and experience in using digital technologies were significant predictors of teachers' digital technologies integration; with skills as the best predictor followed by attitudes.

These factors continue to be critical in the Malaysian context. Ghavifekr and Rosdy (2015) and Majeed & Yusof (2015) studies on the effectiveness of ICT integration in Malaysian schools found that while most teachers think ICT integration is effective, the integration of ICT was still at a minimum level. This was due to ICT tools and facilities provided in school being insufficient; training and professional development not adequately provided for teachers and lack of technical support (Ghavifekr & Rosdy, 2015).

Similarly, Ghavifekr, Kunjappan, Ramasamy and Anthony's (2016) study on issues and challenges for teaching and learning with technology tools from teachers' perception list the following issues:

i. Insufficient numbers of laptops/notebooks
ii. School computers out of data and/or needing repair
iii. Lack of adequate skills of teachers
iv. Insufficient technical support for teachers
v. Insufficient pedagogical support for teachers
vi. Difficulty to integrate technology into curriculum
vii. Lack of adequate content/material for teaching

The findings of previous studies on low levels of digital technologies integration in Malaysian schools and all of these barriers highlighted by teachers clearly reflects that schools have not yet achieved the Smart school status as projected.

The above factors are similar to those found in studies conducted in other countries. These include teachers' lack of knowledge and experience in teaching using digital technologies, lack of technology resources and support (BECTA, 2004; Cher Lim, 2007; Mumtaz, 2000; Pelgrum, 2001; Slaouti & Barton, 2007), and lack of time for preparation and implementation (Bauer & Kenton, 2005; Cuban, Kirkpatrick, & Peck, 2001; Cher Lim, 2007; Slaouti & Barton, 2007; Vannatta & Fordham, 2004) to successfully integrate digital technologies into the curriculum have frequently been reported. Others have found that teacher's attitudes towards digital technologies (Wozney, Venkatesh, & Abrami, 2006) and teacher's pedagogical beliefs about digital technologies integration (Ertmer, 2005; Inan & Lowther, 2010; Cher Lim & Chai, 2008; Palak & Walls, 2009) influence teachers' decisions to adopt particular technologies in their teaching. Teachers' perceptions of the usefulness and ease of use of digital technologies (Hu, Clark, & Ma, 2003; Ma, Anderson, & Streith, 2005; Slaouti & Barton, 2007; Smarkola, 2007; Teo, 2010; Teo, Lee, Chai, & Wong, 2009) have also been reported as strong predictors towards digital technologies acceptance and adoption among teachers. In addition, lack of mentor support and opportunities for apprenticeship have an impact on teacher's ability to utilise digital technologies in their teaching and learning (Slaouti & Barton, 2007).

Despite the considerable research in the advantages of digital technologies in teaching, and in the adoption of digital technologies by teachers (for example see: Baek, Jung, & Kim, 2008; Cuban et al., 2001; Frank, Zhao, & Borman, 2004; Inan & Lowther, 2010; Martins, Steil, & Todesco, 2004) regular use of digital technologies in the classroom continues to be "far from common" (Ward & Parr, 2010, p. 113). In addition, it has been argued that "technology has not been fully integrated into the field of education" (Guzey & Roehrig, 2012, p. 162). Even if digital technologies were used in the classroom, "it typically is not used to support the kinds of instruction believed to be most powerful for facilitating student learning" such as the student-centred approach (Ertmer & Ottenbreit-Leftwich, 2010, p. 256). Most recently, the United States Department of Education (2017) reported that many schools do not yet have access to or are using digital technologies in ways that can improve learning on a daily basis.

In response to these continuing concerns, previous studies suggested that teachers should be actively involved in continuous professional learning to improve teacher's technology integration practice (Chiew & Lim, 2017; Hennessy, Ruthven, & Brindley, 2005; Kopcha, 2012; Omar, Rashid, Mohamad & Yusof, 2017; Rashid, Abdul Rahman & Yunus, 2017, Ward & Parr, 2010; Woodgate-Jones, 2012). Importantly, Ward and Parr (2010) argued the need for more research that looks at new forms of professional learning to gain further insights into how teachers could successfully integrate digital technologies in their teaching practices. Hermans, et al., (2008) pointed out that teachers might have a shared set of educational beliefs in particular schools and proposed future research to look at specific school conditions and school culture variables. In particular, it has been argued that investigating teachers as learners in the social and cultural context of the school environment could provide valuable knowledge on how teachers learn to improve their digital technologies integration (Glazer, Hannafin, Polly, & Rich, 2009; Kopcha, 2012; MacDonald, 2008; Webb, Robertson, & Fluck, 2005; Windschitl & Sahl, 2002).

As teachers might have a shared set of educational beliefs about integrating digital technologies within their school environment (Hermans, et al., 2008), research should look at specific school conditions and culture for understanding the relationship between them. Also, it has been noted by Kopcha (2012, p. 1119) that "a

variety of situated learning activities around the principles of effective professional development may be the key to providing teachers with the knowledge and support needed to integrate technology more fully into their instruction". This is an important point that necessitates understanding of how teachers learn to integrate digital technologies within their school environment. My study therefore aims to explore the nature of teachers learning to integrate digital technologies from the social cultural perspective of Situated Learning and more specifically Communities of Practice (CoP).

1.2 Conceptual framework for analysis

In my study, the theories of Situated Learning by Lave and Wenger (1991) and Communities of Practice (CoP) by Wenger (1998) underpin the development of the research questions for my study, as well as the conceptual and analytical frameworks for the analysis. These theories have been acknowledged as valuable theoretical frameworks for understanding learning in situated environments (Cochrane et al., 2013; Fuller, 2007; Korthagen, 2010; Somekh, 2007).

Situated Learning and CoP describe learning as a process of social participation which is embedded in an activity, context and culture (Lave & Wenger, 1991; Wenger, 1998). To learn is to actively participate in the communities of shared practices which demonstrate certain beliefs, cultures and behaviours (Skerrett, 2010). Participation in CoP involves elements of mutual engagement, joint enterprise and shared repertoire which complement each other (Wenger, 1998).

Identity formation is an important aspect of learning by participating in CoP (Kwan & Lopez-Real, 2010; Wenger, 1998). Identity refers to how we perceive ourselves in relation to others, which will shape our practices and might be shaped by the practices of the communities (Wenger, 1998). Participation in the CoP also involves interaction with boundary objects and brokering that provide connections between communities. For example, brokering is an element of connection that could bring elements of one CoP's practices into other CoP (Wenger, 1998).

Guided by Situated Learning and CoP theoretical frameworks, my study focuses on how teachers engage in situated learning in school's CoP to integrate digital technologies in their teaching practices. This study investigates how teachers' participate, negotiate and interact in the school's CoP to enhance their competencies in using digital technologies. Explorations of the elements of mutual engagement, joint enterprise and shared repertoire that occur in the school's CoP are important parts of this study. This study also explores how teachers change, shape and re-shape their practice and identities in relation to digital technologies integration as a result of participation in the CoP. The role of brokers who can bring changes in teachers' digital technologies integration is also of interest in this research. Further discussion of Situated Learning and CoP theories is provided in Chapter 3.

1.3 Research aims

This study aims to understand how teachers learn to integrate digital technologies in their teaching and learning. Ultimately, I want this study to contribute new insights into theories about how teachers' practice and learning to integrate digital technologies could be improved in the school's CoP. Also, I hope that the findings of this study will contribute to the improvement in the technology integration policies, especially those related to teachers' professional learning.

1.4 Research questions

In order to achieve the research aims I conducted my study based on the following research questions. The major research question shaping this study is:

How do teachers' participation in school's Communities of Practice (CoP) influence their digital technologies integration in the classroom?

In particular this study is guided by the following sub-questions:

I. How do teachers integrate digital technologies in their teaching?

II. What is the role of mutual engagement, joint enterprise and shared repertoire in mediating teachers' digital technologies integration?

III. What is the role of identity in shaping and developing teachers' digital technologies integration?

IV. What is the role of brokers for improving teachers' digital technologies integration?

1.5 Scope and limitations

This thesis focuses on teachers' learning in relation to digital technologies integration. This study therefore explores issues related to how teachers learn to integrate digital technologies in the situated environment of their school.

Theoretically, this study is underpinned by the theories of Situated Learning (Lave & Wenger, 1991) and more specifically Communities of Practice (Wenger, 1998). It is important to note that this study did not use other variations of community theories.

Methodologically, this study is based on a single case (embedded) design, involving ten teacher participants from one school in Malaysia. As a consequence, the findings of this study are not statistically generalizable to other teachers or schools. This is in line with Yin's (2009) recommendation that qualitative case study is not aiming for "statistical generalization" but more into "analytical generalization" (p. 38). Similarly, Hartley (1994) also posits that the generalization in a qualitative case study is about "theoretical propositions rather than populations" (p. 225). Because my study is qualitative research and seeks to explore the nature of teachers' learning within a situated environment of a particular school's CoP, it is not possible to extrapolate the findings to broad populations or to draw general conclusions from the findings. The findings however could be a basis for future recommendation in teacher's professional learning related to digital technologies integration in Malaysian school.

1.6 Introducing the research context: A Malaysian Smart School

The Malaysian Smart School (MSS) concept was introduced in 1996 by the Malaysian Ministry of Education as an aspiration to produce creative and innovative future generations. It is one of the seven flagships in the establishment of the Multimedia Super Corridor (MSC) that has been operating since 1996 (Lubis, Ariffin, Muhamad, Ibrahim, & Wekke, 2008). In 1999, a total of 87 schools were chosen to become the pilot schools to set the benchmark of teaching and learning using digital technology under the MSS pilot project (Abdullah, 2006).

The MSS Blueprint highlighted the fundamental components of the Smart School teaching and learning environment in four areas, namely curriculum, pedagogy, assessment, and teaching and learning materials. According to the blueprint, the Smart School's curriculum should be designed to help students to achieve overall and balanced development, which includes the integration of digital technologies in the curriculum. It was stated in the blueprint that "the curriculum uses technology as one delivery system, examines the influence of technology on students' lives, and gives students the skills they need to use technology" (Smart School Project Team, 1997, p. 28).

The MSS Blueprint emphasises the integration of technology in four components; curriculum, pedagogy, assessment, and teaching and learning materials. In terms of the pedagogy, it should allow an appropriate mix of learning strategies to ensure mastery of basic competencies and promotion of holistic development. The assessment should be designed to give accurate feedback of students' readiness, progress, achievement and aptitude. The teaching and learning materials should be cognitively challenging and motivating (Smart School Project Team, 1997).

The implementation of these four components (i.e., curriculum, pedagogy, assessment, and teaching and learning materials) involves the *management* and *administration* aspects of the teaching and learning. This includes involvement of *people, skills and responsibilities,* the *processes,* the *technology* and the *policies,* as illustrated in the Malaysian Smart School conceptual framework (see Figure 1-1).

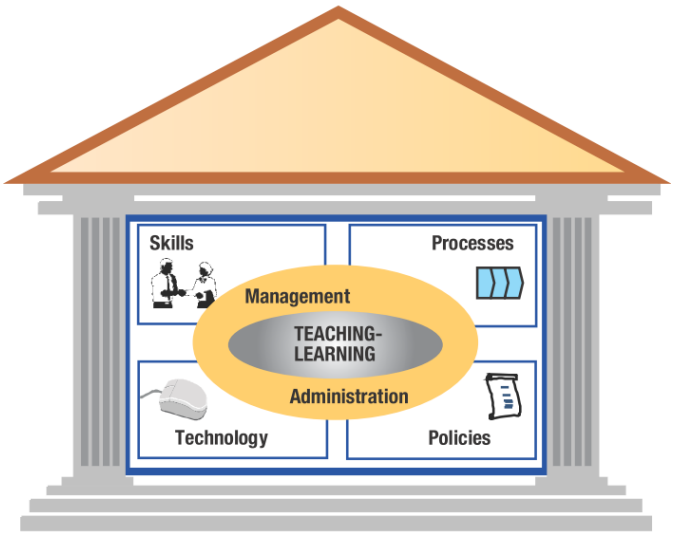

Figure 1-1: Malaysian Smart School Conceptual Framework (Smart School Project Team, 1997, p. 26)

The inclusion of these four elements suggests the need for a mutual understanding among the MSS's communities to respond and work together towards achieving the smart school's policy. The skills and responsibilities of the people within this MSS's community are very important in the development of its curriculum, pedagogy, assessment and teaching and learning materials. The people (i.e., policy makers, administrators, teachers and other stakeholders) involved in the MSS's project should mutually engage with each other to successfully implement the Smart School's teaching and learning processes, especially when it is related to the integration of digital technologies.

In achieving the MSS's objective of creating conducive and creative teaching and learning environment through the use of digital technologies, all schools involved in this project are supposed to be well-equipped with digital technologies for teaching and learning (Abdullah, 2006; Multimedia Development Corporation, 2005). The MSS project is funded by the Malaysian government and therefore schools should have technology facilities such as computer labs with Internet access, classrooms with LCD projectors, and Wi-Fi access.

The Smart Schools pilot project costs over 400 billion Ringgit Malaysia (about 130 billion Australian dollars). The MSS pilot project ended in December 2002, and supposedly, by 2010, all 10,000 schools in Malaysia were to become Smart Schools (Multimedia Development Corporation, 2005). However, there is no information available to report whether all schools in Malaysia had become Smart schools by 2010. To date, all the schools involved in the pilot project continue to carry the title of a Smart School.

Despite the MSS policy and reform, and funding and facilities being introduced for more than a decade, the technology resources and support are still unsatisfactory in most Smart Schools. Lack of facilities, very low access to the Internet technology, and lack of training and support were among the major concerns of teachers in the Smart Schools (Md Yunus, 2007). As a consequence, low level of digital technologies integration among teachers in the Malaysian Smart Schools has been reported within the Malaysian literature (Wan Ali et al., 2009; Ya'acob, Mohd Nor, & Azman, 2005; Majeed & Yusoff, 2015).

It was highlighted in the Malaysian Smart School's blueprint that teachers in Malaysian Smart Schools are expected to integrate digital technologies in their daily teaching and learning. To achieve this expectation, teachers are provided with training on how to use digital technologies in their teaching. This is stated in the Smart School blueprint as follows.

> Teacher development will be critical to the success of the Smart School. Teachers will need intensive training in the use of information technology and in its integration into classroom activities in ways that enhance thinking and creativity. Smart School teachers will also need to learn to facilitate and encourage students in taking charge of their own learning. In the long term, these teachers will need to augment their skills regularly, if they are to stay abreast of developments in their profession and remain confident in their application of the technology. (Smart School Project Team, 1997, p. 13)

One of the important domains in the success of Smart School's vision as outlined in the blueprint is the intensive training to teachers which suggests that teachers were given the skill to integrate digital technologies in their teaching. The

Smart School's policy also sees digital technologies integration as a matter of skill acquisition. However, in its implementation, it is more into simplifying professional learning through intensive training without realizing that in order for teachers to integrate digital technologies in their teaching, it also involves teachers' beliefs and attitude towards digital technologies, knowledge and skills in using digital technologies, and ultimately teacher's identity and practices. This approach taken by the Ministry of Education may be one of possible reason why the integration of digital technologies in Malaysian Smart Schools has not been successful.

The literature shows that digital technologies integration and professional learning are not a simple matter of training. Intensive training or short-term workshops focused on learning certain software or technological tools have not been effective in making teachers successfully integrate digital technologies into their lessons (Borko, 2004; Zhao, Pugh, Sheldon, & Byers, 2002). Digital technologies integration is a matter of ongoing skill acquisition and it need to be sustained over time (Duran, Runvand, & Fossum, 2009; Henderson, 2007; Kopcha, 2012). For example, a study conducted by Duran et al. (2009) based on a three year project with 17 student teachers, 17 cooperating teachers, 5 university-level faculty, and 3 student teaching supervisors demonstrated that an approach to professional learning that encourages ongoing networking, mutual learning, and sharing of strategies and resources among teachers is an effective strategy to improve digital technologies integration in science education. Hence my study adopts the Communities of Practice lens to see if a more complex socio-cultural approach can shed light on teacher's professional learning to integrate digital technologies.

1.7 Thesis outline

In the organisation of my thesis, I presented the study in 10 chapters. A brief overview of each chapter is as follows:

Chapter 1 introduces the main elements of this study. It presents the focus of the study, the research objectives and the research questions. This chapter also introduces the context for this study (i.e., The Malaysian Smart School). This is follows by the significance, scope and limitations and of the study. It also provides an overview of the structure of each chapter.

Chapter 2 presents a review of past and recent literature on teachers' digital technologies adoption and integration. First, digital technologies integration is defined in relation to its use in the classroom for teaching and learning purposes. Several frameworks and models such of technology integration are reviewed and discussed to understand the complex practice of integrating digital technologies. The review also includes ongoing research related to barriers or facilitating conditions that influence teachers' digital technologies integration and research related to teachers' pedagogical beliefs to integrate digital technologies. This chapter is concluded with the insight that while previous research could inform us about the levels of teachers' digital technologies integration and the conditions or factors influencing teachers' digital technologies integration; these studies lacked the elements of social and cultural influences and thus did not help in understanding how teachers would learn to successfully integrate digital technologies in their teaching.

Chapter 3 discusses the main theoretical lenses adopted in this study, namely Communities of Practice (Wenger, 1998) and its foundation, Situated Learning (Lave & Wenger, 1991). This study focuses on the three dimensions of CoP, namely mutual engagement (doing things together), joint enterprise (responding together) and shared repertoire (resolving problems together). Other dimensions such as learner identities in the CoP and the role of brokering are also part of the research focus. This chapter argues that Situated Learning and Communities of Practice theories are valuable to understand the complex practice of digital technologies integration among teachers, and to understand how teachers within the situated environment of the school

community could learn from each other to successfully integrate digital technologies in their teaching.

Chapter 4 outlines the methodological choices and research design adopted in this study. The first section explains why and how this study is located within a qualitative case study paradigm. This is followed by a discussion on the selection of the context of the study (Malaysian Smart Schools), the recruitment process for the case of the study (Perdana Secondary School) and the embedded cases of the study (teacher participants). Next, discussion on the reliability and validity of the study is outlined, especially on the construct validity. Selection of various methods of data collection which include semi structured interviews, informal observations and documents archives are explained. This chapter also discusses on how the researcher carried out the data analysis using thematic analysis approach.

Chapter 5 introduces the case study. A profile of the school (i.e., Perdana Secondary School) is provided to give an overview of the school's setting and environment, ICT facilities available at school and some of the educational reform involved in the school related to ICT integration. This is followed by the teacher participants profile or teacher's background information. This information is important to contextualise teacher participant's responses and positions within the school's CoP.

Chapter 6 discusses the findings related to teachers' digital technologies integration practices and learning. It provides an analysis on teachers' digital technologies integration practices in their teaching as part of teachers' participation and reification of integrating digital technologies in the school's CoP. The pressures and barriers in integrating digital technologies are then analysed and discussed in relation to teachers' negotiation of their digital technologies integration practices.

Chapter 7 discusses the findings on teacher's way of learning for integrating digital technologies from the CoP perspective. In this chapter, teacher's joint enterprise, mutual engagement and shared repertoire are discussed according to their localised teachers' CoP; the English teachers' CoP, Science and Maths teachers' CoP, student-teachers CoP and ICT leader CoP.

Chapter 8 discusses the findings related to teachers' identity formation in the school's CoP. This chapter provide a discussion of how 'identity' is defined and theorised in Wenger's CoP followed by an analysis of teachers' identity formation. The analysis and discussion in this chapter centred on the role of identity in shaping and developing teachers' digital technologies integration.

Chapter 9 discusses the findings related to the role of brokers in the school's CoP in influencing teachers' digital technologies integration. The analysis and discussion in this chapter focuses on the roles of the ICT leaders as brokers in empowering teachers' mutual engagement, joint enterprise and shared repertoire to integrate digital technologies.

Chapter 10 concludes the study by summarising the findings and major discussions. In this chapter, the significance and implications of this study to inform future practice in the integration of digital technologies in the classroom are discussed. Also, recommendations for improvements in the policy and school practices related to digital technologies integration are provided. Finally, in this chapter, I discuss some possibilities for future research and the final conclusions of the study.

Chapter 2 Digital technologies in teaching and learning

This chapter provides a literature review of the key concepts and issues related to the integration of digital technologies in teaching and learning. This chapter is organised first to understand the definition of technology for teaching and learning and similar terminology such as information and communication technology (ICT), educational technology and learning technology, and more recently digital technologies in education. Second, the review traces discussion of the key concepts, frameworks and models related to teachers' digital technology adoption and integration. This chapter also provides a review of research within the field of teachers' digital technologies adoption and integration from both Malaysian and international perspectives. This includes discussion on barriers in integrating digital technologies and teachers' pedagogical belief related to their digital technologies integration. Importantly, the literature referred to in this chapter was gathered to inform understanding of teachers' learning for integrating digital technologies in the situated environment of the school's setting.

2.1 Digital technologies in teaching and learning

Within the educational context, there are several terms used to refer to the field of technology integration in teaching and learning. These include learning technology, educational technology, and ICT in education. Baek, et al.'s (2008) study within the Korean context defines digital technologies in teaching and learning as "electronic media such as computers, video, and the associated hardware, networks, and software" (p. 225) used for enhancing classroom teaching. Hennessy, Ruthven and Brindley (2005) within the U.K. context with reference to U.S. literature defined ICT in education as "the range of hardware [desktop and portable computers, projection technology, calculators, data-logging, and digital-recording equipment], software applications [generic software, multimedia resources], and information systems [Intranet, Internet]" (p. 155) available at school.

In an Australian context, Lloyd (2005) asserts that ICT could also be understood "to entail the specific devices or processes which collectively make up the technology" (p.3), which include the hardware and the software. Similarly, Newhouse (2002) provides a definition of ICT as "typically used to refer to computer technologies but should also include other technologies used for the collection, storage, manipulation and communication of information" (p. 66). Both Lloyd and Newhouse's definition of ICT referred to the use of computerised or digital technologies as an aid to learning and teaching in schools. These definitions of technology and ICT are similar to those applied within the Malaysian context, where ICT in education refers to the use of digital technologies (both hardware and software) that support the basic process in educational management and administration, teaching and learning, as well as for supporting lifelong learning (Ministry of Education Malaysia, 2001).

Terms or concepts such as educational technology and learning technology also used in the literature to refer to the use of digital technologies or ICT for supporting teaching and learning process (Gourlay, Hamilton, & Lea, 2014; Guzey & Roehrig, 2012; Lloyd, 2005; Newhouse, 2002) . For example, Januszewski and Molenda (2008, p. 1) offered a definition of educational technology as "the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources". Similarly, Orlando (2005) defined learning technology as "a field that uses technology as a tool to enhance the learning process" (p.23).

The above definitions reveal that the terms digital technologies and ICT in education share certain characteristics which make it difficult to provide a distinctive definition of each term. Therefore, following the above definitions, in my study, the terms digital technologies and ICT refers to the use of computer technology that include both hardware and software, multimedia resources and Internet applications to support the teaching and learning process. Whenever possible, the term 'digital technologies' is used primarily in this thesis, as it refers to a broader domain which also includes ICT (Llyod, 2005).

2.2 Integration of digital technologies in teaching and learning

The Technology in Schools Task Force, U.S. Department of Education (2002), offered a definition of technology integration in schools as follows:

> Technology integration is the incorporation of technology resources and technology based practices into the daily routines, work, and management of schools. Technology resources are computers and specialized software, network-based communication systems, and other equipment and infrastructure. Practices include collaborative work and communication, Internet-based research, remote access to instrumentation, network-based transmission and retrieval of data, and other methods... It is important that integration be routine, seamless, and both efficient and effective in supporting school goals and purposes. (p.75)

This is a very broad definition of technology use in schools, which does not only focus on digital technology integration in the classroom. However, this definition clearly suggests that successful technology integration should incorporate the use of digital technologies in teaching practices. It emphasises that digital technologies should be integrated in the daily school and classroom activities to support and facilitate the education goals.

To successfully integrate digital technologies in teaching and learning practices is not easy (Bauer & Kenton, 2005). It has been argued that technology integration should change the relationship between teachers and students (Technology in Schools Task Force, 2002), support the development of higher order thinking skills and problem solving (Jonassen, 2000) and promote meaningful learning (McCrory, 2006; Wiske, 2006). In addition, Hadley and Sheingold (1993) affirms that integration of digital technologies requires teachers to "readily and flexibly incorporate technologies into their everyday teaching practice in relation to the subject matter they teach" (p.265). This suggests that the daily use of technology is not really an important characteristic of digital technologies integration. What is more important is the notion of supporting teaching and learning goals. Therefore, in order for teachers to be able to integrate digital technologies successfully, they must be

competent in using a particular digital technology and understand the pedagogical theories underpinning the instructional practice.

Integration of digital technologies is not about the amount or type of technology used, but it is more about how and why it is used in the teaching and learning process. In this regard, Inan and Lowther (2010) grouped the primary usage of digital technology into three broad categories; "technology for instructional preparation, technology for instructional delivery, and technology as a learning tool" (p. 138). The examples of teachers' use of digital technologies for instructional preparation include preparing and organizing lesson plans and teaching materials using word processors, spreadsheets or databases, finding information from the Internet, and communicating with peers using e-mail.

In terms of instructional delivery, technology could be used by both teachers and students (Inan & Lowther, 2010); for example, teachers may use digital technologies to enhance instructional delivery by using presentation software (Ward & Parr, 2010). Students may be using instructional applications such as drill and practice, tutorials and remediation (Ward & Parr, 2010; Wozney et al., 2006). Other examples of digital technology for instructional delivery could include simulations, interactive learning games and authoring tools (Palak & Walls, 2009).

Technology as learning tools includes using basic and advanced applications to facilitate students' learning such as problem solving and critical thinking (Inan & Lowther, 2010; Jonassen, 2000). This could include using applications such as databases, spreadsheets, expert systems and modelling, coding and data visualisation. Technology as learning tools also helps in students' creation of learning products (e.g., presentation, portfolios and concept mapping). Other examples of learning tools are the use of communication and collaborative systems (Wozney et al., 2006) such as e-mail, online forums and weblogs.

Considering the various uses of technology that are possible among teachers and students, in my study, digital technologies integration is defined as a combination of digital technologies or ICT usage for instructional preparation, instructional delivery, and as learning tools (Inan & Lowther, 2010) with the primary goals of

facilitating teaching and learning practices (Hennessy et al., 2005) and adding value to the students' learning experiences (Ertmer, 1999).

2.3 Digital technologies integration in Malaysian schools

The Malaysian Ministry of Education, envisioned that the use of digital technologies in teaching and learning could enable teaching and learning activities to be conducted anywhere and anytime (Ministry of Education Malaysia, 2001). It was also hoped that the use of digital technologies could enhance the quality of education and to facilitate the educational processes based on the students' capabilities and needs. The Ministry outlined three important areas on the implementation of digital technology in education. They are:

i. Technology literacy for all students which emphasizes that student must learn the knowledge and skills of using digital technologies.
ii. Technology as curriculum and teaching and learning tools. Technology as curriculum means that students learn about digital technology as one of the subjects. Technology as teaching and learning tools means using digital technologies such as courseware, Internet, and other computer applications to assist the teaching and learning process.
iii. Technology for productivity, efficiency and effectiveness of management systems. This could be achieved through office automation and the implementation of management application system to improve the management process.

(Ministry of Education Malaysia, 2001)

This policy regarding the integration of technology within the Malaysian education system shows that the Malaysian government saw the importance of integrating digital technologies for the whole school communities (i.e., students, teachers and administrators). One of the core technology usages in the implementation of Smart Schools has been the use of multimedia courseware that aims to help teachers to be more effective in their teaching and learning strategies. The courseware was designed in multiple formats including in the form of interactive CD-ROM and

also web-based applications. According to Halim, Zain, Luan and Atan (2005), the teaching and learning courseware would enable teachers to integrate multimedia materials in their lesson, access to online information and include communicative features such as online forum and discussion.

As the Smart School concept originated based upon the needs of promoting innovation (Smart School Project Team, 1997; Shaharuddin & Abidin, 2009), developing innovative ways of teaching and learning was a core mission. The technology rich environment in the MSS was meant to enable teachers and students to make use of digital technology and actively participate in the teaching and learning process (Ministry of Education Malaysia, 2012). In this regard, teachers need to play important roles in facilitating the teaching and learning process that integrate the use of digital technology and at the same time provide guidance and support for different student's need (Shaharuddin & Abidin, 2009).

Although the Malaysian government had a clear definition of digital technologies integration and promoted it through significant policy initiatives, in the implementation stage, it was not as successful as it was hoped. There was ongoing research that reported on the low level of digital technologies integration in the Malaysian school including those in the Smart Schools (Abu Ziden, 2017; Bakar, Wong, Wong, & Hamzah, 2013; Ghavifekr & Rosdy, 2015; Halim et al., 2005; Jaafar, 2008; Mahmud & Ismail, 2010; Umar & Hassan, 2015; Wan Ali et al., 2009; Zain et al., 2004).

It was highlighted by Zain et al. (2004) that teachers faced challenges to transform existing teaching and learning practices into more engaging, stimulating and active learning based upon the Smart School concept. A study conducted by Jaafar (2008) revealed low usage of the Smart Schools courseware, since only 12 percent from the total of 609 students' responding frequently used the courseware. A high percentage of students (73 percent) indicated that they rarely used the courseware. These findings on the low level of digital technologies integration within the Smart Schools provide another justification for the needs of my study.

My study did not aim to evaluate the effectiveness or success of the Malaysian ICT policies and the Smart School program. However, further research is required in

order to explore how teachers in Malaysian Smart Schools could build their competencies to integrate digital technology through situated learning within their school communities. Therefore, in my study, I explored issues such as how teachers respond and negotiate the national agenda to integrate digital technology and how these policies influence their enterprise of integrating digital technology within the school's community of practice.

2.4 Challenges in integrating digital technologies

There have been many studies that support the benefits of using digital technologies to improve the outcomes of student learning (e.g., Hartley, 2007; Newhouse, 2002; Rovai, Ponton, Wighting, & Baker, 2007; Wang, 2009). However, other studies indicate that teachers use of digital technologies in the classroom are minimal, because of the low level of digital technologies used, teacher-centred approaches, and lack of meaningful engagement in collaborative activity (Cuban et al., 2001; Hadley & Sheingold, 1993; Mahmud & Ismail, 2010; Ward & Parr, 2010). Concerns about the low level of digital technologies integration among teachers has prompted researchers (e.g., Bauer & Kenton, 2005; Cuban et al., 2001; Ertmer, 1999, 2005; Mumtaz, 2000; Pelgrum, 2001; Vannatta & Fordham, 2004) to investigate the challenges that influence teachers' decisions to not utilize digital technologies in their teaching and learning practices.

In the literature, the challenges that teachers face are mainly discussed in terms of the obstacles or barriers for integrating digital technologies. The barriers are commonly categorised into first-order barriers (extrinsic) and second-order barriers (intrinsic) (Bai & Ertmer, 2008; Bauer & Kenton, 2005; Bingimlas, 2009; Chen, 2008; Cher Lim & Khine, 2006). First-order barriers refer to obstacles that are extrinsic to teachers, such as the institutional factors, or typically described in terms of the resources (e.g., equipment, time, training, support). These types of barriers are easy to measure and could easily be eliminated, and therefore the majority of early integration efforts focused on eliminating these barriers through funding and allocation of resources. The Malaysian Smart School project introduced in 1997 is an example of such effort (see section 1.6 for introduction to this project). Unfortunately,

although the resources and access to digital technologies are much better in the 21st century, significant research continues to report on these barriers of technology integration (Bauer & Kenton, 2005; Kaur & Hussein, 2015; Majeed & Yusoff, 2015; Mumtaz, 2000; Pelgrum, 2001; United States of Education Department, 2017; Vannatta & Fordham, 2004) .

The assumption that integration would follow once adequate resources were obtained was not reliable (Cuban et al., 2001; Ertmer, 1999). Ertmer (1999) asserts that "even if every first-order barrier were removed, teachers would not automatically use technology to achieve the kind of meaningful outcomes..." (p. 51). In this regard, second-order barriers may also affect teacher's digital technologies adoption and integration in their teaching practice (Ertmer & Ottenbreit-Leftwich, 2010; Vannatta & Fordham, 2004). Second order barriers are factors that "interfere with or impede fundamental change" and "typically rooted in teachers' underlying beliefs about teaching and learning and may not be immediately apparent to others or even to the teachers themselves" (Ertmer, 1999, p. 51).

Although second-order barriers are more complicated and less tangible than the first-order barriers, literature suggests that these barriers are common amongst today's teachers and continuously reported in the later literature. For example, studies have found that second-order barriers such as teachers' attitudes towards digital technologies (Wozney et al., 2006) and teachers' pedagogical beliefs about digital technologies (Ertmer, 2005; Inan & Lowther, 2010; Cher Lim & Chai, 2008; Palak & Walls, 2009) have an impact on teachers' technology integration practices. Teacher's beliefs about teaching and learning may influence their classroom practices including teaching methods, organizational and management styles, and assessment procedures (Ertmer, 1999). In addition, teachers' beliefs about the usefulness of and the ease of use of a particular digital technology may influence their decision whether to integrate or not to integrate technology in their teaching practices (Ertmer & Ottenbreit-Leftwich, 2010; Inan & Lowther, 2010; Vannatta & Fordham, 2004). This suggests that digital technologies integration is a complex practice as it involves numbers of affordances and constraints in its implementation (Lloyd, 2005; Windschitl & Sahl, 2002). Therefore, my study aims to explore this complex relationship particularly on

how teachers may try to resolve these barriers through negotiation and participation in the school's communities of practice.

Within the Malaysian context, both first and second order barriers were also continuously reported in the literature. Following are the frequently cited factors which influence the digital technologies integration among teachers in the Malaysian schools as reported in several studies (Bakar & Mohamed, 2001; Darus & Luin, 2008; Lau & Sim, 2008; Mahmud & Ismail, 2010; Samuel & Abu Bakar, 2006).

i. Limited access to computer and technical support, lack of technology training, and lack of time
ii. Teacher's knowledge, attitude, perception, beliefs and commitment towards digital technologies usage

The first is related to the first-order barriers, whilst the second is considered the second-order barriers. Similarly, a study conducted by Wan Ali et al. (2009) on the conditions that facilitated and hampered the implementation of digital technologies integration in the Malaysian Smart Schools among 21 teachers from three different schools, found eight conditions namely;

i. Availability of digital technologies resources
ii. Acquisition of digital technologies knowledge
iii. Accessibility to digital technologies resources
iv. Existence of digital technologies support
v. Teacher's commitment to the digital technologies innovation
vi. Influences of the external forces
vii. Desire to change
viii. School practice

These conditions were categorised into two sets of facilitating conditions. First is the essential condition which refers to the availability of digital technologies resources and acquisition of digital technology knowledge. The second condition is the supporting conditions which comprise the accessibility of digital technologies resources, existence of administrative support, teachers' desire to change school practices, influence of external forces and teacher's commitment to the innovation. In

their study, time, course content and technical malfunction were found to be the main problems that the teachers faced to successfully integrate digital technologies in the classroom.

These barriers to integrate digital technologies within the Malaysian context point out that there is a range of influencing factors that may be apparent within, or influence teachers' digital technologies integration in the school's CoP. However, these lists of factors do not help in understanding how they actually influence teachers' practice. For instance, in Wan Ali et al's (2009) study, they didn't discuss how the teacher's desire to change interacts with their identity formation to integrate digital technologies, or how teacher's commitment interacts with peers support and their practices. My study therefore, also investigates barriers that teachers face in their digital technologies integration practices, and how these barriers were negotiated among teachers in the school communities of practice.

2.5 Teachers' pedagogical beliefs and their digital technologies integration

As discussed in the previous section, second-order barriers typically rooted in teacher's beliefs are more complicated than first-order barriers. Consequently, issues related to teacher's beliefs have become an important area of interest within the literature on teachers' digital technologies integration. Researchers are examining the relationship between teachers' pedagogical beliefs and their actual digital technologies integration practices (e.g., Bai & Ertmer, 2008; Chen, 2008; Ertmer, 2005; Cher Lim & Chai, 2008; Palak & Walls, 2009). Research in this area is trying to understand teachers' decisions in adopting or not adopting a particular pedagogical (technology-based) strategy.

With regard to teachers' beliefs, Pajares (1992) noted that "the beliefs teachers hold influence their perceptions and judgments, which in turn, affect their behaviour in the classroom" (p.307). It has been noted that the construct of belief is very broad (Ertmer, 2005; Pajares, 1992) and it is difficult to conceptualize the meaning of teachers' beliefs without defining the context of the belief system. Pajares (1992) recommends that it is more appropriate to define the context of the belief system such

as "beliefs about confidence to affect students' performance (teacher efficacy) "and "beliefs about the nature of knowledge (epistemological beliefs)" (p. 316). Following Pajares' (1992) recommendation, Ertmer (2005) defined teachers' educational beliefs as a teacher's conceptions about teaching and learning and narrows this into the context of digital technology use. Therefore, in relation to my study, the context of teachers' beliefs being reviewed is more focused on teachers' pedagogical strategies using digital technology.

As an example, Ertmer's (2005) study conducted in the USA explored the connection between teachers' educational beliefs, which she referred to as pedagogical beliefs, with teachers' beliefs about "how technology enables them to translate those beliefs into classroom practice" (p. 28). According to Ertmer (2005), most teachers have limited knowledge and experience about how digital technologies should be integrated into curriculum to facilitate teaching and learning. When trying to integrate digital technologies into their instruction, teachers normally refer to their existing beliefs and prior experiences. It has been argued that teachers' existing beliefs could influence the development of beliefs about both digital technologies integration and their teaching practices (Bai & Ertmer, 2008; Ertmer, 2005; Hermans, Tondeur, van Braak, & Valcke, 2008). The pedagogical approach adopted by teachers is also important in shaping the practice of digital technologies usage in the classroom. It has been emphasized by Lim and Chai (2008) that different pedagogical beliefs may have significant influences on how teachers plan and perform their instructional practice.

Within the literature, several terms are used to conceptualise pedagogical belief teachers hold about digital technologies. For example, Chen (2008) and Hermans, Tondeur, van Braak, & Valcke (2008) identify two distinct kinds of teachers' pedagogical beliefs, called constructivist beliefs and traditional beliefs. Constructivist beliefs are also referred to student-centred approach (Palak & Walls, 2009). Whereas, traditional beliefs also referred to as behaviourist (Cher Lim & Chai, 2008) or teacher centred approach (Palak & Walls, 2009).

Hermans, Toundeur and Valcke's (2008) study of 525 primary school teachers in Belgium investigated the relationship between teachers' beliefs and their

computer use. Findings from this study indicated that teachers' constructivist beliefs were a strong predictor of classroom use of computers. In contrast, Hermans et al., (2008) found that teachers who hold a "traditional" (p. 1506) view of teaching have negative views on the use of computers. Computer experience and attitudes towards computers also have significant effect on teachers' use of computers (Hermans et al., 2008). Hermans, et al., (2008) pointed out that the result of this study suggests that teachers might have a shared set of educational beliefs in particular schools and proposed future research to look at specific school condition and school culture variables. In this regard, the Communities of Practice perspective adopted in my study may provide a useful lens for understanding the relationship between school condition and culture with teachers' digital technologies integration.

In another study, Palak and Walls (2009) conducted a survey involving 113 respondents from West Virginia to investigate whether teachers who use technology frequently change their beliefs and practices towards a student-centered paradigm. They looked at the relationship between teachers' beliefs (i.e. student-centered beliefs, teacher-centered beliefs and teachers attitudes) and their technology instructional practices (i.e. teacher software use, student software use, and instructional strategies). Other predictor factors analysed in this study were teacher confidence and comfort with technology, technical and administrative support and computers-students ratio. It was found that a teacher's attitude toward technology is the most important belief factor influencing a teacher's decision to use digital technologies. For the other factors, ratio of computers to students was found to have a direct correlation with teachers' decisions to use certain types of software and teachers' instructional strategies (Palak & Walls, 2009). Palak and Walls (2009) study is relevant to the Malaysian Smart School policy discussed earlier in this thesis (see Chapter 1, section 1.6). The findings from their study imply that if the policy was an accurate reflection of what is happening in schools, then teachers should be more likely to use the digital technologies. This also suggests that digital technologies integration not only requires teacher's beliefs, but also high degree of access to computers.

Supplemented with qualitative data gathered from four cases, Palak and Walls' (2009) study also revealed that teachers who believed in a student-centred

approach mostly used digital technologies for independent learning. For example, teachers adopted a project-based approach where students became independent learners, explored concepts and found information on their own. Interestingly, teachers who held teacher-centred beliefs also used digital technologies for independent learning, but they prefer students to use digital technologies for repetition and reinforcement activities to master a particular skill. However, the results of this study indicated that teachers did not shift their teaching from teacher-centred to student centred practices, even though they had positive attitudes towards digital technologies (Palak & Walls, 2009).

Although Hermans, et al. (2008) and Palak and Walls (2009), found a significant relationship between teachers' pedagogical belief and their technology use, some research shows inconsistencies in their findings. For example, Judson's (2006) research conducted in the United States found no relationships between teachers' beliefs and their technological practices. Although most teachers in this research (n=32) posit that they held strong constructivist beliefs based on survey questionnaires, they failed to exhibit what they believe in their teaching practices during the classroom observation. The finding of Judson's (2006) study indicated that teachers' knowledge and understanding might be influencing their view of what they see as constructivist teaching and how they interpret this belief in their teaching practices. In other words, there is a complex relationship between teachers' situated learning such as their expertise and competence to integrate digital technologies, their pedagogical beliefs and their technology integration practice. In this regard, Communities of Practice theory may provide a better lens to understand these complexities in teachers learning to integrate digital technologies.

Similar to Judson's (2006) finding, Chen's (2008) case study of 12 Taiwanese teachers found that teachers' beliefs about digital technology integration were not consistent with their teaching practices. Teachers in this study reported high agreement with constructivist teaching concepts, but in their real practice (based on the observation, interview and documentation) their digital technologies use was actually for personal purposes, for instructional planning and for administrative work. They did not use digital technology in teaching and learning to facilitate students' problem solving or to conduct collaborative and co-operative learning. Data from the

interviews revealed factors that explained why teachers' beliefs were not aligned with their digital technologies integration practices. Influences of external factors such as lack of computer access, insufficient time for planning the instruction, and lack of technical and administrative support were reported by teachers. Limited theoretical understanding also explained why teachers did not incorporate their expressed concept or beliefs into their teaching practices (Chen, 2008).

The above examples revealed that teachers' pedagogical beliefs influence the way digital technologies are used in teaching and learning. However, the inconsistencies in research findings raise important questions about how teachers integrate digital technology in their teaching and learning practices in regard to their pedagogical beliefs. As noted by Judson (2006), "teachers' beliefs about instruction do not necessarily resonate in their classroom practices when integrating technology" (p. 592). There are some other factors that teachers' face which hampered them from practising what they believe. This is related to teachers' confidence to demonstrate what they believe about technology (Ertmer, 1999), teachers' theoretical knowledge (Chen, 2008; Judson, 2006) and teachers' experience in integrating technology (Hughes, 2007; Judson, 2006).

The above studies on teachers' pedagogical beliefs reviewed were mainly conducted within the U.S.A context. Limited research was found within the Malaysian context. Most of the studies conducted within Malaysian context were limited to examining teachers' attitude towards digital technology (e.g., Abdullah, Zainol Abidin, Luan, Majid, & Atan, 2006; Bakar & Mohamed, 2001; Wong & Hanafi, 2007) and no link was made with teachers' pedagogical beliefs to integrate digital technology. This is discussed further in section 2.7.

To conclude this section, this review of the literature on teachers' pedagogical belief has suggested that there is a possible positive relationship between teacher's pedagogical beliefs with their digital technologies integration. However, studies in this area did not include a focus on situated environment that may explain the complexity in the relationship. Furthermore, the inconsistencies of their findings may be explained by taking a socio-cultural perspective, such as Communities of Practice. This perspective may help to reveal not only the contextual and interpersonal

pressures on how a teacher forms and acts on beliefs but also accommodate issues such as policy, access, and teacher experience.

2.6 Frameworks and models of technology integration

Technology integration is not a simple task (Ertmer & Ottenbreit-Leftwich, 2010; Inan & Lowther, 2010; Vannatta & Fordham, 2004). Its complexity can vary in several ways depending on its purpose or goals, such as for pedagogical or administrative purposes. It can also vary according to the educational goals or beliefs such as the learning theories we adopted. In this regard, the ways teachers use or integrate digital technologies in their teaching is varied. Within the literature, there are several frameworks and models of technology integration developed to describe the way technology was integrated in the classroom and the factors that influenced its integration.

In the earlier years of technology being introduced in education, Moersch (1995) provided a distinctive indicator for describing different technology use among teachers. In his framework called Level of Technology Use (LoTi), first introduced in 1994 in the U.S. context, teacher's technology use was categorised in seven distinct levels, from non-use to refinement (see Table 2-1). This framework indicates that teachers' technology integration is a developmental process, progressing from the lower level (non-user) to the higher level (expert-user). As the teacher progresses from one level to another, changes in their instructional practices can be observed. For example, the teacher's instructional focus shifts from teacher-centred to learner-centred. To support learner-centred activities in teaching and learning, the teacher may use technology as a tool to enhance students' understanding of important concepts and processes. This can be achieved using digital technologies such as databases, multimedia, spreadsheets, graphing applications and telecommunications devices. Accordingly, as teachers move from a lower level to a higher level, teachers will progressively replace "traditional verbal activities" with "authentic hands-on inquiry" related to a problem, issue or theme (Moersch, 1995, p.41).

Table 2-1

Levels of Technology Use (LoTi) Framework (Moersch, 1995, p.42)

Level	Category	Indicators
0	Non-use	A perceived lack of access to technology-based tools or a lack of time to pursue electronic technology implementation. Existing technology is predominately text-based.
1	Awareness	The use of computers is generally one step removed from the classroom teacher. Computer-based applications have little or no relevance to the individual teacher's instructional program.
2	Exploration	Technology-based tools serve as a supplement to the existing instructional program. The electronic technology is used either as extension activities or as enrichment exercises to the instructional program.
3	Infusion	Technology-based tools including databases, spreadsheets, graphing packages, probes, calculators, multimedia applications, desktop publishing, and telecommunications augment selected instructional events.
4A	Integration (Mechanical)	Technology-based tools are integrated in a mechanical manner that provides rich context for students' understanding of the pertinent concepts, themes, and processes. Heavy reliance is placed on pre-packaged materials and sequential charts that aid the teacher in the daily operation of the instructional curriculum. Technology is perceived as a tool to identify and solve authentic problems relating to an overall theme/concept.
4B	Integration (Routine)	Teachers can readily create Level 4 (Integrated units) with little intervention from outside resources. Technology-based tools are fully integrated in a routine manner that provides rich context for students' understanding of the pertinent concepts, themes, and processes. Technology is perceived as a tool to identify and solve authentic problems relating to an overall theme/concept.
5	Expansion	Technology access is extended beyond the classroom. Classroom teachers actively elicit technology applications and networking from business enterprises, governmental agencies, research institutions, and schools to expand student experiences directed at problem solving, issues resolution, and student activism were surrounding a major theme/concept.
6	Refinement	Technology is perceived as a process, product, and tool for students solving authentic problems related to an identifiable "real-world" problem or issue. Technology, in this context, provides a seamless medium for information queries, problem solving, and/or product development. Students have ready access to and a complete understanding of a vast array of technology-based tools to accompany any particular task.

This classification of level of use is helpful for interpreting observational data of teachers' technology use and integration. For example, Dawson's (2006) study conducted in Florida used LoTi framework to identify student teachers' level of technology integration during an internship program. It was found that the majority of student teachers were at the earlier stage of technology integration. It was found that fifty six per cent (56%) of teachers were at level 2 (exploration), 21% at level 1 (awareness), 15% at level 3 (infusion) and only 6% of them at level 4a (integration-routine). Teachers who were categorised in level 2 (exploration) used technology to complement selected lessons by providing in-depth coverage of the content and emphasizing on higher-level thinking using technology. Similar to Dawson's (2006), study by Rakes, Fields and Cox (2006) study among 186 elementary teachers in the southern states of the U.S.A. found that majority of the teachers (35.1%) were non-technology use (Level 1).

In response to the low level of technology integration among the student teachers, Dawson (2006) acknowledged time, learning processes and other condition as necessary for teachers to become effective technology-using teachers. In explaining this, Dawson's (2006) study was supported with qualitative data from teachers' reflective activity and inquiry (using journals and synthesis paper) to evaluate the student teachers' experiences and thoughts in using digital technology. According to Dawson (2006), the qualitative data recognized the complexities of technology integration, and enabled prospective teachers to consider how their beliefs about teaching and how digital technologies could be integrated in their teaching practices.

Although Moersch's (1995) classification of technology use is helpful for interpreting observational data of teachers' technology integration, it has its limitations. Rakes, Fields and Cox (2006) pointed out that the questionnaire based on LoTi instruments did not consider the complexity of technology applications used at school or the frequency of their use. In addition, unexamined factors affecting the relationship between technology use by teachers and their instructional practices may exist that are not accounted for in the LoTi instruments.

Within the Malaysian context, there were several studies interested in measuring teachers' technology integration by categorising them into levels. For

example, a study by Wan Ali et al. (2009) identified levels of approaches in integrating digital technology in the curriculum among Malaysian Smart School teachers. They found that teachers employed four levels of approaches in integrating ICT in the curriculum; as verbal resources at level one, as printed resources at level two, as hands-on experience at level three and a combination of all the approaches at level four, as shown in the Table 2-2.

Table 2-2

Levels of ICT integration approaches in the curriculum among Malaysian Smart Schools teachers (Wan Ali et al., 2009, pp. 27-28)

Level	Approaches	Situation
Level 1	ICT as verbal resources	Teacher teaches with the aid of ICT as a verbal resource. e.g: Teachers provide the website addresses or name of courseware that help students to enhance their understanding of topics.
Level 2	ICT as printed resources	Teacher teaches with the aid of ICT as printed resources, e.g: Distributed printed or downloaded information as teaching aids.
Level 3	ICT as hands-on experience	Teacher teaches with the aid of computer, courseware, software or Internet.
Level 4	A combination of all the levels. ICT as hands-on experience, printed resources and verbal resources.	Teacher teaches with the aid of computer, courseware, software or Internet in delivering the lesson. Teacher also provides handouts with information printed from the Internet or courseware

This study on Malaysian Smart Schools teachers' digital technology integration that was analysed based upon categories only describes the use of digital technology among teachers. This model should not use levels as its organizing structure as Level 4 should be more complex than Level 3. The study also did not provide further investigation of why teachers were at certain level of technology integration, and how teachers may improve their digital technology integration practice. In my study, I am not interested in categorising teachers' use of digital technology into different levels, as suggested by Moersch (1995) and Wan Ali et al. (2009) as it does not help to fully understand how teachers learn to integrate digital technology in the school's CoP.

Other than LoTi (Moersch, 1995), there are other influential models of technology integration (Chamblee & Slough, 2004; Legris, Ingham, & Collerette, 2003; Straub, 2009). These include the diffusion of innovation model (Rogers, 1995, 2003), the computer based adoption model (CBAM) (Hall & Hord, 1987), technology acceptance model (TAM and TAM 2) (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; 2000), and Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003).

These models have been used across disciplines. For example, Rogers' model has been used broadly in many disciplines including education, business and medical sciences to provide theoretical base for understanding individual or organizational choices for adopting technology (Straub, 2009, p. 627). Similarly, the technology acceptance model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) which originated within the computer science domain and have been applied to many educational settings (Straub, 2009; Sumak, Hericko & Pusnik, 2011). TAM and its recent model called UTAUT have been proposed to address "why users accept or reject" a particular technology or computer system (Legris et al., 2003, p. 192).

2.6.1 Diffusion of Innovation Theory

Rogers' (1995, 2003) diffusion of innovation theory has been widely used for understanding innovation adoption in corporate setting (Straub, 2009). It has also been applied as a theoretical framework for understanding technology adoption and integration in education and classroom settings (Kebritchi, 2010; Straub, 2009). It provides a theoretical foundation to understand individual or organizational choices for adopting an innovation. However, the innovation does not solely focus on technology. According to Rogers (2003), "an *innovation* is an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (p.12). To be called an innovation, the idea, practice, or tool does not have to be necessarily newly invented. The perception of the individual or the other unit of adoption (a group of people or an organisation) will determine whether the idea, practice or object introduced to them is new or not. For example, within an educational setting, a

particular technology system or ICT could be an innovation to an individual teacher or to the entire school.

Rogers' (2003) diffusion of innovation model consists of two main theories. The first, referred to as the theory of adoption, examines the individual's choices to accept or reject an innovation. This adoption process consist of five attributes namely knowledge, persuasion, decision, implementation and confirmation. For an individual to adopt a particular innovation, he or she needs to learn about the innovation and be persuaded to try the innovation before making a decision to adopt or resist the innovation.

In addition, Rogers classified the stages of innovation adoption by an individual into various categories, namely innovators, early adopters, early majority, late majority, and laggards. The bell shaped distribution of individual innovation adoption and the percentage of potential adapters for each category is shown in Figure 2-1. It was theorized that individuals' levels of adoption towards innovation vary; some can easily adopt new innovation, whereas some are reluctant to accept changes.

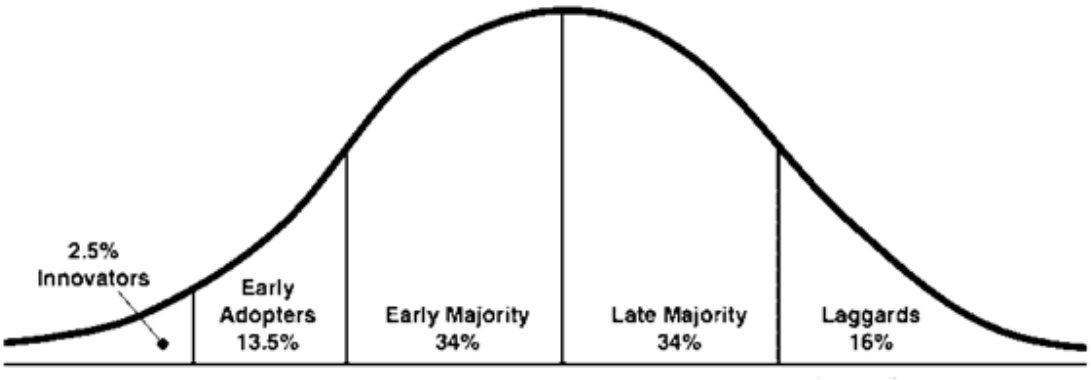

Figure 2-1: Categories and percentage of innovation adopters (Rogers, 2003, p. 281)

The second theory, referred to as the theory of diffusion, examines 'how' and 'why' innovation is adopted or rejected by a collective of people such as an organization or a population. There are five important variables that determine the rate of adoption; perceived attributes of innovations, type of innovation-decision, communication channels, nature of the social system, and change agents' efforts (see Figure 2-2).

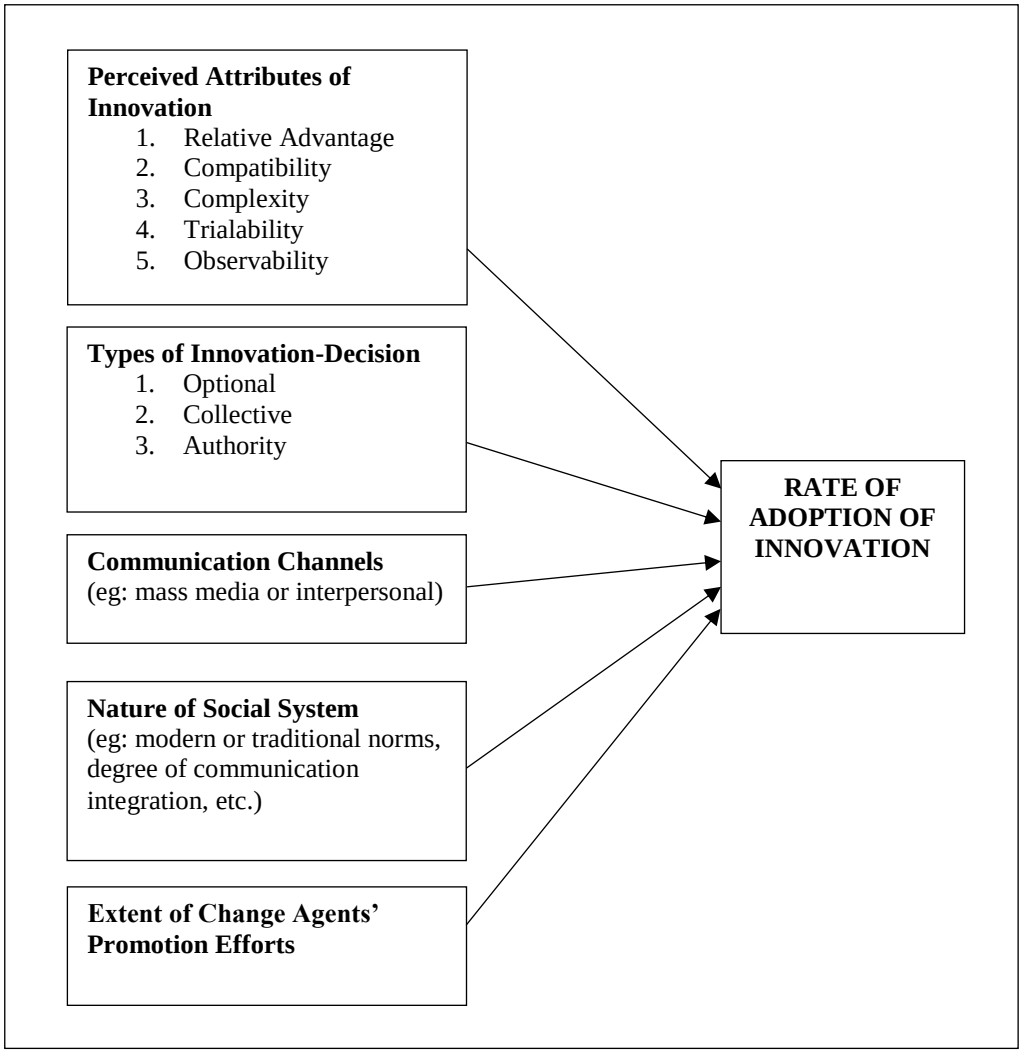

Figure 2-2: Rate of adoption of innovation (Rogers, 2003, p. 222)

However, studies on adoption of innovation have mainly focused on the first variable that is the perceived attributes of innovation, which explores the characteristics of an innovation that may influence its adoption. These include relative advantage, compatibility, complexity, trialability, and observability (Martins et al., 2004).

Relative advantage refers to how an innovation is perceived to improve the currently existing innovation. Compatibility refers to how well the innovation aligns with the values and needs of the people who are adopting it. Complexity refers to how easy the innovation is to understand and use. Trialability is the level at which an innovation adopter can easily test and assess the innovation before fully adopting and

implementing it. Finally, observability is a measure of whether the result or benefits of adopting the innovation are visible to other people who are considering adopting it. It is hypothesized that the increase in each of these attributes will increase the rate of adoption, with exceptions for complexity, in which the decrease in complexity is hypothesized to increase the rate of adoption (Rogers, 2003). In summary, innovations that have more relative advantage, compatibility, trialability, and observability; and have less complexity as perceived by potential adopters are more likely to be adopted more rapidly.

In a study by Martins, et al. (2004), which investigated factors influencing language schools in Brazil to adopt Internet technology in the curriculum, all five attributes of innovation adoption were found to be significant. Observability and trialability of the Internet were found to be the two most significant predictors of adoption. The results indicated that 55% (out of 92) schools were adopting Internet as a teaching tool. Interestingly, in Martins, et al.'s study, adoption took place in 65% of the schools that had pedagogical coordinators to help teachers in using the Internet as a teaching tool. It was argued that the existence of a pedagogical coordinator is valuable in showing the usefulness and ease of use of a particular innovation, and at the same time in providing opportunities for teachers to observe and use it (Martins et al., 2004).

The findings from Martins, et al.'s, (2004) study suggests that a coordinator may act as a change agent who has a positive influence on how people will perceive the innovation as described by Rogers (2003). The roles of the change agents (i.e. the coordinator) was not explored further in Martins, et al. (2004) as their study was based on the five perceived attributes of innovation, and did not include the other four variables (i.e., types of innovation decision, communication channels, nature of the social system and the extent of change agent's promotion efforts).

Rogers' model of innovation adoption has been a highly influential theoretical framework in the technology adoption research, including in research that involved teachers (Kebritchi, 2010; Martins et al., 2004; Straub, 2009). However, Roger's model does not deal with the complexities of technology adoption and integration (Franklin & Bolick, 2007). Although Roger's model does highlight some of the issues

including affordances and constraints in adopting technology innovation, issues related to social and cultural influences to integrating technology such as identity were not discussed. It has also been argued that the model does not necessarily apply to all situations (Straub, 2009) such as in researching technology innovation in schools, in which the decision making process is more complex and involved other social forces (Frank et al., 2004). In response to this limitation, Straub (2009) proposed that future research should explore how the adoption and diffusion model could be applied in informal facilitation structures, like a community of practice, which is the focus of my study

This literature review of Rogers' diffusion and innovation model provided an important stage in my study, since it informed my view that the notions of teachers' technology adoption and integration should be discussed together with teachers' learning to integrate technology in their school's setting. Importantly, the acceptance of any innovation is shaped by the social and cultural context in which the adoption occurs (Frank et al., 2004; Straub, 2009). In my study therefore, I have chosen the theory of Communities of Practice (Wenger, 1998), so I could explore the adopters (teachers) involvement in the social system of the school, and the potential of change agents (i.e., the roles of ICT coordinator and brokers among teachers) in the integration of digital technology from the situated environment of the school context.

2.6.2 Concern Based Adoption Model (CBAM)

Rogers' (1995, 2003) Diffusion of Innovation model is one of the most influential theories in describing innovation adoption in an organization within a corporate setting (Straub, 2009). However, within the educational setting, the Concerns Based Adoption Model (CBAM) (Hall & Hord, 1987), is arguably "the most robust and empirically grounded theoretical model for the implementation of educational innovations" (Anderson, 1997, p. 331) that has been widely used to understand change in terms of technology (Straub, 2009).

The CBAM is based on Frances Fuller's 1960s work on teacher change and classification of teachers' concern about innovation and change (Straub, 2009). The development of the CBAM was underpinned by several assumptions about classroom change in curriculum and instruction: (1) change is a process, not an event, (2) change is accomplished by individuals (3) change is a highly personal experience, (4) change involves developmental growth (5) change is best understood in operational terms, and (6) change can be facilitated through intervention on individuals, innovations, and contexts involved (Anderson, 1997; Straub, 2009). The CBAM is concerned with "measuring, describing, and explaining the process of change experienced by teachers involved in attempts to implement new curriculum materials and instructional practices, and with how that process is affected by interventions from persons acting in change-facilitating roles" (Anderson, 1997, p. 331).

The CBAM consists of three diagnostic tools; Stages of Concern (SoC), Levels of Use (LoU), and Innovation Configurations (IC). These tools could be used to gather diagnostic data, to inform the change facilitator of any intervention needed. Interventions in this change process refer to "actions that affect and facilitate teachers' use of new program or practices" (Hall & Hord, 1987, p. 13).

The first diagnostic tool, the Stages of Concern (SoC) describes "how teachers or others perceive an innovation and how they feel about it" (Hall & Hord, 1987, p. 13). It measures seven stages in the concerns process: awareness, information, personal, management, consequence, collaboration, and refocusing. This tool could provide the change facilitator with information on what concerns individuals involved in the innovation process. The stages and description of the stages of concern are presented in Table 2-3 as follows.

Table 2-3

Stages and descriptions of the stages of concern (Straub, 2009, p. 635)

Stage	Name	Description of concerns
0	Awareness	Teachers have little awareness or concern for a particular innovation. The innovation is seen not to affect them at this stage.
1	Informational	Teachers have general or vague awareness of an innovation. Teachers may begin some information seeking to gain additional knowledge about the innovation.
2	Personal	Teachers' concerns are about the personal costs of implementing an innovation—how a particular innovation will change the demands of or conflict with existing understanding of what they currently do.
3	Management	Teachers' concerns will focus around how to integrate the logistics of a particular innovation into their daily jobs.
4	Consequences	Teachers' concerns are primarily on the impact of the innovation on their students.
5	Collaboration	Teachers begin to have concerns about how they compare to their peers and how they can work with their fellow teachers on an innovation.
6	Refocusing	Teachers' concerns are how to better implement an innovation.

The second diagnostic tool, Level of Use (LoU) addresses "what a teacher is doing or not doing in relation to the innovation" (Hall & Hord, 1987, p. 14). It provides a framework for understanding teachers' behaviour in the implementation of an innovation (Straub, 2009). The LoU framework categorises teacher's actions from non-use (level 0) which indicates lowest behavioural implementation, up to renewal (level 6) which indicates the highest behavioural implementation. This framework suggests that as teachers progress from the lowest level to the highest level, teachers are transforming and extending the innovation in their practice. The description of each level of use is outlined in the following table (see Table 2-4).

Table 2-4

Stages and descriptions of Levels of Use (LoU) (Straub, 2009, p. 636)

Level	Name	Description of use
0	Non use	A teacher does not use or has no intentions to use an innovation
1	Orientation	A teacher is seeking additional information about an innovation but has not determined whether he or she will implement it
2	Preparation	A teacher gets ready to include an innovation (but has not yet implemented it)
3	Mechanical	A teacher begins implementation but generally struggles with the logistics of the innovation
4A	Routine	A teacher successfully integrates an innovation
4B	Refinement	A teacher changes the innovation to suit his or her needs
5	Integration	A teacher goes beyond his or her own classroom to share his or her implementation of an innovation with peers
6	Renewal	A teacher extends an innovation, transforming the innovation

The third diagnostic dimension, Innovation Configurations (IC), addresses the innovation itself. This dimension focuses on describing the operational forms an innovation can take. For example, (Hall & Hord, 1987) pointed out that "teachers may adapt, or in some cases, mutate the innovation as they become involved in its use" (p.14). It was anticipated that, through the IC, the change facilitator could identify and describe the innovation or adaptation of new programs and thus plan interventions that suits the innovation in a particular classroom setting (Hall & Hord, 1987).

The Hall and Hord's (1987) SoC and LoU categorizations are similar to Moersch's (1995) categorization in Levels of Technology Implementation (LoTi) reviewed earlier in section 2.6 (see Table 2-1). In addition, the CBAM focuses on the behaviour change or the progression in the innovation or technology use. Although CBAM is useful in describing teachers' attitude and behaviours towards technology

use, similar to Roger's (2003) model of Diffusion of Innovation it does not include social and cultural elements of the school setting that might influence teachers' attitude and behaviours to successfully integrate digital technology in their teaching practices.

2.6.3 Technology Acceptance Model (TAM)

Another theoretical model related to technology adoption and integration is the Technology Acceptance Model (TAM) first introduced by Davis in 1986 (Davis, 1989; Davis et al., 1989). Later, the model was extended based on four longitudinal studies by Venkatesh and Davis (2000) known as TAM2. These two models, especially the original TAM have been widely used for explaining individual behaviour regarding acceptance of technology (Legris et al., 2003; Nair & Das, 2012; Straub, 2009). In particular, TAM has been widely accepted because of its "parsimony and explanatory power" (Calantone, Griffith, & Yalcinkaya, 2006, p. 1). In a school setting, TAM has been applied for investigating factors related to teachers' (in-service or pre-service) technology acceptance and integration (Baek et al., 2008; Hu et al., 2003; Teo, 2010; Teo et al., 2009).

TAM theorised that people's acceptance of technology is driven by its perceived usefulness and perceived ease of use (see Figure 2-3). According to Davis (1989), perceived usefulness is "the degree to which an individual believes that using a particular system would enhance his or her job performance" (p. 320) and perceived ease of use refers to "the degree to which an individual believes that using a particular system would be free of physical and mental effort" (p. 320). This model emphasizes that people develop perceptions about the usefulness of a particular technology and about how easy the technology is to use. These perceptions, in turn, influence an individual's intention to use a particular technology, and subsequently their actual usage (Davis, 1989; Davis et al., 1989).

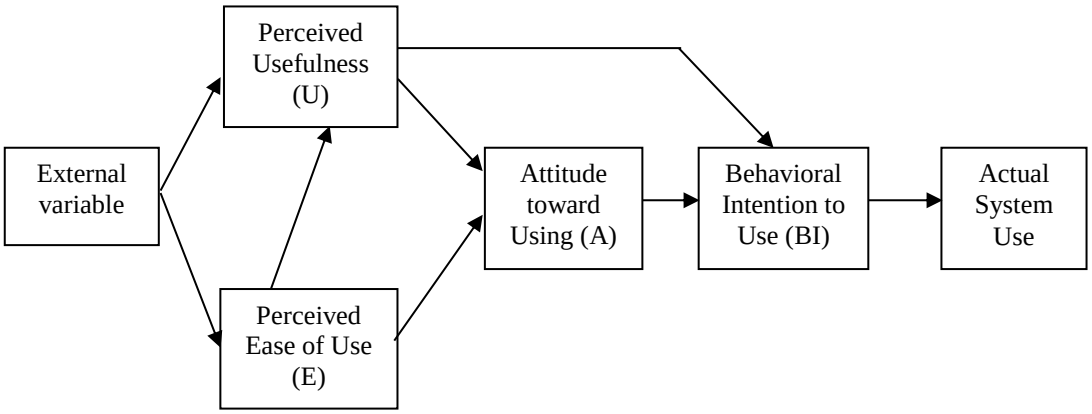

Figure 2-3 : Technology Acceptance Model (TAM) (Davis et al., 1989, p. 985)

In relation to teachers' technology integration, previous studies conducted using TAM hypothesised that teachers' attitude towards technology are driven by these two factors (perceived usefulness and perceived ease of use), relating to their intention to use a particular technology (Hu et al., 2003; Ma et al., 2005; Smarkola, 2007; Teo, 2010; Teo et al., 2009). For example, Smarkola (2007) found that perceived ease of use and perceived usefulness together explained 48-50 per cent of the variance in student-teacher's and experienced teacher's intentions to use technology. Similarly, Yuen and Ma (2002) and Hu et al., (2003) also found that perceived usefulness is a significant predictor of intention to use a technology, with perceived ease of use having a direct effect on perceived usefulness, but not directly on intention to use.

It has also been discovered that perceived usefulness was more influential compared to ease of use in predicting user's intention to use technology (Hu et al., 2003; Ma et al., 2005; Smarkola, 2007). Findings from these studies suggest that teachers need evidence that technology is useful for the students' learning and could make the classroom practice more meaningful, before making a decision whether to adopt technology or not in their teaching practices. For example, Hu et al., (2003) examined 130 teachers' technology acceptance or their decision-making of using Microsoft PowerPoint in their classroom teaching. It was found in their study that perceived usefulness is an important determinant of user acceptance and its influence appears to increase as teachers become more experienced. Their findings

suggest that a teacher is likely to consider a technology to be useful when it is relevant to their task, such as whether the use of Microsoft PowerPoint would make teachers accomplish tasks more quickly, increase teachers' productivity, and make teachers teaching job easier.

Teachers' technology integration is also driven by other internal and external factors that influence their pedagogical actions, such as social influences factors and the facilitating conditions (Baek et al., 2008; Teo, 2010). The theoretical extension of TAM, called as TAM 2 which was based on four longitudinal studies by Venkatesh and Davis (2000) has incorporated social influences factors such as experiences and voluntariness that moderate individual intention to use a new technological system (see Figure 2-4).

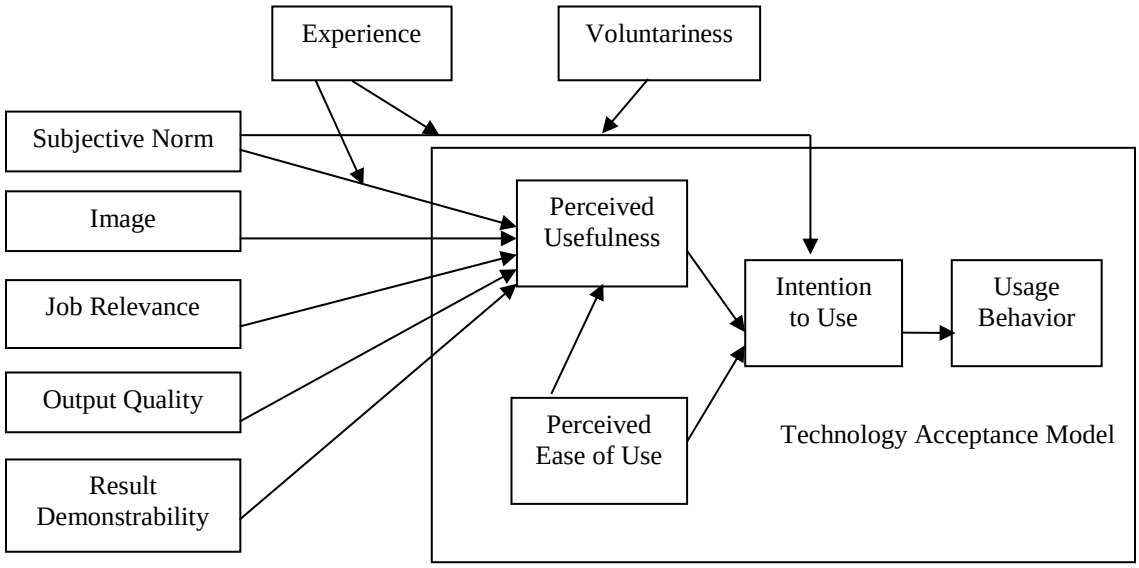

Figure 2-4: Technology Acceptance Model 2 (Venkatesh & Davis, 2000, p. 188)

One of the additional constructs proposed in TAM 2 was the notion of subjective norm (originally from the Theory of Reasoned Action by Fishbein and Ajzen, 1975), which refers to a "person's perception that most people who are important to him or her think that he or she should or should not perform the behaviour in questions" (Fishbein & Ajzen, 1975, cited in Venkatesh & Davis, 2000, p. 187). It was argued in TAM 2 that an individual may take into consideration other

people's perceptions about the importance of using a particular system or technology tools (Venkatesh & Davis, 2000).

For example, Baek, Jung and Kim's (2008) study of Korean teachers' technology adoption also included the notion of subjective norms, which they define as teachers' "adaptation towards external requests and other's expectations" (p. 228). Examples of items included in their scaleto measure the subjective norms construct are: "It is commonly perceived that good teachers use technology well" and "I might be uncomfortable if I don't use it, because most teachers use it" (Baek et al., 2008, p. 228). In Baek, et al.'s study, subjective norms were found to be the strongest factor influencing teachers' adoption of technology. Other factors found to influence teachers' adoption of technology are drawing attention to themselves, physical fatigue, class preparation and management, and using the basic and enhanced functions of technology.

Another study conducted by Hu, et al., (2003) among teachers who enrolled in a Microsoft PowerPoint training program in Hong Kong also looked at the notion of subjective norms. They argued that an individual's decision to accept digital technology is influenced by other people's opinions in the school community. It was hypothesized that "teacher's perceived subjective norms concerning acceptance of Microsoft PowerPoint has a positive effect on his or her intention to accept the technology" and "teacher's perceived subjective norm concerning acceptance of Microsoft PowerPoint has a positive effect on his or her perception of the technology's usefulness" (Hu et al., 2003, p. 230). Their findings however showed that subjective norms have a negative effect on perceived usefulness, and have no direct effect on the intention to accept the technology. The explanation offered was that the "surprising influence pattern might be partially attributed to a teacher's entrenched pedagogical views or beliefs; e.g. accepting a technology (to comply with the community norm) but not necessarily convinced of its value" (Hu et al., 2003, p. 237). In their recommendation, (Hu et al., 2003) proposed that "school administrators should consider creating user communities or interest groups to support and encourage experience sharing and knowledge transfers among teachers" (p.238). This suggested that the social and cultural influences of the teacher communities within the school might have a greater influence to teacher's technology integration practice.

Although the technology acceptance model (TAM and TAM 2) is a useful model to explain the impact of external variables on internal beliefs, attitudes, and intentions, it has been criticized for its limitations. For example, (Legris et al., 2003) in their critical review of technology acceptance model concluded that to be effective model of technology acceptance, TAM and TAM 2 has to be integrated into a broader model that include variables related to both human and social change processes. In addition, previous studies suggest that in teachers need evidence that technology is useful for the students' learning and could make classroom practice more meaningful (Ertmer, 2005; Hu et al., 2003), and the usefulness of a particular technology in the classroom must be proven to the teachers who are expected to use it (Wozney et al., 2006). This suggest that integrating technology is a complex process and therefore research in teachers' technology integration should also consider the social and cultural aspects of the school environment that contribute to teachers' learning to integrate technology.

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

Considering the limitation of TAM and TAM 2, Davis, Venkatesh, and their research team (Venkatesh et al., 2003) proposed a Unified Theory of Acceptance and Use of Technology (UTAUT). According to Venkatesh, et al, (2003), this theory was developed based on empirical testings of eight adoption and acceptance models namely; theory of reasoned action, technology acceptance model, motivational model, theory of planned behaviour, a model combining the technology acceptance model and the theory of planned behaviour, model of PC utilization, innovation diffusion theory, and social cognitive theory.

In the development of UTAUT, a longitudinal study was conducted at four organizations among individuals being introduced to a new technology in their workplace to empirically test the eight models. It was found that the eight models individually explained between 17 per cent and 53 per cent of the variance in user intentions to use technology (Venkatesh et al., 2003). Based on the findings, the team then formulated a unified model that integrates elements across the eight models (see Figure 2-5).

The UTAUT model consists of four key constructs; performance expectancy, effort expectancy, social influence, and facilitating conditions. These four construct are direct determinants of behavioural intention and actual usage behaviour. In this theory, gender, age, experience, and voluntariness of use are hypothesized to mediate the impact of the four key constructs on behavioural intention and use behaviour. In this model, behavioural intention is a critical predictor of technology use (Venkatesh et al., 2003).

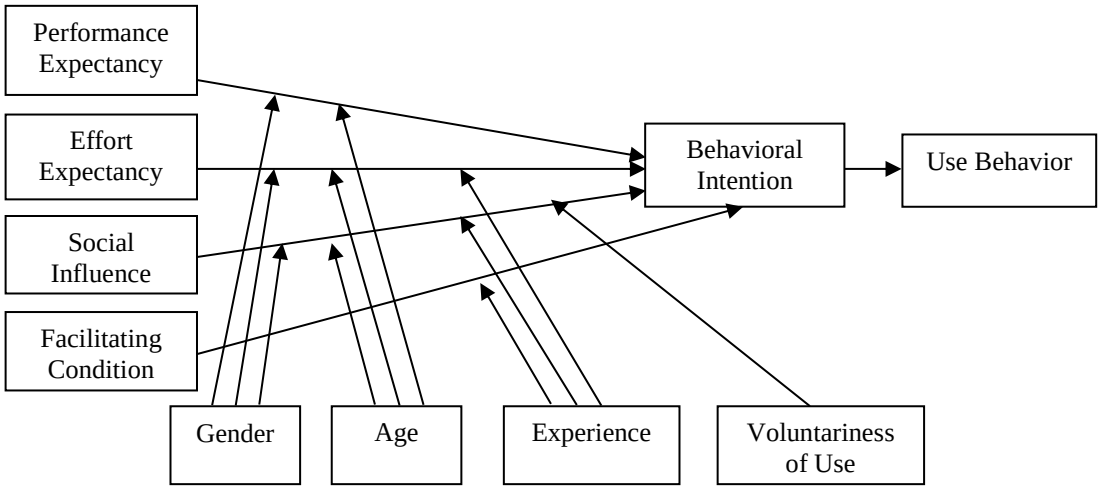

Figure 2-5: Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003, p. 447)

The UTAUT model was tested by Venkatesh, et al., (2003) using the original data from individuals from the four organizations. It was found that the unified model outperformed the eight individual models (adjusted R^2 of 69 per cent). The UTAUT was then confirmed with data from two new organizations and similar results found (adjusted R^2 of 70 per cent) (Venkatesh et al., 2003).These results indicate that the unified model explains up to 70 per cent of the variance in user intention to use technology. Based on the result, Venkatesh, et al., (2003) claimed that:

> UTAUT is a definitive model that synthesizes what is known and provides a foundation to guide future research in this area. By encompassing the combined explanatory power of the individual models and key moderating

influences, UTAUT advances cumulative theory while retaining a parsimonious structure.

UTAUT has offered a more complex model in examining user's intentions to use technology as compared to TAM and TAM 2. However, similar to TAM and TAM 2, the UTAUT model was considered to have significant limitations, especially in educational settings (Birch & Irvine, 2009; Straub, 2009). The original TAM is criticized for being too limited, whilst the UTAUT is criticized for its lack of parsimony, coordination and integration (Bagozzi, 2007; Legris et al., 2003). In addition, the findings from research conducted using these models (TAM, TAM 2 and UTAUT) have been inconsistent (Legris et al., 2003). In addition, the technology acceptance models (TAM, TAM 2 and UTAUT) focused on the individual adoption of technology based on self-report surveys, and therefore were criticized for their inability to account for collective perspective and its relationship with the contextual characteristics of the organization (McFarland & Hamilton, 2006).

Since digital technologies integration is a complex practice, and professional learning to integrate digital technologies is not a simple task, these models at some levels have not answered the important research problem of how teachers learn to integrate digital technologies. For example, the UTAUT model explains why teachers use technology in the classroom, but does not explain how the variables such as social influence and performance expectancy influence teacher's effort to learn and integrate technology in the complex environment of the school. Therefore, my study explores this issue within the qualitative paradigm, underpinned by the socio-cultural perspective of learning namely Communities of Practice (Wenger, 1998), to understand teachers' learning to integrate digital technology within the school communities, rather than using quantitative approaches as suggested by previous models of technology adoption or acceptance. This review on technology acceptance models however is important to highlight the research literature on examining teacher's digital technologies integration.

2.7 Research on digital technologies integration in Malaysia

In this section, I discuss the literature on teachers' technology acceptance and integration within the Malaysian context, to show the importance of conducting this current study. Twenty research articles were found within Malaysian context which closely related to teachers' digital technologies integration. Most of these articles however were not listed in the International databases such as ERIC, ProQuest and PsychInfo. These articles were found through online searching from Malaysian university databases or specific Malaysian online journals website.

A close review of these twenty articles revealed four of these studies were descriptive in nature and only provide background information on teachers' digital technology use (Darus & Luin, 2008; Lau & Sim, 2008), teacher's digital technology knowledge and skills (Bakar & Mohamed, 2001; Lau & Sim, 2008; Mahmud & Ismail, 2010), and teacher's attitude towards digital technology (Bakar & Mohamed, 2001; Mahmud & Ismail, 2010). The major findings from these studies centred around the following issues:

i. Frequency of technology used - Teachers in Lau and Sim (2008) study reported that they frequently use technology (either daily or weekly) in their teaching and for instructional support; whereas teachers in Darus and Luin (2008) reported that they rarely use technology in their teaching.
ii. Attitudes toward technology - Teachers had positive attitudes towards technology (Bakar & Mohamed, 2001; Lau & Sim, 2008; Mahmud & Ismail, 2010).
iii. Teacher's technology level and skills - Teachers possess a moderate level of technology knowledge and skills (Bakar & Mohamed, 2001; Lau & Sim, 2008). Teachers in Lau and Sim's study for example rated themselves to be good in using basic technology applications for teaching such as word processing, teaching courseware and presentation tool. Whereas, teachers in Bakar and Mohamed (2001) studies reported that they were not very confident in using technology in their teaching.

These studies however, only reported the mean scores of self-perceived survey items and simple correlation between the variables. No further explanation is offered on

how these variables may contribute to teacher's motivation to learn about integrating technology in their teaching.

Within the twenty articles, the other four studies adapted TAM in their theoretical framework and analysis (Abdullah et al., 2006; Darus & Luin, 2008; Kumar, Che Rose, & D'Silva, 2008; Teo et al., 2009). All of these studies were investigating factors (causal relationship) that influence teachers' intention to use digital technology in their teaching and learning. For example, Kumar et al., (2008) investigated the relationship between teachers' computer usage and technology acceptance constructs (i.e., attitude, computer compatibility, perceived usefulness, perceived ease-of-use, job relevance, subjective norm, and computer self-efficacy) by adapting the TAM instruments of the original authors (Davis, 1989) combined with instruments developed by other researcher. The study was conducted among Mathematics, Science and English language secondary school teachers in Malaysia. The study found that the constructs of attitude, perceived usefulness, perceived ease of use, job relevance, and computer compatibility, showed significant positive relationship with their computer usage.

Meanwhile, other studies focused on teachers' perception towards ICT and the institutional and contextual factors that influence teachers' technology use (e.g., Abd. Mukti, 2000; Lau & Sim, 2008; Wan Ali et al., 2009). This includes studies that investigate factors that hampered teachers' technology integration as reviewed earlier in section 2.4 (e.g., Lau & Sim, 2008; Samuel & Abu Bakar, 2006; Wan Ali et al., 2009). However, no specific models or theories related to technology acceptance or integration were used in these studies. For example, Lau and Sim (2008) study examined (i) level of ICT use by Malaysian teachers, (ii) teachers' perceived ICT competency, (iii) obstacles faced by teachers in using ICT, and (iv) teacher's training and support need in using ICT. Lau and Sim's (2008) study found that most of the teachers were positive with the use of ICT in school. It also showed that teachers were having positive attitudes towards technology and positive intentions to further integrate digital technology into their classroom instruction.

All of these studies have provided insights into the stages or levels of teachers' digital technologies use in the Malaysian classroom, teacher's knowledge and skills

about digital technologies and their attitude towards digital technologies. However, these studies lack discussion on how these variables contribute towards teacher's learning to integrate digital technologies. On the other side, many of these studies concluded and recommended that teachers require further training and professional learning to successfully integrate digital technologies in their teaching and learning process. For example, Lau and Sim (2008) concluded that teachers' need continuous, rather than one-off training, so that teachers' knowledge is upgraded over time. Similarly, Abdullah et al., (2006) also concluded that more attention is needed in the area of teacher training or professional development to improve teachers' digital technologies integration. Nikian, Mohamad Nor and Aziz (2013) also highlighted that teachers need to attend more training in the use of computers to motivate them to apply more digital technology in their teaching. All of these studies suggest that the training programs provided by the Ministry of Education and the schools in the Malaysian Smart School policy did not fulfil teacher's professional learning needs and standards. These have also suggested that teachers need new forms of professional learning approaches to successfully integrate digital technologies in their teaching. Therefore, in my study, I explore the issue of teacher's learning to integrate digital technologies from the communities of practice perspective that may help to suggest new approaches to professional learning for Malaysian teachers.

2.8 Towards teachers' professional learning in school's CoP

Studies conducted based on Rogers' Diffusion of Innovation, CBAM, TAM, TAM 2 and UTAUT models as reviewed in this chapter do not help in understanding how teachers' learn to integrate technology and have paid little attention to discussion about how teachers' participation in school communities contributes to teachers' digital technologies integration. In particular, it has been noted that investigation of the cultural and social influences of teachers' technology integration (Windschitl & Sahl, 2002) and the formation of teachers' identity as they integrate technology (Lim, Lee, & Hung, 2008) are lacking in previous studies. The need for incorporating cultural and social aspects of digital technologies integration and community

influences into the technology acceptance model were highlighted by Bagozzi (2007) as follows:

> Why is it important to consider group, cultural, or social aspects of technology acceptance? Much of human behavior is not best characterized by an individual acting in isolation. To be sure, we sometimes act seemingly as individuals spontaneously, deliberatively, or in response to social pressure. But perhaps more often than not we act interpersonally, or as agents of organizations, or jointly with others, or in a holistic sense as members of collectivities. Decisions with regard to technology acceptance and actual usage are often done collaboratively or with an aim to how they fit in with, or affect, other people or group requisites. (p. 247)

Bagozzi (2007) also argued that technology adoption and integration should be viewed as a process involving goal striving including planning, overcoming obstacles, readjusting actions and negotiating the goals and meaning that will fill the gaps between intention and behaviour to integrate digital technologies. Therefore, my study seeks to fill this gap by developing understanding of teachers' learning processes in integrating digital technology from the socio-cultural perspective of communities of practice.

Reviews of the literature emphasise the importance of professional learning as a medium for change in teachers' beliefs regarding the value of technology (Ertmer, 2005; Judson, 2006; Palak & Walls, 2009) and to enhance teachers' knowledge and competencies in using technology (Lawless & Pellegrino, 2007; Wozney et al., 2006). The literature suggests that teachers' professional learning plays an important role in promoting change in teachers' pedagogical beliefs and improving teachers' competencies regarding the integration of digital technologies in teaching and learning (for example see: Ertmer, 2005; Judson, 2006; Palak & Walls, 2009). Nevertheless, teachers' professional learning has been criticized for not being successful and adequate (Borko, 2004; Looi, Lim, & Chen, 2008). Teacher professional learning programs are often organized as fragmented workshops or seminars (Borko, 2004). Short-term workshops focused on learning certain software or technological tools without pedagogical and curricular connections have not been

effective in helping teachers successfully integrate digital technologies into their lessons (Zhao et al., 2002). In some cases, professional learning programs conducted by an external agency offers pre-packaged training courses which lack relevance to teachers' pedagogical needs (Looi et al., 2008). Therefore, there is a need to look for alternative approaches to make teachers' professional learning more meaningful and successful (Borko, 2004; Butler, Lauscher, Jarvis-Selinger, & Beckhingham, 2004). In response to this continuing concern about teachers' professional learning, Woodgate-Jones (2012) asserts that:

> Teachers' professional development should move away from external, short-term inputs and towards more ongoing, in-house approaches with more collaboration and an increasing requirement for teachers to share their practice and learn from each other. (p.148)

Woodgate-Jones' (2012) views were corroborated with previous research which emphasized that teachers' professional learning related to digital technologies integration should consider the notion of communities of practice (Ertmer, 2005; Henderson, 2007; Hennessy et al., 2005; Looi et al., 2008; MacDonald, 2008). Also, it has been argued that teachers could improve their digital technologies integration practices through collaborative learning in the social and cultural context of their school environment (Glazer et al., 2009; MacDonald, 2008; Webb et al., 2005).

The literature also highlights the need to promote change in teacher beliefs about digital technologies integration. For example, Ertmer (2005) argued that teachers need to have first-hand experiences with technology, observe successful implementation of technology by others, and engage in learning communities. Teachers' engagement in learning communities involved issues of social-cultural influences, in which teachers' practices and beliefs are continually shaped by their ongoing experiences as teachers (Ertmer, 2005). Teachers' practices and beliefs could also be influenced by the values and opinions expressed by those around them, and by the expectations of others (Ertmer, 2005; Glazer et al., 2009).

The importance of teacher's beliefs in influencing teacher's digital technologies integration was noted by Mumtaz (2000) in her review of factors affecting teachers' use of digital technologies as follows:

> Teachers' theories about teaching are central in influencing teachers to use ICT in their teaching. Even if teachers are provided with up-to-date technology and supportive network, they may not be enthusiastic enough to use it in the classroom. Teachers need to be given evidence that ICT can make their lessons more interesting, easier, more fun for them and their pupils, more enjoyable and more motivating. (p. 338)

This remark by Mumtaz (2000) suggests that teacher's beliefs about the usefulness or benefits of using digital technologies in their teaching, as shaped by the experience of others (i.e., social influence) are important factors that influence their digital technologies integration in the classroom. Investigating social influence is particularly important in my study since I aim to explore teachers' learning to integrate digital technologies in the situated environment of the school's CoP. I explore how teachers participate in school activities and engage in shared practice with other teachers in the school communities and what influence this has on their digital technologies integration practices.

2.9 Conclusion and chapter review

In this chapter, the review of literature on teachers' technology integration and models related to technology integration reveal that issues related to teachers' learning to integrate digital technologies are complex. Investigating digital technologies integration is more complicated than considering barriers, motivations, or teacher's beliefs. More research needs to be conducted on situated learning, as teachers might have a shared set of beliefs about integrating digital technologies within their school setting that involves elements of school culture and conditions (Hermans, et al., 2008). Therefore, in the construction of my study, I aim to explore the notion of teachers learning to integrate digital technologies in the school's communities from the social-cultural perspective. In the next chapter, I argue that Situated Learning (Lave & Wenger, 1991) and Communities of Practice (Wenger, 1998) theories could provide a lens to understand the complex practice of digital technologies integration among teachers.

Chapter 3 Situated Learning and Communities of Practice

Chapter 2 included a discussion of issues relating to teachers' digital technologies integration. Factors related to teachers' adoption and dissemination of digital technologies integration were analysed and debated. From the literature, it was suggested that teachers need more training and professional development programs to improve their technology adoption (Abdullah et al., 2006; Lau & Sim, 2008; Nikian, Mohamad Nor & Aziz, 2013). Literature also suggests that teachers would learn better to improve their digital technologies integration practices in the social and cultural context of their school environment (Ertmer, 2005; Glazer et al., 2009; MacDonald, 2008; Webb et al., 2005).

This chapter therefore, provides a second stage of my literature review and discusses the notion of teachers' learning from the socio-cultural perspective of Communities of Practice (Wenger, 1998) and its foundation, Situated Learning (Lave & Wenger, 1991). I argue that Situated Learning and Communities of Practice theories could provide a lens to understand the complex practice of technology integration among teachers.

It is important to note here that my study uses the original work of Lave and Wenger's (1991) *Situated Learning: Legitimate Peripheral Participation* and Wenger's (1998) *Communities of Practice* as the theoretical lenses, and not any other variation of socio-cultural or community theories. My study does not draw on Wenger's (2002) *Cultivating Communities of Practice* because of its different foci (this is discussed further in section 3.5).

3.1 Situated Learning: Legitimate Peripheral Participation

Lave and Wenger's (1991) *Situated Learning: Legitimate Peripheral Participation*, emphasizes learning as a social activity that takes place at any time, usually unintentionally and embedded within an activity, context and culture. Based on that assumption, situated learning theory focuses on informal learning and situated apprenticeship through the process of social interaction known as "legitimate peripheral participation" (p.40).

Situated learning is intimately connected with social participation (J. R. Anderson, Reder, & Simon, 1996; Boylan, 2010; Cox, 2005). As Lave and Wenger (1991), argue:

> In our view, learning is not merely situated in practice - as if it were some independently reifiable process that just happened to be located somewhere; learning is an integral part of generative social practice in the lived-in world. (p. 35)

It has been emphasized that to learn is to be involved in the social practice of the community. Lave and Wenger (1991) define social practice as follows:

> A theory of social practice emphasizes the relational interdependency of agent and world, activity, meaning, cognition, learning, and knowing. It emphasizes the inherently socially negotiated character of meaning and the interested, concerned character of the thought and action of persons-in-activity. The view also claims that learning, thinking, and knowing are relations among people in activity in, with, and arising from the socially and culturally structured world. (p. 50-51)

According to Lave and Wenger (1991), to learn is to actively participate in a community of a shared practice. It involves participation in an activity, as well as engagement with the communities. This participation and engagement enable a person to perform new tasks and functions, and to negotiate joint understandings.

Lave and Wenger's (1991) focus was on newcomers. The concept of legitimate peripheral participation is central in explaining the newcomers' learning process in the communities of practice. Lave and Wenger (1991) assert that:

> Learners inevitably participate in communities of practitioners and . . . the mastery of knowledge and skill requires newcomers to move toward full participation in the sociocultural practices of a community. Legitimate peripheral participation provides a way to speak about the relations between newcomers and old-timers, and about activities, identities, artefacts, and communities of knowledge and practice. It concerns the process by which newcomers become part of a community of practice. (p. 29)

The process of learning in the situated learning communities is likened to an apprenticeship process. According to Lave and Wenger (1991), the nature of apprenticeship in situated learning is that the learner starts the participation process as a newcomer. Being a member of a community of practice demands the newcomer to learn skills, acquire knowledge, and understand the identity and culture of the community (Lave &Wenger, 1991). Social interaction and collaboration are the essential components of situated learning. Learner participation involves both "absorbing and being absorbed" (Lave & Wenger, 1991, p. 97) in the community of practice which embodies certain beliefs, cultures and behaviours.

Over time, as learners become more experienced, they move from the periphery of a community to its centre, becoming more knowledgeable. Such learners are known as old timers and become the experts in the community. This learning process by apprenticeship is mostly unintentional, unplanned and unstructured. Members of a community of practice do also learn through observation. Observing what other people do, is part of the learning process, through looking at, "what everyday life is like; how masters talk, walk, work, and generally conduct their lives; how people who are not part of the community of practice interact with it; what other learners are doing; and what learners need" (Lave & Wenger, 1991, p. 95).

Lave and Wenger's (1991) theory of Situated Learning has been widely adopted in teacher education research to explain the learning and teaching concept

(Korthagen, 2010). Lave and Wenger's work offers a starting framework to address some of the major challenges faced by the workplace or informal learning literature. However, because of the short length of the original book, there are some weaknesses in Lave and Wenger's (1991) work. For example, the concept of communities of practice (CoP) was loosely defined (Cox, 2005). This was acknowledged by Lave and Wenger (1991, p. 42) themselves, as they noted, "the concept of community of practice is left largely as an intuitive notion, which serves a purpose here but which requires more rigorous treatment".

Lave and Wenger (1991) argue that communities of practice "consist of and depend on a membership, including its characteristics biographies/trajectories, relationships and practices". The focus of Lave and Wenger (1991) however was on the legitimate peripheral participation; which intended to be the 'conceptual bridge' to describe the process of the production of 'knowledgeable identities' and the production of 'sustained learning' in the communities of practice. This concept of CoP is expended in Wenger's (1998) work, where a community of practice entails mutual engagement, joint enterprise, and a shared repertoire of actions, which become important elements of shared practice. This is further discussed in the next sections.

3.2 Communities of Practice

The term Communities of Practice (CoP) was first coined in the work of Lave and Wenger (1991) in *Situated Learning: Legitimate Peripheral Participation.* It refers to a framework of learning that emphasizes a learning process that occurs in a shared learning environment, or a CoP. As noted in the previous section, the original Lave and Wenger's (1991) book did not expand on the CoP idea. However Wenger's (1998), *Communities of Practice: Learning, Meaning and Identity* further defined and discusses the concept of CoP in detail.

Wenger (1998) argued that CoP are integral part of people's lives. CoP could be found everywhere, at home, workplace, school, or even in special interest groups. However, it should be noted that not all communities or special interest groups are CoP (Henderson & Bradey, 2008b; Skerrett, 2010; Wenger, 2001). In this regard,

Wenger (2001, pp. 2-3) argues that "a community of practice is not merely a community of interest. ... Members of a community of practice develop a shared repertoire of resources: experiences, stories, tools, ways of addressing recurring problems – in short a shared practice". In Skerrett's (2010) words, "communities of practice are groups of people that are mutually engaged in a joint enterprise and who share a common repertoire... for engaging in their work" (p.648). Importantly, members of a community of practice "are connected by more than their ostensible tasks. They are bound by intricate, socially constructed webs of belief, which are essential to understanding what they do" (Brown, Collins, & Duguid, 1989, p. 34).

A CoP is defined by its engagement, in terms of identity and practice. Wenger (1998) suggested some indicators that a community of practice has formed, as follows:

1) sustained mutual relationships – harmonious or conflictual
2) shared ways of engaging in doing things together
3) the rapid flow of information and propagation of innovation
4) absence of introductory preambles, as if conversations and interactions were merely the continuation of an ongoing process
5) very quick setup of a problem to be discussed
6) substantial overlap in participants' descriptions of who belongs
7) knowing what others know, what they can do, and how they can contribute to an enterprise
8) mutually defining identities
9) the ability to assess the appropriateness of actions and products
10) specific tools, representations, and other artefacts
11) local lore, shared stories, inside jokes, knowing laughter
12) jargon and shortcuts to communication as well as the ease of producing new ones
13) certain styles recognized as displaying membership
14) a shared discourse reflecting a certain perspective on the world.

(pp. 127-128)

The elements of mutuality, joint enterprise and shared practices (Wenger, 1998) make CoP different from other communities such as those called 'learning communities' or 'professional learning communities'. Learning communities or professional learning communities usually refer to structured groups designed to continuously "discover, create and negotiate new meanings that improve their practice" (Skerrett, 2010, p. 648). In contrast, CoP develops around a shared work and practice. It is constructed and sustained by the practices of individual within the CoP (Benzie & Somekh, 2011).

3.2.1 Participation and reification in CoP

Participation in a CoP does not require any formal membership. However, as part of the community of practice, an individual or a group of people must have a sense of belonging to the particular community, which reflected through their mutual engagement in the communities (Wenger, 1998). It is also important that as part of the community, the participant should engage in the activities and collaborative works to form a relation among members to enable knowledge sharing and to learn from each other. To be part of a community of practice, members must be interacting with or relating to each other to achieve a mutual understanding or to negotiate meaning (Wenger, 1998).

According to Wenger (1998), "negotiation of meaning involves the interaction of two constituent processes … *participation* and *reification"* (p. 52). Participation is the key in both situated learning and the CoP perspective (Glazer, Hannafin, & Song, 2005). From the CoP perspective, participation is more than an action. It is a practice that reflects about how we interpret and interact with the environment around us to form some kind of common understanding. Wenger (1998) argues that, "participation in social communities shapes our experience, and those communities… Indeed, our ability to (or inability) to shape the practice of our communities is an important aspect of our experience of participation" (p.56).

Participation involves reification, which refers to a "concept to describe our engagement with the world as productive of meaning" (p.58). Reification describes

the situation where an abstract is treated as a concrete object (Wenger, 1998). It covers a wide range of participation processes and artefacts involved in negotiation of meaning. Wenger (1998) also argued that through reification we are creating a focal point for the negotiation of meaning. In this sense, reification may include how we perceive or interpret information and situations. The information and situations presented can be in the form of documents, charts, monuments or stories.

Participation and reification cannot be separated. Both participation and reification are complementary in the process of negotiating meaning in CoP. "The process of reification complements participation in the sense that mutual engagement typically involves the use of artefacts that are the products of prior reifications" (Cobb, McClain, de Silva Lamberg, & Dean, 2003, p. 22). As an example, a lesson plan produced by a teacher can be a form of reification, and the production of the lesson plan itself is a part of teacher participation in a school's CoP. The lesson plan is a concrete object written on paper and at the same time it reflects teacher's participation in the school's CoP. It means that, teacher produce a lesson plan as part of their negotiation of meaning of what it takes to be in the lesson plan (i.e.; teaching objectives, pedagogy, and time management). The lesson plan then acts as a focal point for a negotiation of meaning. For instance, if another teacher has to replace a teacher who is on emergency leave, he or she will refer to the lesson plan. Based on the lesson plan, a teacher can conduct the class by (re)negotiating what is written in the lesson plan to suit his or her own pedagogical style.

Participation and reification could also take place in teacher's practice of digital technologies integration, such as in how teachers view digital technologies as a teaching and learning tool. For instance, a computer application such as educational courseware provided to teachers is a kind of reification, an artefact or a tangible tool, which can be interpreted and used as a teaching aid. The meaning of the courseware as a teaching aid however depends on the participation of the teachers. In other words, this digital technologies can be shared among teachers, however it need to be negotiated in terms of what and how it should be integrated in the teaching and learning process. The same courseware may be integrated in different ways by different teachers but to achieve a similar teaching goal.

Wenger's (1998) account of reification is particularly relevant for my study. This is the idea that things can be created that represent aspects of practice, can be shared, but need to be reinterpreted when they are incorporated into new practices. Such accounts emphasise that digital technologies is not simply encountered, but must be learnt, and that work is needed to make sense and use of it. Digital technologies are no longer positioned as the cause of practice, but as the residue of practice; it is what is left over when the performance of a practice has ended, and what may be taken up as a resource in future practices.

3.2.2 Mutual engagement, joint enterprise and shared repertoire

Wenger (1998) pointed out that a practice in a community has three important dimensions; mutual engagement, a joint enterprise and a shared repertoire. All of these elements exist within a community when people take part in active negotiation of meaning in their CoP.

Mutual engagement is about doing things together to achieve shared goals or joint enterprise. Participation in social relations among CoP members during meetings or in the daily conversations could enable mutual engagement among them. Wenger's (1998) example of how claim processors in an insurance company negotiate their mutual engagement is that, "they work together, they see each other every day, they talk with each other all the times, exchange information and opinions, and very directly influence each other's understanding as a matter of routine" (p. 75). An example provided by Henderson (2004; 2006) explains that mutual engagement could be teachers who work together, have coffee together, or attend meetings together. Within the school's CoP, teachers would negotiate a joint enterprise through mutual engagement, such as coming to a tacit agreement about how to interpret and respond to departmental requirements and guidelines (Henderson, 2006; Henderson & Bradey, 2004).

The interrelationship between these elements is summarised by Wenger (1998) in the following figure (see Figure 3-1).

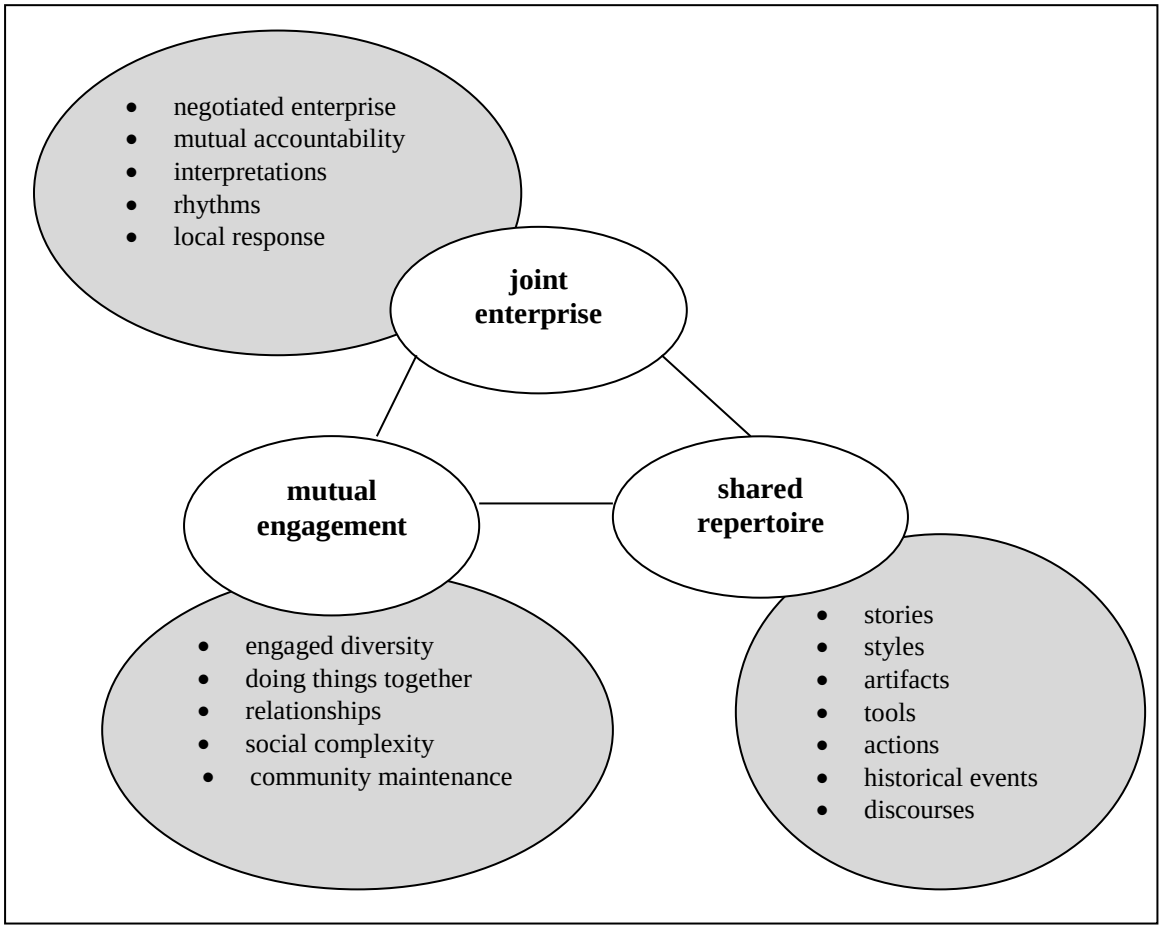

Figure 3-1: Dimensions of practice as the property of a community (Wenger, 1998, p. 73)

The interaction, collaboration and mutual engagement to pursue the joint enterprise may require and/or produce a shared repertoire. The shared repertoire may include "routines, words, tools, way of doing things, stories, gestures, symbols, genres, actions, or concepts that the community has produced or adopted in the course of its existence, and which has become part of its practice" (Wenger, 1998, p. 83). Within the school setting, Henderson (2004; 2006) pointed out that teachers would share their repertoire of ways in which to meet their needs. For instance, tools of the

trade, such as computers, are viewed, discussed and used in certain ways which make most sense to teachers and only partially understood by those outside of the community.

Another example to conceptualise the notion of mutual engagement, joint enterprise and shared repertoire is provided by Cobb, et al. (2003) within the context of mathematics teachers' community. According to Cobb, et al. (2003), their joint enterprise might be that of ensuring that students understand central mathematical ideas and are able to perform well on the assessments of mathematics achievement. This could be achieved through mutual engagement in which teachers respond to the general norms that are specific to mathematics teaching, such as the standards to which teachers are accountable, when they justify pedagogical decisions and judgments. Their shared repertoire includes normative ways of reasoning with instructional materials and other resources when planning for instruction. It also includes normative ways of using tasks and other resources to make students' mathematical reasoning visible (Cobb et al., 2003).

The potential of community of practice in shaping teachers' digital technologies integration has been highlighted by Hennessy, et al., (2005), as follows;

> One potentially important contextual factor which shapes how technology is the 'community of practice' (Lave and Wenger, 1991) associated with their subject. This is a social framework within which the planning, support, and evaluation of student learning takes place. Each subject community could be said to share a set of tools and resources; approaches to teaching and learning; curriculum practices; cultural values, expectations, and aims. (p.160)

In relation to my study, which is in the context of teachers' digital technologies integration, the joint enterprise of teachers' in their CoP might be to ensure that classroom learning is supplemented with the use of a particular digital technologies such as interactive whiteboard system or simulations software to enhance students' understanding of a particular subject. To achieve this, teachers mutually engage with peers through active discussion and collaboration to come up with lesson plans that incorporate digital technologies usage. They share their

experiences and learn from other teachers who successfully integrate digital technologies in their teaching and learning. The lesson plan, the experience, the stories and the language used to communicate, are all examples of a shared repertoire. This is one way we could imagine the role of CoP in improving teachers' learning to integrate digital technologies. However, in teachers' participation in the CoP, they will be undoubtedly pressured by many competing demands, contextual issues, personal needs and goals. All of these are part of teachers' learning trajectories and contribute to teacher's identity formation.

The key to community and situated learning as discussed by Wenger (1998) are the elements of mutual engagement, joint enterprise and shared repertoire. In order to move from legitimate peripheral to centripetal participation, community members need to increasingly invest in the mutuality of engagement, the joining of enterprise, and sharing of repertoire. These elements of cohesion as discussed by Wenger (1998) together with Henderson (2007) as clarified in Table 3-1 below will be the basis for my analysis of data from the teacher participants.

Table 3-1

Elements of Cohesion (Henderson, 2007, p. 51)

Elements of Cohesion	Characteristics
Mutual Engagement is	• Doing things together • Sharing in an activity (MacBeath, 2003) • Being included in what matters • Relationships between members: members form mutual relations of engagement • Membership: it defines membership, that is the practices of a community and the context for belonging • Community maintenance: the formal and informal work that enables engagement • Negotiating Diversity: members are not homogenous, they find a unique place and identity within the community. • Mutual engagement is as likely to facilitate differentiation as homogenisation. • Understanding Partiality: individuals cannot define or encapsulate the entirety of the Community of Practice.

		• Mutual engagement is understanding members' competencies, that is, what each member can and cannot do and being able to tap into those skills and knowledge. • Making sense of the world: people are engaged in actions whose meanings they negotiate with one another
Joint Enterprise	is	• Responding together • Mutual accountability. This is a socially negotiated understanding of what matters, what is important, what needs to be done and what can be taken for granted. It includes knowing what can be ignored, what should not be done, and what should be left unsaid. It is having a sense of what needs to be justified, what is good enough and what needs improvement. • Locally responding to global needs and institutional pressures • Reconciling competing demands (MacBeath, 2003). • Understanding and judging quality (MacBeath, 2003) • A negotiated response to their situation (and thus belongs to them in a profound way, which also makes it difficult for non-members to observe and articulate) • Not immune to the "pervasive influence of the institution" (Wenger, 1998b, p. 79). A CoP can be influenced, manipulated, duped and intimidated, but it can also be inspired, helped, supported, enlightened and empowered. • Not necessarily a harmonious or identical response, but rather a response which has been shaped, and given meaning through mutual engagement. • A local means to satisfying or avoiding institutional demands. "Even if strict submission is the response its form and its interpretation in practice is a local collective creation" (Wenger, 1998b, p. 80). • Both a source and direction for social energy. "It spurs action as much as it gives it focus" (Wenger, 1998b, p. 82).
Shared Repertoire	is	• Resolving problems together • Using and creating communal resources in the process of negotiating meaning • A socially negotiated, and therefore profoundly unique, understanding of routines, words, tools, ways of doing things, stories, gestures, symbols, and actions of community • A historical reflection of mutual engagement • Boundary formation (Thorpe, 2003). People who cannot understand the reified objects of a community, and who do not share the community's discourse cannot fully participate in that community.

It should be noted here that the elements of community cohesion as listed in the above table are central to this research. As CoP is sustained through community cohesion; mutual engagement, joint enterprise and shared repertoire (Wenger, 1998; Henderson, 2007), it would be important for my study to employ these elements in the analytical framework. The remainder of this chapter continues to explore the CoP theory and further clarify the complex processes involved in community learning within a CoP. However, it is the model of CoP cohesion that will be used to inform the research design and analysis of this study.

3.2.3 Identity and learning trajectories

The issue of identity is placed on the centre stage in the CoP perspective (Henderson & Bradey, 2008a, 2008b). This was emphasized by Wenger (1998), who said that the "issues of identity are an integral aspect of a social theory of learning and are thus inseparable from the issues of practice, community and meaning" (p.145). Identity refers to how individuals within the community perceive themselves, which results from participation and reification in the CoP (Wenger, 1998). Henderson and Bradey (2008b) argue that: "It is how we perceive our environment and how we interact with what goes on around us" (, p. 86).

Wenger (1998) also argues that "our membership constitutes our identity… Identity in this sense is an experience and the display of competence that requires neither an explicit self-image nor self-identification with an ostensible community" (p. 152). It means that identity is not a self-concept, but is socially constructed. From the CoP perspective, our identity is a negotiated experience and closely linked with our practices. In this regard, our identities shapes and is shaped by our practices (Henderson & Bradey, 2008b; Wenger, 1998). Identity is not static. It is constantly changing, or being developed in relation to what is happening and what is needed in the CoP.

Wenger (1998) also emphasizes learning as a process of engaging, participating and developing. It is an ongoing practice that is situated within the

community of practice, where learners become participants in the community (a practitioner). In this process, the learner starts the participation process as a newcomer. Newcomers learn skills, acquire knowledge, and understand the identity and culture of the community. Over time, the learner becomes more experienced, knowledgeable and known as an old timer. The old timers or senior members of the community help and coach the other generation of newcomers. Newcomers also have an influence in the CoP and could contribute to the learning process through negotiation of meaning. Wenger (1998) pointed out that as "members interact, do things together, negotiate new meanings, and learn from each other… that is how practices evolve" (p. 102). This process of apprenticeship is an ongoing practice which involves social and interactional processes.

Through this apprenticeship, members of a CoP are continually constructing their identities. For example, in teacher education, a student teacher involved in a teaching internship is an example of an apprentice in a school's CoP. Ottesen (2006) argued that student teachers are experiencing new teaching environments during the internship program. Student teachers are exposed to the authentic experience of teaching within the socio-cultural environment that is important for the development of teachers' identities (Ottesen, 2006). The short period of teaching internship might not allow student teachers to fully engage in the socio-cultural environment of the CoP and become the more experienced person known as old-timers. However, the knowledge, stories, histories and shared repertoires they gained during the internship program could provide a valuable foundation in student teachers identities formation which will be carried along in their teaching practices.

Another aspect of participation in a CoP is the notion of identity as learning trajectory. Wenger (1998) emphasized that,

> The term trajectory suggests not a path that can be foreseen or charted but a continuous motion – one that has a momentum of its own in addition to a field of influences. It has a coherence through time that connects the past, the present and the future. (p.154)

In addition, Battey and Franke (2008) claimed that "identity is shaped by the knowledge and skills we acquire and shapes the knowledge and skills we seek to develop" (p.128). This suggests that our identities are influenced by where we come from and where we believe we are going. Our identities are also influenced by our current competence as members of the community of practice. Identity evolves by the ways we participate and reify ourselves; by the trajectories of our memberships and our learning; by reconciling our membership in a number of communities into one identity; and by negotiating "local ways of belonging to broader constellations" (p. 149). This notion of identity is defined just as much by the practices in which we engage (participation) as in the practices in which we do not engage (nonparticipation).

In the following section, I discuss Lim, et al's (2008) study of one teacher's experiences that gives insights into how learning trajectories can shape teacher identity and technology integration. Cassie, an experienced elementary school teacher in Singapore revealed how the social structure of the school and her involvement in outside school's CoP influenced her identity formation in incorporating technology. Cassie had twenty seven years teaching experience. She received training in ICT literacy without having prior knowledge in ICT. She was keen to learn and started to use technology in her teaching even though at first it was more focused on a teacher-centric approach. Lim et al. (2008) showed that over time, Cassie became more confident and competent in using ICT through participation in ongoing learning and later became involved in an action-research project at the national level. She moved from the teacher-centric into student-centric or constructivist approach. She developed digital resources for the subject she taught and was hoping to change the structure of classroom teaching using ICT in her school. Her learning journey in becoming a technology integration expert was not easy, since her approach did not gain acceptance from her peers. However, she turned to a community of teachers involved in technology integration outside her school community and received recognition for her work. She also received an invitation to share her approach with other schools. She was hoping that the external validation she received would help her to bring changes in her internal school's CoP. All of these learning experiences reaffirmed her goals to adopt meaningful pedagogies including technology for her students' benefit.

Cassie's learning experiences and ongoing practice influenced her identity formation, and trajectory in becoming an expert in technology integration. Identity is clearly an important part of situated learning, so in my study, I aimed to explore how teachers' participation in a school's CoP and teacher's learning trajectories shape and reshape teacher identities and practices of integrating technology. This is important because in relation to teaching practices, it is argued that teachers' identities are the mediating factors that influence teachers' pedagogical strategies using technology (Battey & Franke, 2008; Henderson & Bradey, 2008b).

3.2.4 Brokering and boundary objects in the CoP

Another important element of a CoP is the way in which 'brokers' and 'boundary objects' facilitate new practices. According to Wenger (1998), brokers are people who can provide connections between CoP by introducing "elements of one practice into another" (p.105). Although brokers are necessarily members of multiple communities of practice (Davies, 2005), this multi-membership does not guarantee the brokering of practices (Wenger, 1998). Wenger (1998) and Davies (2005) also emphasized that brokers generally remain at the periphery. The process of brokering however "requires enough legitimacy to influence the development of a practice, mobilise attention, and address conflicting interests" (Wenger, 1998, p.109). This is important to ensure that the brokers have sufficient access and influence within the community of practice to introduce a new practice. It has been pointed out by Wenger (1998) that:

> Brokers must often avoid two opposite tendencies: being pulled in to become full members and being rejected as intruders. Indeed, their contributions lie precisely in being neither in nor out. Brokering therefore requires an ability to manage carefully the coexistence of membership and non-membership, yielding enough distance to bring a different perspective, but also enough legitimacy to be listened to. (p. 110)

Wenger argued that the role of brokering is a complex process. The positioning or membership of the brokers in multiple CoP has implications for the 'contribution' or the new practices to be brought into the other communities.

All members of communities of practice however, have the potential to become a broker, by having necessary skills and knowledge to influence other members practice. Hartnell-Young (2006) argued that within a school setting, teachers or the principal could become brokers, by making "connections across communities of practice and open new possibilities for meaning" (p. 465). In relation to my study, within the school's CoP, there might be teachers who act as change agents or brokers in terms of digital technologies integration practices. In this regard, the roles of leaders such as the ICT coordinator and ICT teachers in influencing other teachers' digital technologies integration practices are explored.

The role of 'boundary objects' is also important in providing connection between multiple CoP. The interaction, participation and engagement in multiple CoP involve the negotiation of meaning dealing with boundary objects that exist in and surround the CoP. Boundary objects are "artefacts, documents, terms, concepts, and other form of reification around which communities of practice can organize their interconnections" (Wenger, 1998, p.105).

In relation to my study, the role of boundary objects may give the idea of how teachers within the situated environment of school connects and negotiates with each other in terms of how the teacher should successfully integrate digital technologies in their teaching and learning. For example, a digital technology in the form of courseware use by an English teacher could be a boundary object that connects him or her with other English teachers who are using the similar courseware. The courseware however, is mostly understood by teachers' within the English department, and only partially understood by a teacher from another department.

3.3 Teachers and the school's Communities of Practice

School has been described as an example of a CoP where groups of teachers with common interest and shared practices mutually engage in collaborative works and socially relate to each other (Butler et al., 2004; Hennessy et al., 2005; Skerrett, 2010, Wenger, 1998). In a CoP, people do things together, negotiate their joint enterprise, and share common repertoire (Wenger, 1998). In schools, teachers within the same curriculum or subject department "could be said to share a set of tools and resources; approaches to teaching and learning; curriculum practices; cultural values, expectations, and aims" (Hennessy et al., 2005, p. 160). This suggests that departments or other groups of teachers working together in the school could be a CoP. However, not all formal structures such as teachers' associations or informal gatherings among teachers' interest group necessarily mean that they are CoP.

Teachers can also be members of multiple CoP. Even if we see a school as one CoP, teachers might be members of other CoP that exist within the school or external to it. In my study, this conception of CoP is illustrated in Figure 3-2 which suggests that a school's CoP can consist of multiple CoP which mainly based on teachers' subject areas.

Other than subject based CoP, there might be other CoP within the school's CoP, for example, teachers using technology CoP which include teachers from different subject backgrounds who have an interest to integrate digital technologies in their teaching and learning. These teachers actively participate in the technology CoP to learn about the best way to integrate digital technologies from other teachers. Within the teachers using digital technologies CoP there might be someone who is known to have experience and competence in digital technologies integration and may have more power to influence the negotiation of practice. He or she might be a technology teacher, who teaches an ICT related subject and at the same time teaches other subjects such as Mathematics, Science or Physical Education. In this sense, teachers may actually belong to multiple CoP within the school's CoP. In my study, I will first explore how these multiple teachers' CoP may exist within the school's CoP and what characteristics bind teachers' membership in a particular CoP.

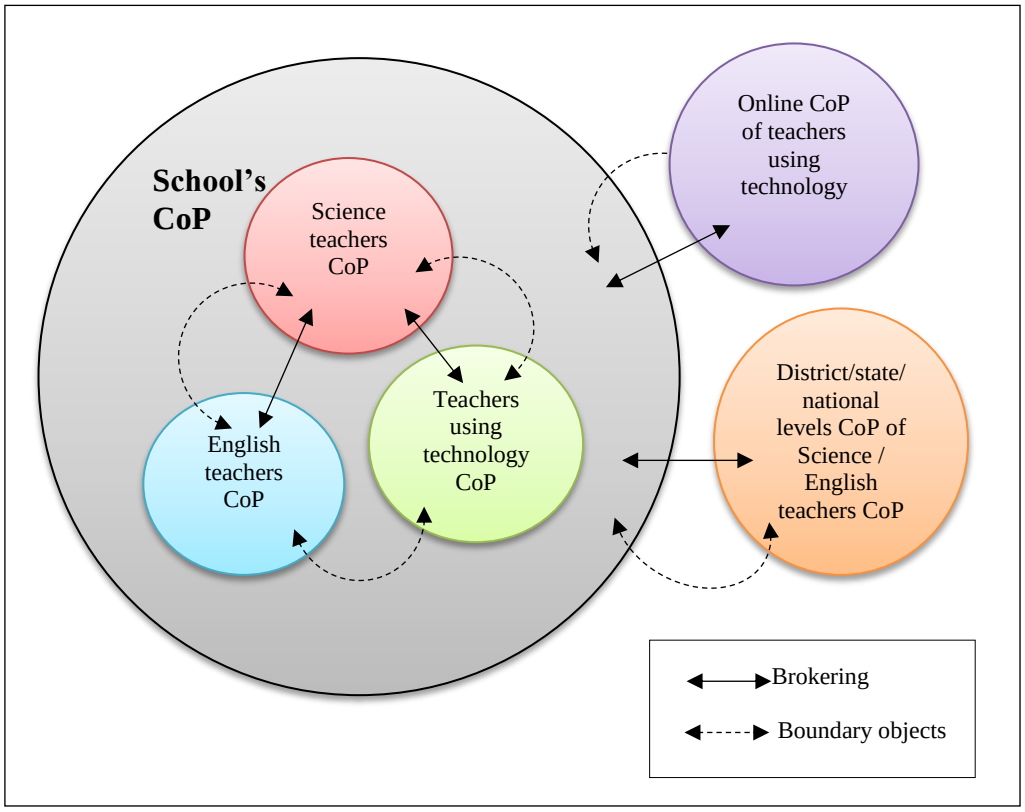

Figure 3-2: Conceptual framework of multiple CoP in a school's CoP

Teachers may also become a member of a CoP that exists outside their school environment or the 'globalised' CoP (Wenger, 1998). For example, the emerging communities of teachers who teach with digital technologies exist in relation to specific practice related to teaching with digital technologies. These teachers might form an online community of technology teachers. Other than that, they might be part of a district, state, or national level communities of Science or English teachers. The notions of teachers' membership within and outside the school's CoP will also be explored in my study to provide insights into "local" and "global" (Wenger, 1998, p. 131) CoP's interaction, participation and engagement among teachers that would contribute into their learning to integrate digital technologies.

As teachers are involved in multi-memberships, there might be an interaction involved between the CoP. These interactions could involve brokering or boundary objects connections. For example, a technology teacher who is also a science teacher learns to make effective use of weblogs to facilitate collaborative knowledge construction from the online teachers' technology communities and is able to share his/her knowledge and experience with peers in the science CoP. In this sense, the technology teacher has been brokering a new strategy along with new ideas and beliefs from the technology teachers CoP into the science teachers CoP.

This connection between multiple CoP might also involve boundary objects. As an example, a lesson plan prepared by an English teacher which also includes digital technologies integration strategies may be a boundary object for teachers from other CoP (e.g. Science teachers). Science teachers who are interested in using digital technologies might be able to connect and engage themselves with discussion related to digital technologies integration strategies with English teachers. This is an example where boundary objects could provide connections between CoP.

3.4 Teachers' learning to integrate digital technologies in schools' CoP

Ottesen (2006) argues that "ICT is not the same thing to people across activities; the meanings of technology emerge in the activities of its use" (p.277) and "ICT as artefacts in educational practice is given meaning through the actions of the participants" (p.285). This suggests that teachers' attempts to integrate digital technologies in teaching and learning involves a process of inquiry in which teachers negotiate and make decisions about what are suitable digital technologies to be used, what impact the digital technologies will bring to the students' learning, and what method of instruction can best be applied using the chosen technology tools (Ottesen, 2006). This requires teachers to reflect upon their existing knowledge and experience, as well as to look at others' exemplary usage and experiences.

Vanatta and Fordham (2004) recommended that sharing of ideas, regular discussion and reflection about pedagogy and instructional practice among teachers are important to develop a culture that will promote teaching improvements using technology. By interacting and collaborating with peers, teachers gain invaluable knowledge and experience that are useful to be applied in their own teaching practice (Glazer et al., 2005; Vannatta & Fordham, 2004).

In regard to teachers' collaboration and participation in a school's CoP, Glazer and Hanaffin (2006) within the US context proposed a framework of collaborative apprenticeship which was developed based on the theories of Situated Learning (Lave & Wenger, 1991) and Communities of Practice (Wenger, 1998) to support teaching communities at schools. In Glazer and Hanaffin's (2006) framework, experienced teachers called teacher-leaders with advanced knowledge and skills provide ongoing support to other teachers. The support provided by the teacher-leaders happens within the school's CoP during the school day so that any teachers who need help and support can reach them at any time. Teachers together develop new knowledge, skills and resources to be used in the classrooms. Through this process, teachers develop competencies and advanced expertise not only in their knowledge and skills related to their own teaching, but they also able to mentor their peers. The teacher-leaders also gain knowledge from the peers and further develop their expertise (Glazer & Hannafin, 2006).

Glazer and Hannaffin's (2006) framework of collaborative apprenticeship also stresses the importance of shared repertoire, mutual engagement and joint enterprise that define the teaching CoP. In a further study, Glazer, et al. (2009) found that teachers' interaction in the CoP that included sharing ideas, giving and seeking advice, and responding to task-based questions, enhanced their digital technologies integration in a way that helped them to design, develop and implement technology-enhanced lessons. Glazer, et al. (2009) noted that teachers showed evidence of mutuality by expressing interest in achieving a common goal through a joint enterprise such as maintaining lesson quality, and shared repertoire through engagement in similar tasks and using common language. Their participation and interactions in the CoP were influenced by certain factors that arise within the CoP

itself such as shared planning time, physical proximity, anxiety and comfort level, as well as teachers' individual beliefs.

These factors reflect Wenger's (1998) theory which emphasised that tensions and conflicts may exist in the CoP that will influence the growth and practices of a community. However, Glazer et al's (2009) study only focused on the types of teachers' interaction and factors that influence teachers' interaction in the CoP.

3.4.1 CoP approach in teachers' professional learning in Malaysia

Within the Malaysian context, the notion and application of communities of practice theory for teachers' professional learning is new. Limited studies in the area of digital technologies integration were found within the Malaysian context that explored or applied this theoretical framework. The only research available was a project on creating and maintaining virtual communities of practice among Malaysian Smart School teachers called e-CPDeIT. This was conducted by a group of academics (Murugaiah, Azman, Ya'acob, & Thang, 2010; Thang, Hall, Azman, & Joyes, 2010; Thang, Hall, Murugaiah, & Azman, 2011; Thang, Murugaiah, et al., 2010). This project involved bringing teachers from different schools together and assuming that the group was or would be a CoP.

The e-CPDeIT project aimed to help teachers develop their teaching profession and at the same time improve their use of digital technologies as teaching and learning tool. The project was piloted in 2008 involving 20 teachers from five Malaysian Smart Schools. The project required teachers to be exposed to new skills and enhanced their technology and pedagogy skills through sharing and discussion during the blogging session (Murugaiah et al., 2010). Other findings from this project however, reported problems faced by the teacher participants during their involvement in the virtual communities of practice (Thang et al., 2011). Some of the problems highlighted were:

i) Teachers had not fully developed trust and rapport, and therefore teachers were 'discomfort' to interact with unfamiliar members from other schools in the virtual CoP.

ii) Teachers were having performance anxiety, concerning about whether they were doing the task correctly or whether their posts in the community blog were right or wrong.

The researchers related their explanation of these problems to the challenging process of social bonding in virtual environment and the needs of clearer guidelines and relevant examples from the mentors on participating in the virtual CoP. These problems occurred because this project was trying to impose the CoP in the first place, by creating online or virtual CoP, and members of the CoP were bring into. As noted by Wenger (1998), a community of practice could not be created. It is develop over time, through the shared practices of their members.

As teachers who were involved in the e-CPDeIT project came from different schools and did not know each other at first, they might not have had a mutual understanding of what needed to be done, and lacked mutual engagement and a shared common repertoire of practice. Although they might have some sense of mutuality, enterprise and repertoire at the global level as members of teaching CoP (as teachers in Smart Schools), they were in the process of negotiating their competence in practice and identity resulting a non-harmonious relationship. This also suggests that identity formation in the group was not clear, and their competence was not assured. In this regard, it is likely that the teachers were worried about how to demonstrate their competence in the group.

This project was a limited example of CoP but does show that even if CoP is a useful approach to understanding professional learning, there needs to be caution about assuming that a CoP is simple to create. Even though the participants were all teachers and members of the same global teaching CoP, the situated context was still sufficiently different that they could not effectively mutually engage, develop shared repertoire and negotiate the joint enterprise. The focus on teacher professional learning should be on localised CoP, with teachers from the same department, who work closely together as a team represent robust CoP (Hennessy et al., 2005).

Although this project aimed to be an intervention to teachers' professional learning in Malaysia, it reveals that creating a CoP would be more difficult than

sustaining the potential of an existing CoP. As noted by Wenger (1998), a CoP could not be created, but it can be designed for (Wenger, 1998). A CoP is developed over time, through the shared practices of their members (Wenger, 1998). Furthermore, in an existing CoP, members of the community have some kind of understanding of what they should do, and how it should be done in their communities through mutual engagement, negotiation of an enterprise and through the development of shared practices.

My study therefore, aims to understand how teachers in a school's CoP understand and negotiate each other's roles and practices, as well as in shaping their learning and identity to integrate digital technologies. Teachers' practice is likely to change as they participate in their professional communities of practice that discuss new materials, methods, and strategies, and support the struggle involved in transforming their teaching practice using digital technologies (Higgins & Spitulnik, 2008). In my study, I investigate how through mutual engagement, joint enterprise and shared repertoires in localised teacher CoP, teachers can build their competencies and shape their identities and practice for integrating digital technologies.

3.5 Critical perspectives on Communities of Practice

The notion of CoP has been widely debated in the literature. However, not all studies on teachers' professional learning refer to Wenger's (1998) framework of learning in CoP, which originated from the situated learning theory (Lave & Wenger, 1991). In his later work, Wenger with McDermott and Snyder (2002) published a book called *Cultivating Communities of Practice*. Some researchers claimed that the later work is the refinement and extension of Wenger's (1998) original work (e.g. Andrew, Tolson, & Ferguson, 2008; Cremers & Valkenburg, 2008; Klein & Connell, 2008; Kopcha, 2010) and has been treated as the same theory. However, it has been argued by Cox (2005), Henderson (2007) and Fernando (2008), that these two works should be viewed as different theories because of their different foci.

Cox (2005) asserts that Wenger, et al. (2002) "is genuinely a different concept from that proposed in Wenger (1998), not just a change of tone or position; it is

simply a different idea" (p 534). Also, it has been argued that Wenger, et al.'s, (2002) focus is on managing knowledge in organizations, in which the purpose is specifically "to learn and share knowledge, not to get the job done" (Cox, 2005, p. 534). On the other hand, the original Wenger (1998) communities of practice theory focus is on learning through participation and mutual engagement in situated learning environment to pursue the joint enterprise.

Wenger's (1998) work has received several criticisms. One of the central criticisms is that Wenger's theoretical framework is difficult to operationalize (Cox, 2005). This criticism centred on the notion that the term "communities" has indistinct definitions (Cox, 2005; Hughes, 2007). As a result, the term communities of practice has sometime been used interchangeably with other terms such as 'professional learning communities' and 'organizational learning communities', which have different connotations (Skerrett, 2010). In addition, others have criticized Wenger (1998) for not offering a practical guide on how CoP could be established and sustained (Herrington & Oliver, 2000). This however, is not a weakness of the theory if people use similar terms or get confused with the term communities. It was also not the goal of Wenger (1998) to provide a practical model but rather to describe a form of situated learning.

Despite these criticisms, Wenger's theory of CoP has received considerable attention and has been proposed as a valuable theoretical framework for understanding the concept of informal learning (Fuller, 2007; Korthagen, 2010; Somekh, 2007) and identities formation (Benzie & Somekh, 2011; Kwan & Lopez-Real, 2010) within a social practice. The contribution of CoP as a theoretical framework has been highlighted by Benzie and Somekh (2011) as follows:

> CoP is theory well suited to research that has a developmental focus... It can focus on the experience of individuals, but always sees them as 'situated' within the social practices of the groups to which they belong. (p.20)

Benzie and Somekh (2011) also argue that "CoP model provides a number of very useful analytical tools which can be used to develop a constellation of interrelated research questions" (p. 177). In addition, Fuller (2007) asserts that

Wenger's "theorization promotes the collective or group as the important unit of analysis rather than the individual. Individuals are important in so far as they learn by being in social relation to others" (p. 19).

In this regard, situated learning and communities of practice can provide lenses for understanding teachers' learning in the socio-cultural context of their school's CoP. Within this perspective, the notion of teachers' learning to integrate digital technologies could be viewed as a process of participation and identity formation in the communities of practice. It is important to note that my research uses the original work of Lave and Wenger's (1991) *Situated Learning: Legitimate Peripheral Participation* and Wenger's (1998) *Communities of Practice* as the theoretical lenses, and not any other variation of community theories.

3.6 Conclusion and chapter review

In this chapter, several key concepts from the Situated Learning and Communities of Practices theories have been discussed as they are central to the analytical framework in my study. In particular, this chapter explored the elements of mutual engagement; joint enterprise and shared repertoire (Wenger, 1998) that contribute to understanding teachers' learning to integrate digital technologies. This chapter also discussed the elements of identity, brokering and boundary objects to further explore teachers' identity formation in school's CoP and its relationship with their digital technologies integration, and the role of brokers in influencing other teachers' digital technologies integration practices as theorised by Wenger (1998).

The next chapter discusses how this research is carried out in relation to the Situated Learning and Communities of Practice lenses.

Chapter 4 Research Design: Qualitative Case Study

This chapter focuses on discussion of the research design, including the research paradigm, method of inquiry, methods of data collection, selection of participants, data analysis and ethical considerations in conducting this study. This research design framed the research work which aimed to answer the following research question:

How do teachers' participation in school's Communities of Practice (CoP) influence their digital technologies integration in the classroom?

To facilitate the research process, this study was guided by the following sub-questions, which indicate the scope of the research and the elements of teachers' learning in the school's CoP investigated.

I. How do teachers integrate digital technologies in their teaching?

II. What is the role of mutual engagement, joint enterprise and shared repertoire in mediating teachers' digital technologies integration?

III. What is the role of identity in shaping teachers' digital technologies integration?

IV. What is the role of brokers for improving teachers' digital technologies integration?

4.1 Rationale for choice of qualitative methodology

In this study, I adopted a qualitative research paradigm to understand how teachers learn to integrate digital technologies in the situated environment of a school. Qualitative methodology was chosen because it is suitable to conduct an in-depth exploration of a central phenomenon (Creswell, 2005) and to understand the culture of a particular setting from the insider's perspective (Ary, Jacobs, Razavieh, & Sorenson, 2006). According to Ary, Jacobs, Razavieh and Sorenson (2006),

> Qualitative inquirers argue that human behaviour is always bound to the context in which it occurs, that social reality (e.g., cultures, cultural objects, institutions, etc.) cannot be reduced to variables in the same manner as physical reality, and that what is most important in the social disciplines is understanding and portraying the meaning that is constructed by the participants involved in particular social settings or events. (p. 449)

In relation to my study, digital technologies integration is a contemporary phenomenon which exists within the real-life context of teachers who participate in school's CoP. In understanding this phenomenon, teacher participants are the insiders who are able to provide valuable information about the social culture of the school's CoP. Since my study focused on understanding teachers' learning to integrate digital technologies "in their natural settings" of the school environment and "in terms of the meanings people bring to them" (Denzin & Lincoln, 1994, p. 2), qualitative research was appropriate for this study.

Previous research in technology integration such as studies based on the Technology Acceptance Model (TAM) by Davis (1989) and Venkatesh and Davis (2000), as reviewed in Chapter 2, have examined the causal relationship among variables influencing teachers' acceptance or intention to use a particular technology or system. These variables include perceived ease of use, perceived usefulness, social influence and other external variables. While these variables might be part of teachers' disposition in learning to integrate digital technologies in their school's CoP, these variables were not tested quantitatively in my study, as my study investigated the issue of teachers' digital technologies integration from the teacher participants view using qualitative method.

It has been argued by Denzin and Lincoln (2003) that:

> The word *qualitative* implies an emphasis on the qualities of entities and on process and meanings that are not experimentally examined or measured in terms of quantity, amount, intensity or frequency. Qualitative researchers stress the socially constructed nature of reality, the intimate relationship between the researcher and what is studied, and the situational constraints that shape enquiry. (p. 13)

As my study required development of deep understanding of how teachers are involved in a socially constructed nature of the school environment to learn about integrating digital technologies, quantitative or causal study was not appropriate. Henderson (2007) used Communities of Practice as the theoretical lens to investigate how CoP cohesion sustained participation of teachers in a small-scale blended professional development course. He noted that in researching communities of practice "the variables are far too numerous, the causal relationships are unclear, and the nature of the study revolves around deeply subjective topics" (p. 79), so qualitative approaches should be adopted. Therefore, in my study, the choice of qualitative methodology was the most useful and workable approach to provide rich details about the phenomenon.

4.2 Case study approach

There are various methodological approaches within a qualitative framework such as phenomenology, grounded theory, ethnography and case study. In my study, I have chosen a case study approach within its qualitative paradigm as suggested by Yin (1993):

> … case studies are the preferred strategy (for doing social science research) when "how" or "why" questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real life context. (p. 13)

I also drew my rationale for selecting qualitative case study from Stake's (1995) views as follows:

> To sharpen the search for explanation, quantitative researchers perceive what is happening in terms of descriptive variables. They represent happenings with scales and measurements (i.e., numbers). To sharpen the search for understanding, qualitative researchers perceive what is happening in key episodes or testimonies, and represent happenings with their own direct interpretations and stories (i.e., narratives). Qualitative research uses these narratives to optimize understanding of the case. (p. 40)

Case study is "an empirical enquiry that investigates a contemporary phenomenon in depth" (Yin, 2009, p. 18). In my study, I wanted to explore how teachers' participation in school's CoP influence their digital technologies integration in the classroom, that involve "complex interrelationships" (Stake, 1995, p. 37) of the social and cultural factors in the school's communities of practice. In this regard, I needed to understand this phenomenon by gathering teachers' views, experiences and stories which involve masses of qualitative data (interviews and document archives).

Merriam (1988) argued that qualitative case studies provide:

> ... insights into aspect of educational practice [to] have a direct influence on policy, practice, and future research (p. xii) [and] ... A case study approach is often the best methodology for addressing problems in which understanding is sought to improve practice (p. xiii).

In relation to my study, the major research question investigated was: How do teachers' participation in school's CoP influence their digital technologies integration in the classroom? Ultimately, I wanted this study to contribute new insights into theories about how teachers' practice and learning to integrate digital technologies could be improved in the school's CoP. Also, it was hoped that the findings would contribute to the improvement in the ICT integration policies especially those related to teachers' professional learning.

In addition, case study was also chosen as a method of enquiry to allow an "intensive description and analysis of a phenomenon or social unit such as individual, group, institution, or community" (Merriam & Associates, 2002, p. 8). In a qualitative case study research, we try to "seek greater understanding of the case" under study (Stake, 1995, p. 16). The unit of analysis or entity (e.g., person, social communities, or organizations) determines the case study (Flick, 2006; Merriam & Associates, 2002; Yin, 2009). In this regard, case study is not only limited to the study of individuals, but could also apply to institutions such as schools and groups of individuals including teachers. In my case, the social unit investigated is the school communities, and the teacher participants are the unit of analysis or the entity of the case study. This approach enabled me to develop a better understanding of the complexities that arise in teachers' digital technologies integration and their social interaction in the school setting.

A review of the literature on research methodology also provided an insight into the most appropriate method to be adopted in my study. For example, Henderson (2007) and Johnson (2001) indicated that the majority of studies that employ situated learning or CoP theoretical framework used a qualitative case study approach. Nevertheless, their reviews were located in the broader context of CoP with attention to learning sustainability (Henderson, 2007) and online CoP (Johnson, 2001). Another study conducted by Ismail (2014) also used CoP framework, however it focused was on young people's use of digital technologies and their participation in and out the school's CoP.

In addition to these, I searched literature within the narrow context of teachers' learning in the school's CoP in regard to digital technologies integration by utilising the Monash University's library online access to the education databases. As a result of this literature search, only three studies which closely related to teachers' digital technologies integration conducted using situated learning or CoP perspectives were found (i. e. Phillips, 2014; Lim et al., 2008; Webb et al., 2005). The others did not focus on digital technologies integration, but were related to teachers' learning in general in school's CoP (i.e. Kwan & Lopez-Real, 2010; Niesz, 2010; Skerrett, 2010). These examples, summarized in Table 4-1 provided supportive evidence that studies on teachers' learning in CoP were conducted using case study approach.

Table 4-1

Summary of related research conducted using case study

Author(s)	Research objective	Methodological approach	Strategies of data collection
Phillips (2014)	Examining teachers' TPACK enactment through a situated learning and Communities of Practice.	Case studies of four teachers in one Australian school.	Documentation, interviews and observations.
Kwan & Lopez-Real (2010)	Investigating teacher-mentors' learning and professional development in communities of practice, and on how their identities are constructed in relation to their mentoring role.	Case studies of two teacher-mentors.	Interviews.
Niesz (2010)	Exploring how teachers and school district administrator participation in an educator network contribute to the production of meaning, identity, and agency.	Ethnographic case study.	Observation, interviews, collection of artefacts, and records of online conversations.
Skerrett (2010)	Examines how one secondary English department at an ethno culturally diverse school functioned as a CoP but struggled to develop the CoP into a professional learning community.	Case study of an English department (10 teacher participants).	Interviews and analysis of related documents.
Lim, et al. (2008)	Examines how an experienced teacher negotiates her identity formation in becoming an expert in technology integration.	Case study.	Analysis of related documents and interviews.
Webb, Robertson & Fluck (2005)	Investigating how teachers' professional learning in information communication technology (ICT) is transferred to actual classroom practice.	Case studies of four schools.	Survey

These examples of previous research related to teachers' learning in situated environment of their school's CoP provide a basis for justifying that my study is practically and theoretically appropriate to be conducted using a case study approach.

4.3 Case study design

In my study, I employed single-case (embedded) design adapted from Yin (2009) as illustrated in Figure 4-1. The context for this study is a Malaysian Smart School (secondary level) in one state within the northern part of Peninsular Malaysia. The case is a school's CoP and the embedded units of analysis are the Science teachers' CoP and the English teachers' CoP. The individual teachers who participated in this study are the sub-units of analysis.

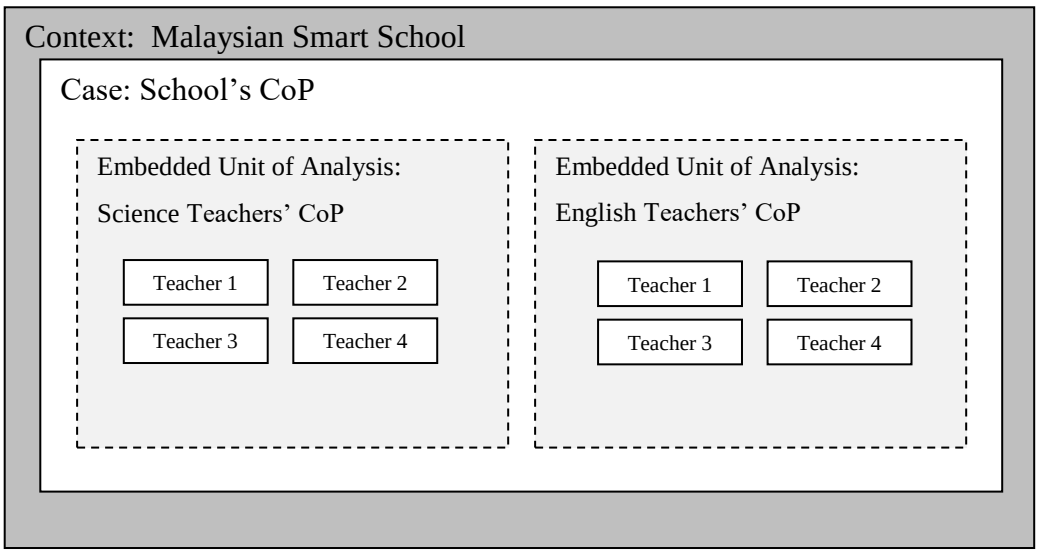

Figure 4-1: Single-case (embedded) design adapted from Yin (2009, p. 46)

When designing this case study, I assumed that teachers from the same department or same teaching area would be likely to belong to the same CoP whose formation is based on their subject interest. This assumption was drawn from Hennessy et al. (2005) finding that teachers in the same department work closely to each other to achieve their common goal, respond to their departmental strategies and

work around shared repertoires of their subject areas. However, it is important to note that these teachers could also belong to other CoP within their school or outside school setting which might have stronger influence on how they learn to integrate digital technologies in their teaching practices.

The data gathered from this study was collected to determine how these teachers locate themselves in any particular CoP and what makes them belong to a particular CoP. It was hoped that the data would allow for possibilities in interpreting whether this assumption is correct, or provide new means to describe how teachers negotiate their CoP membership. Issues related to membership in the CoP are part of the discussion that emerged from the data.

It was anticipated that the resources and infrastructure of Smart Schools should influence the ways teachers learn to integrate digital technologies in their teaching practices. Therefore, a Smart School was purposely selected in this study. It was hoped that the characteristics of Smart Schools could provide a richer context to interpret teachers' learning to integrate digital technologies from the CoP perspectives.

Science and English teachers were chosen for a few reasons. First, Science and Mathematics are among the subject areas where the teachers are expected to integrate digital technologies highly in the teaching and learning (Abdul Razak & Embi, 2004; A. Abdullah, 2006), especially since the introduction of the national program called English for Teaching Mathematics and Science (ETeMS).This selection of teacher participants is important to ensure that the potential participants in this study were using or integrating digital technologies in their teaching and learning to a certain extent. The school's principal, ICT coordinator and ICT teacher were also invited to take part in this study to provide more information on the nature of teachers' learning to integrate digital technologies, and to see whether the administrator or the ICT staff may act as "brokers" in the teachers' digital technologies integration practices.

Second, in terms of practicality, Science and English departments are commonly among the larger departments in most schools and would provide a larger source of potential participants. Third, Science and English teachers normally teach the same subjects and might also teach other subjects as their options. My

investigation aimed to find out if these characteristics of English and Science teachers corresponded to the shared teaching practices of their content areas and whether they were mutually engaged in departmental activities that contribute to their learning to integrate digital technologies.

Although this study was conducted within a single-case design, the embedded units of analysis which included two teachers' CoP and the individual teachers provided extensive analysis about how teachers learned to integrate digital technologies in the school's CoP. It has been argued that single case (embedded) design is complex and can provide significant opportunities for in depth analysis and enhancing insights into the single case (Yin, 2009). Furthermore, by looking at multiple CoP in a single school context, I aimed to capture rich data about the elements of teachers learning in schools' CoP. This is aligned with Wenger's (1998) theorization that the CoP is about both the individual and the collective or groups.

At the end of the data collection phase, the actual illustration of the case study design was as follows (see Figure 4-2).

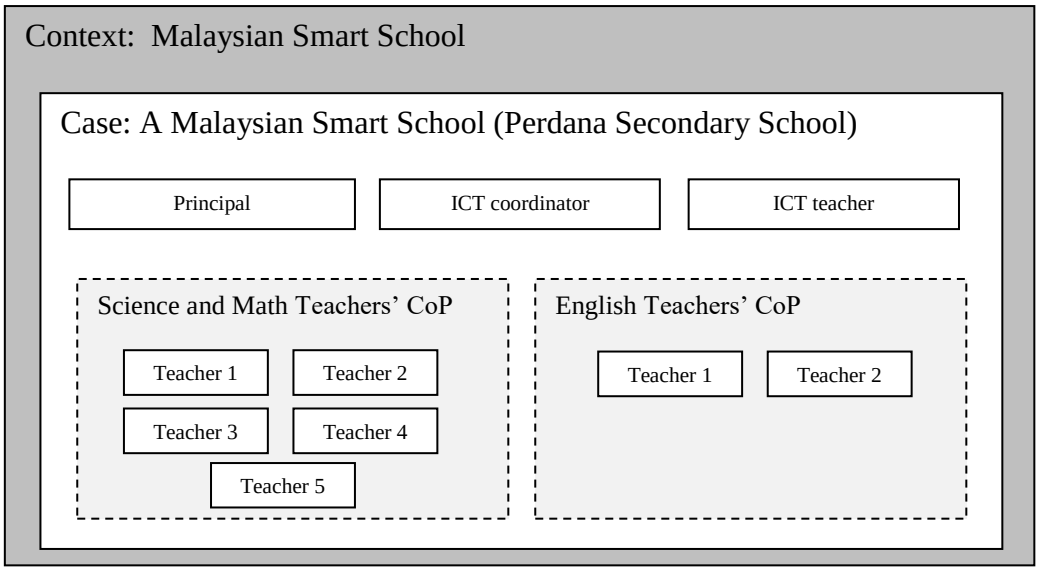

Figure 4-2: Actual case study design

This design changed from the initial design based on the additional teacher participants (i.e. principal, ICT coordinator and ICT teacher) and the number of volunteer teacher participants from each CoP. Further discussion about the selection of the school and teacher participants is provided in the next sections.

4.3.1 Selection of the school

As mentioned earlier, this case study investigated a Malaysian Smart School (secondary level) in the northern part of Peninsular Malaysia. Invitations to participate in this study were sent to five Smart Schools' principals within the Northern part of peninsular Malaysia in January 2011. Out of five invitations, two principals responded within the first two weeks. I then contacted both principals to set an appointment to discuss the research project. During the first meeting with the principals they showed interest in participating and agreed to distribute the recruitment package that included the explanatory statement and consent form for all Science and English teachers, and to the ICT coordinator or ICT teachers in their schools.

Two weeks after the first meeting with the principals from two different schools, I went back to the schools' office to collect the consent forms. The Perdana Secondary School (pseudonym) returned 12 consent forms whilst the other school returned only 7 consent forms. Considering the three months' time frame that I had for data collection in Malaysia, I decided to stop the recruitment process and chose Perdana Secondary School as the case for this study. I notified both principals of the decision and started contacting the individual teachers from Perdana Secondary School based on the contact details provided in the consent forms. In this recruitment process, I met the criterion of selection which was clearly stated in the ethics form as well as in the consent forms.

4.3.2 Selection of the teacher participants

At the beginning of the data collection phase, 12 participants from Perdana Secondary School volunteered to take part in this study. These included the principal, the ICT coordinator, and an ICT teacher, five teachers from the Science and Mathematics department and four English teachers. However, two female English teachers who agreed and returned the consent form to take part in this study withdrew their participation before the interviews were conducted due to several reasons. As this study was voluntary and participants could withdraw at any stage of the research up to two weeks after the interview session I had to accept their decision. Therefore, towards the end of data collection, the data were gathered from only ten participants. Throughout this research, the anonymity of the teacher participants involved was maintained by using pseudonyms. In this thesis, no specific description is written that could reveal the identity of the teacher participants.

4.4 Validity and reliability

Both validity and reliability are important in qualitative research (Silverman, 2006; Yin, 2009) for attaining rigor (Morse, Barret, Maria, Olson, & Spiers, 2002). In this study, I addressed issues related to validity and reliability in several ways as discussed in the following sections.

4.4.1 Validity

In qualitative study, threats to validity are the major concerns among researchers (Morse et al., 2002; Silverman, 2006; Yin, 2009). Within the qualitative paradigm, validity is sometimes referred to other terms such as ‘trustworthiness’, ‘relevant’, ‘plausible’, ‘confirmable’, ‘credible’ or ‘representative’ (Denzin & Lincoln, 1998; Guba & Lincoln, 1989; Hammersley, 1987; Mishler, 1990). However, Merriam (1988) argued that validity is about “To what extent can the researcher trust the findings of a qualitative case study?” (p.164).

Hammersly (1987) claimed that:

> ... the 'validity" of the research resides with the representation of the actors, the purposes of the research and appropriateness of the process involved. ... There are differences between quantitative and qualitative research in what they attempt to research. Quantitative research limits itself to what can be measured or quantified and qualitative research attempts to 'pick up the pieces' of the unquantifiable, personal, in depth, descriptive and social aspects of the world. Many of the allegations of invalidity from both sides can be attributed to a failure to recognise the purposes to which each methodology is suited. External validity is often of no importance to qualitative research and the attempt to achieve it can seriously hinder its overall validity. However, qualitative findings are best generalised to the development of theories and not wider populations. (p.2)

In my study, I was aware that focusing on one school and ten teacher participants would certainly not provide statistical generalizations about how teachers learn to integrate digital technologies in a school's CoP. However, I was more interested in what Hammersley (1987) referred to as an opportunity to develop or enhance theories from studies. This is consistent with Stake (1995) who argued that it is important to generate "particularization" rather than "generalization" (p. 8) in order to develop deep understanding of the processes and factors surround teachers' learning in the school's CoP.

According to Yin (2009) there are three types of validity issues that a researcher needs to deal with. There are construct validity, internal validity and external validity. The definitions of each are as follows:

- *Construct validity*: identifying correct operational measures for the concepts being studied.
- *Internal validity:* seeking to establish a causal relationship, whereby certain conditions are believed to lead to other conditions, as distinguish from spurious relationships.
- *External validity:* defining the domain to which a study's findings can be generalized. (p. 40)

Yin (2009) noted that internal validity is only applicable for explanatory or causal studies and not for descriptive or exploratory studies. This is especially relevant to experimental and quasi-experimental studies. My study, which is exploratory in nature, did not have concerns about the threat to internal validity.

Issues of construct validity and external validity however, are important in my study. Construct validity is important to test whether the strategies employed during data collection are appropriate or valid for gathering the information needed to address the research questions. To address the issue of construct validity, I employed multiple methods of data collection to provide multiple measures of the same phenomenon (Maxwell, 2005; Yin, 2009, 2012).

Various data sources are highly complementary and important to provide the case study evidence and to enhance the rigorous of the case study research through triangulations (Yin, 2009). Yin (2009) emphasized the importance of using multiple sources of evidence as follows;

> The most important advantage presented by using multiple source of evidence is the development of *converging lines of inquiry,* a process of triangulation and corroboration… Thus, any case study finding or conclusion is likely to be more convincing and accurate if it is based on several sources of information… (p. 115-116).

The choice of multiple data collection was one of the strategies that I adopted to ensure the construct validity of this case study research as suggested by Maxwell (2005) and Yin (2009). It was hoped that the data gathered would provide rich information to answer the research questions and to discuss the issues that surround teachers' learning processes to integrate digital technologies.

In my study, data from semi-structured interviews served as the major sources of evidence to capture the participants' perspective, their experiences and stories about teacher participation and engagement in the school's CoP. In addition, the analysis of related documents and teachers' learning materials, as well as notes from the informal observations helped to corroborate the facts or information gathered from

the interviews. Data from these different sources were triangulated to answer the same research question (see Figure 4-3).

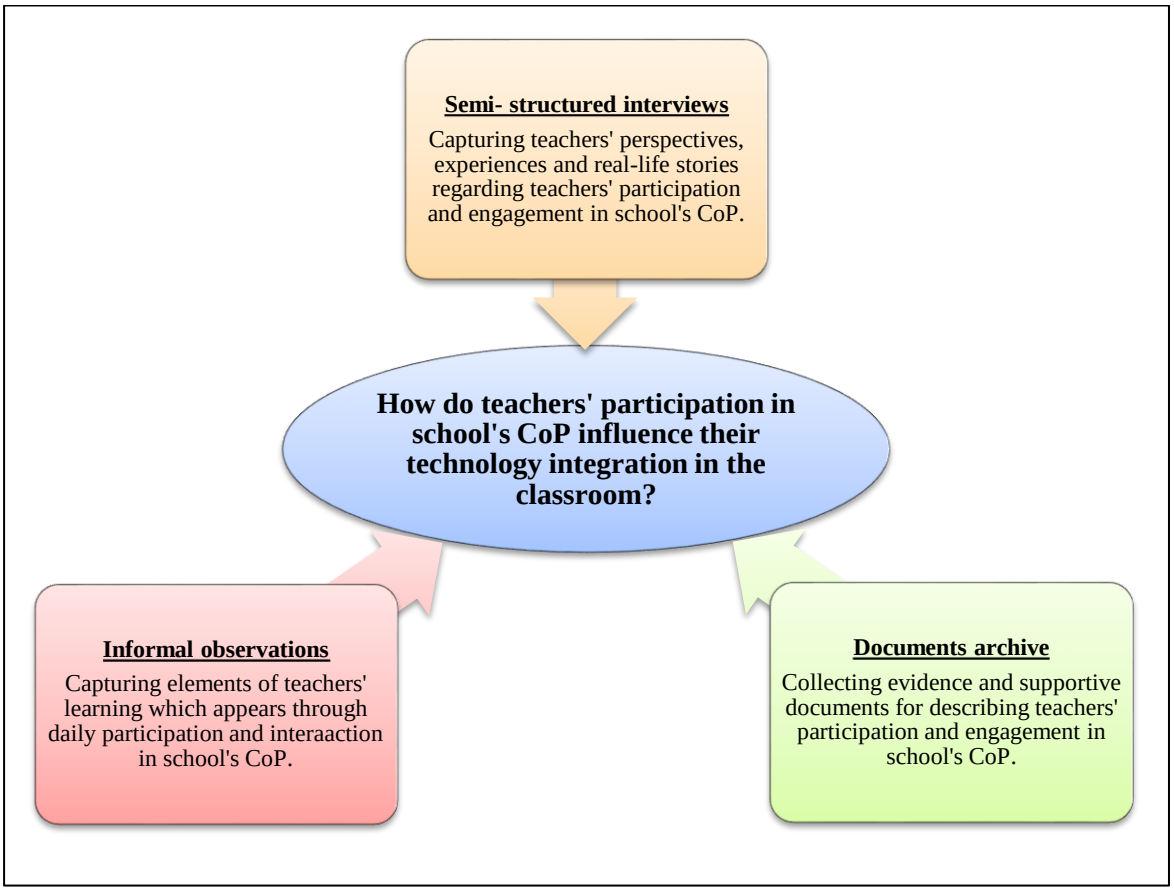

Figure 4-3: Triangulation using different data sources

External validity refers to "whether a study's findings are generalizable beyond the immediate case study" (Yin, 2009, p. 43). My study however did not aim to generalize the findings to other case studies, samples or population. The generalization involved in this case study is called as "analytical generalization, in which the previously developed theory is used as a template with which to compare the empirical results of the case study" (Yin, 2009, p. 38). In this regard, in using the findings from this case study, I aimed to investigate whether the theories of Situated Learning and Communities of Practice do explain how teachers' in a school's CoP learn to integrate digital technologies in the classroom through participation and engagement with each other.

4.4.2 Reliability

Threats to reliability can be addressed through the use of various strategies. Yin (2009) proposed that the researcher should always "make as many steps as operational as possible and to conduct the research as if someone were always looking over your shoulder" (p. 45). This could be achieved using case study protocol or case study databases during the data collection phase (Yin, 2009, 2012). In my study, a case study protocol was developed to fulfil this reliability test. The case study protocol includes the instruments (i.e. semi-structured interviews and observation protocol) and also basic procedures and general guidelines in conducting the interviews and observation.

In addition, in qualitative research that involves interviews as the primary method of data collection, the issue of reliability can be addressed by using standardised methods in preparing the transcripts (Silverman, 2006). In my study, a transcription system was developed prior to the interviews (see section 4.6.1) to increase the reliability of this case study. The transcription system provided a standardised form in transcribing the interview recorded using digital audio recorder into verbatim format for further analysis.

4.5 Methods of data collection

As mentioned earlier, I employed various methods of data collection including semi structured interviews, analysis of teachers' lesson plans and teaching materials, school policies and other technology related documents, and a series of informal observations. These methods (i.e. interviews, document analysis and observations) are common in case study research (Chadderton & Torrance, 2011; Merriam, 1998; Yin, 2009, 2012) and have been widely used in previous research related to CoP (for example see Kwan & Lopez-Real, 2010; Niesz, 2010; Skerrett, 2010).

4.5.1 Semi structured interviews

Previous research has demonstrated that interviews are important sources of data collection in case study research (for example see Henderson, 2007; Kwan & Lopez-Real, 2010; Niesz, 2010; Skerrett, 2010). Within the qualitative paradigm, Seidman (2006) argues that the purpose of in-depth interviews is not only to get answers to questions, but also to understand the experience of other people. Seidman (2006) noted that,

> Interviewing provides access to the context of people's behavior and thereby provides a way for researchers to understand the meaning of that behavior. A basic assumption in in-depth interviewing research is that the meaning people make of their experience affects the way they carry out that experience... Interviewing allows us to put behavior in context and provide access to understanding their action. (p.10)

In my study, the major purpose of conducting interviews was to capture teachers' perspective, experiences, and the real-life stories of teachers regarding their participation and engagement in school's CoP to integrate digital technologies. The information gathered from the interviews helped to understand how teachers' learning in school's CoP influences their digital technologies integration practices. The data gathered from the interviews also provided information about teachers' identities formation and the role of brokers in the school's CoP.

Semi-structured interview schedules (see Appendix A) were developed so that the interviewees were all asked a set of common questions, but in addition, there was the possibility for each person being probed or allowed to elaborate on aspects of the questions, or on their views. In many instances, their reflections moved beyond the structured questions and discussion of teacher's learning in the school's CoP. It was in this section of the interviews where rich descriptions of the interviewees' ideas and thoughts often emerged. In many instances, the interviewer was also able to add further questions and comments to stimulate additional responses.

The semi-structured interviews were conducted once, with each individual teacher participant for about 45 minutes. Some teachers were interviewed for the

second time in a follow up interview for not more than 30 minutes, to clarify uncertain issues raised during the semi-structured interview. All interviews were conducted during school hours, at the teachers' convenience. The interviews were conducted on the school's premises in a space of the teacher's own choice such as in the teachers' meeting room, the teachers' staff room and in the school's library. All interviews were conducted in a manner that would not be overheard by others, to ensure teachers' confidentiality.

4.5.2 Informal observations

In addition to the semi-structured interviews, some informal observations were conducted to look at the same phenomenon; teachers' learning to integrate digital technologies in the school's CoP. In particular, data gathered from the informal observations were used to corroborate the data from the interviews.

While previous case studies on teachers' learning in school's CoP mainly developed through interviews (for example see Table 4-1), in my study, observations were important in deepening the understanding of how teachers learn to integrate digital technologies within their particular school setting. The importance of conducting observation in supporting the interviews data collection is noted by Merriam (1998) as follows:

> Observation is a major means of collecting data in qualitative research. It offers a firsthand account of the situation under study and, when combined with interviewing and document analysis, allows for a holistic interpretation of the phenomenon being investigated. (p. 111)

In addition, my goal of completing observations was, as Stake (1995) described, to:

> ... observe the workings of the case, ... record objectively what [was] happening but simultaneously examine its meaning and redirect observation to refine or substantiate those meanings ... The aim [was] to thoroughly understand the situation. (pp. 8-9)

In my study, the major purpose of conducting the observation was to look at the nature of teachers' participation and engagement in the CoP. This observation was

important to capture the elements of teachers' CoP, which teachers might not discuss during the interview session but which appears through the daily participation and interaction in the school's CoP.

Observation was carried out informally by attending teachers' departmental meetings or school activities and other events that are relevant, or by following teachers' discussion in the school's cafeteria. Observation in the teachers' staff rooms were also conducted to look at the nature of teachers' participation and engagement with peers and other school members. Researcher field notes became important data sources in this observation process. No video or audio recordings were taken during the observations.

4.5.3 Analysis of related documents

Merriam (1998) argues that "documents of all types can help the researcher uncover meaning, develop understanding, and discover insights relevant to the research problem" (p. 133). In my study therefore, analysis of teachers' lesson plans and other related documents was conducted to provide evidence and supportive data for describing teachers' participation and engagement in CoP. The documents gathered include school reports, letters and memos related to technology inventories, teachers' lesson plans, and examples of teaching materials prepared using digital technologies. The overview of the data gathered from each participant is tabulated in Table 4-2 as follows.

Table 4-2

Overview of the data collection

Participant's Pseudonyms	**Designation / Department**	**Interview records**	**Documents gathered from each participants**
1. Kamarul	Principal	Interview 1: 90 minutes Interview 2: 20 minutes	1. 2010 academic annual report 2. 2011 academic strategic planning 3. 2011 co-curriculum strategic planning 4. 2010 parents –teachers annual meeting minutes 5. 2008/2009 report of smart school outcomes

				6. Letter from Ministry of Education Malaysia regarding Internet services at school. 7. Letter from State Education Department regarding the implementation of smart classroom. 8. List of ICT equipment.
2.	Zakuan	ICT coordinator	Interview 1: 60 minutes Interview 2: 30 minutes	1. Certificate of "Buddy School" 2. Example of Smart Schools Qualification Standard form (items for assessment)
3.	Rasyidah	ICT teacher	Interview 1: 40 minutes	None.
4.	Raihan	English	Interview 1: 40 minutes Interview 2: 35 minutes	None.
5.	Azlina	English	Interview 1: 45 minutes Interview 2: 25 minutes	1. Examples of lesson plan
6.	Iskandar	Science	Interview 1: 50 minutes	1. Example of lesson plan 2. Example of teaching material (CD supplied by the MOE)
7.	Hanita	Science / Maths	Interview 1: 35 minutes Interview 2: 20 minutes	1. Example of lesson plan 2. Example of teaching materials downloaded from Internet
8.	Liana	Science (student teacher)	Interview 1: 32 minutes	1. Example of lesson plan 2. Example of teaching material prepared using Microsoft Power Points
9.	Farzana	Science (student teacher)	Interview 1: 30 minutes	1. Example of lesson plan 2. Example of teaching material prepared in Microsoft Power Points
10.	Syahril	Maths	Two email interviews.	None.

4.6 Data analysis

The analysis of data was conducted after the interviews with transcription of the interview records into verbatim format using a standardised transcription system adapted for this study. A rigorous analysis using thematic analysis approach was then conducted.

4.6.1 Transcription system

For the data analysis, first, data gathered from the interviews were transcribed using a transcription system adapted from King and Horrock's (2010) basic transcription system. Even though some researchers have developed more detailed and highly complex systems, in this research I decided to use a basic transcription system, because the analysis focused only on the contents or themes discussed by the participants. This follows the suggestion provided by Braun and Clarke (2006) that thematic analysis does not require a detailed transcript as required for conversation, discourse or narrative analysis. It was noted that:

> As there is no one way to conduct thematic analysis, there is no one set of guidelines to follow when producing a transcript. However, at a minimum it requires a rigorous and thorough 'orthographic' transcript / a 'verbatim' account of all verbal (and sometimes nonverbal/e.g. coughs) utterances. What is important is that the transcript retains the information you need, from the verbal account, and in a way which is 'true' to its original nature. (Braun & Clarke, 2006, p. 88)

Therefore, in my study, the following system presented in Table 4-3 serves as a guideline for the transcription system applied in preparing the interview transcript for this study. Examples of excerpts from the interviews are also provided.

Table 4-3

Basic transcription system used in this study

Interview feature	**Descriptions**	**Representation**	**Examples from interview transcript**
Emphasis		Capital letters	
Laughing, coughing and other similar features	One person laughing	[laugh]	
	Both interviewee and interviewer laughing	[both laugh]	
	Coughing	[coughing]	
	Clearing throat	[clearing throat]	
Pause	Short pause, less than 5 seconds	[p] or ...	
	Long pause, more than 5 seconds	[lp: seconds]	
Tone of voice	Excitement	[excited]	
	Voice lowered down	[lowered down]	
Direct speech	Quoting another person or themselves in an interview	" "	*.. so we just "oh hi, have you done this topic, have you covered this, ... can they answer this, can they do this?" just something like that ... (Raihan, English Teacher)*
Audibility problems	Word or phrase completely inaudible	[inaudible]	*When we teach students on the topic of [diversity?] we can use pictures to show the features to differentiate between mammals and amphibians. (Hasliza, Science Teacher)*
	Word or phrase is unclear but the interviewer have some idea of what may have been said	[word /phrase + ?]	
	Background noise	[background noise]	
Inserted by the researcher to indicate what the interviewee is referring to.	Word / phrase not spoken directly by the interviewee but has been mentioned before and it was referring to that particular word (normally refers to something tangible)	|word/phrase|	*Sometimes the class is at level 3, if you have to bring that thing |data projector|, its heavy, and it's not provided in the classroom. (Hasliza, Science Teacher)*

4.6.2 Thematic analysis

The particular analytical approach employed in my research is thematic analysis. According to Braun and Clarke (2006) "thematic analysis is a method for identifying, analysing and reporting patterns (themes) within data" (p. 79). This analytical approach is highly inductive, in which the themes emerge from the data. The initial process involved in the thematic analysis is the identification of themes through careful "reading and re-reading the data" (Braun & Clarke, 2006, p. 87).

Braun and Clarke (2006) highlighted several advantages and disadvantages of adopting thematic analysis for analysing qualitative data. On the positive site, thematic analysis offers flexibility to the researcher since it allows for a wide range of analytic options. It is a relatively easy and quick method to learn and it is accessible to researchers with little or no experience of qualitative research. According to Braun and Clarke (2006), although thematic analysis is quite a simple method, it is very useful to summarize key features of a large body of data, and it could offer 'thick description' of the data set. Importantly, the identification of themes could also help to highlight similarities and differences across the data set, as well as generate unanticipated insights.

Although thematic analysis has also been criticized for its unclear process, a thorough analysis of the data could provide rich description or more detail of particular theme. It has been highlighted that a "rigorous thematic approach can produce an insightful analysis that answers particular research questions" (Braun & Clarke, 2006, p. 97). This is particularly suited my study which explored particular research questions and themes in detail. In my study, I therefore adopted Braun and Clarke's (2003) recommendation on conducting thematic analysis by conducting several processes during the analysis as follows (see Table 4-4).

Table 4-4

Phases of thematic analysis (Braun & Clarke, 2006, p. 87)

Phase		Description of the process
1	Familiarize the data	Transcribing data, reading and re-reading the data, noting down initial ideas.
2	Generate initial codes	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3	Searching for themes	Collating codes into potential themes, gathering all data relevant to each potential theme.
4	Reviewing themes	Checking if the themes work in relation to the coded extracts and the entire data set; generating a thematic 'map' of the analysis.
5	Defining and naming themes	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.
6	Producing the report	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

In my study, analysis started with transcribing the interview data into a verbatim format using Microsoft Word. As the transcribing was conducted by me, this process provided background reading which formed an important part of the analysis process and familiarized me with the data as it and emerging themes. After the transcriptions were done, I read and re-read the data, and noted down the initial ideas and emerging themes using the 'review' tools in Microsoft Word. The data were then imported into the NVivo data management program for generating the initial codes, organizing and re-arranging the codes, and for categorising the codes into themes. The initial themes noted in Microsoft Word helped the codes development in NVivo. The themes emerged from the data, although the organization and categorisation of the codes were guided by the Situated Learning and Communities of Practice theories (i.e., theory-driven).

As I adopted a theory-driven thematic analysis, several key concepts from the Situated Learning and Communities of Practices theories as discussed earlier in Chapter 3 were used as the analytical framework. In particular, I explored the elements of mutual engagement, joint enterprise and shared repertoire (Wenger, 1998) that contribute to teachers' learning to integrate digital technologies. In addition, the definitions provided by Henderson (2007) were used as the starting point for an analytical framework in my study to analyse teacher's interview data which is relevant to joint enterprise, mutual engagement and shared repertoire in their school's CoP, together with the original work of Wenger (1998). As identity formation is an important stage in becoming a competence member of a CoP, in my study, I explored teachers' identity formation in the school's CoP and its relationship with their digital technologies integration, and the role of "brokers" in influencing other teachers' digital technologies integration practices as theorised by Wenger (1998). In addition, the key themes identified from my data were utilised in the analysis of the data.

The qualitative analysis software called NVivo version 9.2 was used to assist the management and organization of the interviews data and documents collected from the teacher participants. The data was grouped and organized according to the embedded cases (i.e. teacher participants) to assist the analysis process. In my study, the use of NVivo software was very useful in data analysis process. It provided tools that supported the analysis process such as coding, annotating, linking and visualizing the data (Bazeley, 2007).

4.7 Ethical consideration

As this research involved human participants, ethics clearance from the Monash University Human Research Ethics Committee (MUHREC) was obtained. Application for ethics approval was submitted after the confirmation of candidature in October 2010. Permission from the Economic Planning Unit, Prime Minister's Department of Malaysia and Ministry of Education, Malaysia to conduct a study in a Malaysian school was also obtained.

The ethical considerations related to voluntarism and self-respect were applied in my study. A consent form or letter informing participants about the research objectives and matters regarding the confidentiality of the research data were provided to the prospective participants, and was included in the recruitment package. The recruitment of participants was conducted in a manner that did not enforce power relations, either from the researcher or from the school's authority. Although the recruitment package was sent through the school principal, the researcher notified the principal that participation in this study should be voluntary and therefore asked the principal to distribute the invitation letters to all teachers in the Science and English department using internal mail. Teachers who voluntarily participated in this study then returned the consent form in a sealed envelope to the school's office. In this way, there was no direct contact between the participants with the school's principal. Detailed procedures about the selection and recruitment of the participants have been discussed earlier in this chapter (see sections 4.3.1 and 4.3.2).

4.8 Conclusion and chapter review

This chapter began by introducing the rationale for choice of qualitative methodology, using case study approach. The case study design was then explained as a single case (embedded) design. The process utilised for the selection of the case study and the teacher participants was outlined, as well as the rationale for selecting Perdana Secondary School for this study. The methods of data collection included semi-structured interviews, informal observations and gathering a range of school and teachers documents related to digital technologies integration practices. The method or approach to data analysis was explained with reference to the thematic analysis framework. Also, discussion on the validity and reliability of the study, as well as consideration of ethical issues in conducting the study was provided.

The following chapters show the use of the data and analysis in action through the thematic analysis approach of the embedded cases, the teachers CoP and teacher's cases. The analysis and discussion chapters are structured thematically, based on the research questions and according to the analytical framework of Situated Learning and Communities of Practice. Chapter 5 provides the profile of the case study and

analysis of data related to teacher's membership in school and teachers' CoP. Chapter 6 provides analysis on teachers' digital technologies integration practices. Chapter 7 provides analysis of data and discussion of the theme of teacher's learning in the school's CoP which focuses on their mutual engagement, joint enterprise and shared repertoire. Chapter 8 focuses on teacher's identity formation in school's CoP, and Chapter 9 focuses on the aspect of "brokering" in the school's CoP.

Chapter 5 Introduction to the case study

This chapter provides a profile of the case study school and the teacher participants. This chapter also provides a descriptive analysis of the teachers' membership in the school communities of practice (CoP) and their digital technologies integration practices.

This study was conducted in one Malaysian Smart School with ten teacher participants who were identified to be closely aligned with several localised CoP or departmental CoP (i.e., English teachers CoP, Maths and Science CoP, student teachers CoP and ICT leaders CoP).

5.1 School profile

This study was conducted in a secondary school in the north of Peninsular, Malaysia. The following Table 5-1 summarizes the basic information about the school.

Table 5-1

School's demographic information

Attributes	School's information
School pseudonym	Perdana Secondary School
School category	Rural
School grade	A
Number of teachers	131 teachers*
Number of students	1468 students*
Number of school sessions	2 sessions (morning and afternoon sessions)

Classes offered	Lower secondary – Form 1 until Form 3 (Ages 13 to15) Upper secondary – Form 4 until Form 5 (Ages 16 to17) Pre-university – Form 6 (Ages 18 to19)
Technology facilities for teaching and learning	2 computer labs for teaching and learning 1 viewing room equipped with audio and visual equipment (radio, television and LCD projector) 1 interactive whiteboard and 10 computers (located in Mathematics common room) 5 Science labs equipped with LCD projector

*Data as gathered in May 2011

Perdana Secondary School is located in a newly developed suburban town. It is very close (within walking distance) to shopping centres, public transport, banks, restaurants and other local amenities. The school however is categorised as a rural school due to its geographical location. Perdana Secondary School is also categorised as a grade "A" school, which means it is an excellent school where the requirements to enter Form 1 is with 5A's or at least 4A's and 1B from the Year 6 (primary school) national examination results.

Malaysian secondary schools normally operate in one session started around 7.30 a.m. until 2.00 p.m. Perdana Secondary School however operates in two sessions, in the morning and afternoon. The afternoon session starts at 12.30 noon until 6.30 p.m. The morning session caters for the primary schooling programs, for Form 3 until Form 6. Only Form 1 and Form 2 classes run during the afternoon session. This school has to run two sessions due to limited resources and large number of students.

According to the ICT coordinator, the school had about 200 personal computers for students and teachers to access, located in different places such as in computer labs and staff rooms. There are two computer labs available to be used by teachers for teaching and learning. The labs however are mainly used by ICT teachers to teach ICT subjects. These computer labs have about 40 computers in each lab and are equipped with a data projector. Other than computer labs, all Science labs in the school are also equipped with data projector and personal computer. Some teachers

involved in the English for Teaching Maths and Science (ETeMS) program owned laptops supplied by the Ministry of Education, Malaysia to assist them in their teaching and learning using digital technologies.

There is one 'viewing room' next to the school library, equipped with a television, a personal computer and a data projector. Within a Malaysian school, viewing room is generally a common room used by teachers and students for viewing and discussing educational television program as part of the teaching and learning process. The viewing room at Perdana Secondary School could accommodate around 40 students at one time. As there is only one viewing room available, teachers have to book the room earlier if they want to use it.

Other than that, there is one Mathematics room available at Perdana Secondary School that could accommodate around 20 students at one time. It is equipped with 10 personal computers and one interactive whiteboard. In all other classes (regular classrooms), there are no data projectors available. If teachers want to use data projectors in the classroom, they have to bring in a portable data projector and laptop. Portable data projectors are available in the school for teachers to use but it is very limited. As a consequence, teachers in this study reported that they rarely use data projectors in the classroom.

There are a few shared computers available in the staff room, school's main office, and library to be used by teachers. Other than that, the school has two computer labs called as 'knowledge cafe' for students. There are about 30 computers in each 'knowledge cafe'. Students may use the computers in the 'knowledge cafe' during their free time to search for information from the Internet or to do their work using the computers and printers that were provided.

It was confirmed by the Principal that Perdana Secondary School had become one of the Malaysian Smart Schools since the pilot project was launched in 1999 and was still in that program in 2011. Some of the ICT resources available at the school had been provided by the Ministry of Education during the implementation of the Smart School project. The more current ICT facilities however came from various funds and projects. These included the ETeMS program and the more recent Cluster School project.

Briefly, ETeMS was implemented starting in 2003 to support the Smart School's project (Lau & Sim, 2008; Thang, Murugaiah, et al., 2010). Through this program, the Science and Mathematics subjects use English language as the instructional medium. In addition, Mathematics and Science teachers are required to master ICT skills in operating the technology resources provided by the Ministry of Education during classroom instruction (Idris, Cheong, Mohd Nor, Abdul Razak, & Md. Saad, 2007). To support this, most teachers of Science and Mathematics in Malaysian secondary schools (including those in Smart schools) were provided with laptops and educational courseware in multimedia format to assist their teaching and learning process.

Since my study commenced, the later educational reform within the Malaysian schools was the implementation of Cluster Schools launched in 2006. According to the principal, Perdana Secondary School met the standards of a Malaysian Cluster School in 2009. The following section provides a brief overview of the Malaysian Cluster School. This is to provide an additional background to the context of this study, as the Cluster School project is also part of the Malaysian educational reforms, one of the latest programs after the Smart School and the ETeMs program.

Cluster schools in Malaysia refer to potential schools in a particular niche area that fulfil the criteria set by the Ministry of Education Malaysia (2006). In the selection process, schools were assessed and evaluated based on their excellence in respective clusters, categorised as follows:

- Primary Schools: National Schools, Chinese National Type Schools, Tamil National Type Schools and the Indigenous Schools.
- Secondary Schools: Fully Residential School, Technical Secondary Schools, National Religious Secondary Schools, Daily Secondary Schools,
- Premier Schools, Centennial Schools, Schools in Putrajaya and Cyberjaya and Special Model Schools.
- Special Education Primary Schools, Special Education Secondary Schools, and Special Vocational Education Secondary Schools.

- International Schools and Private Schools
- Matriculation Colleges and Institutes for Teachers Education.

(Ministry of Education Malaysia, 2006, pp. 119-121)

There are different types of schools in the Malaysian education system (as listed above), so efforts to improve school performance were conducted by generating clusters of excellence in particular niche areas (Ministry of Education Malaysia, 2006). According to the Principal, Perdana Secondary School was categorised under the Secondary Schools cluster, and the areas of excellence for the curricular or academic are in Mathematics and Languages (both Malay and English languages), whilst for the co-curricular or non-academic, the area of excellence is in volleyball. Since receiving Cluster School recognition, there were many projects and activities conducted as part of the project.

The implementation of cluster schools also incorporates elements of technology. Teachers are encouraged to be more creative in creating innovations through the use of technology to accelerate their school excellence (Ismail, 2011). For example, in terms of technology facilities, Perdana Secondary School was provided with an interactive whiteboard in 2010. This interactive whiteboard facility funded by the Cluster School project was part of the technology improvement project for Mathematics teaching and learning processes.

It was mentioned by the Principal and other teachers involved in this study that Perdana Secondary School was affected by a big flood in 2010. As a consequence, many of school's facilities including teachers' staffroom were ruined. Before this incident, the school had only one staffroom located on the ground floor where all teachers were allocated a desk. However, after the flood, the staffroom was moved to the first floor. Six teachers' staffroom were located in different places due to infrastructure constraint in which each room could accommodate around 20 teachers. The school's administration tried their best to allocate teachers in each room according to their department of teaching, such as Science and Mathematics department, English department and others.

5.2 Teacher participants' backgrounds

As noted in section 4.2.3, out of twelve participants who returned the consent forms, two withdrew from participating in this study. Therefore, only ten participants voluntarily took part until the end of the data collection phase. The demographic information of the participants is outlined in Table 5-2.

Table 5-2:

Participants' demographic information

Pseudonym	Age and Gender	Years of Teaching Experience	Current Position	Primary Subject(s) Taught	Additional Subject Taught	Previous Subject Taught
1. Kamarul	48 / M	20	Principal	N/A	N/A	Maths
2. Zakuan	46 / M	21	ICT Coordinator	ICT	N/A	N/A
3. Rasyidah	38/F	15	Teacher	ICT	N/A	Maths
4. Raihan	27/M	4	Teacher	English	N/A	N/A
5. Azlina	27/M	4	Teacher	English	N/A	N/A
6. Iskandar	40/M	10	Teacher	Physic and Chemistry	MUET	N/A
7. Hanita	34/F	10	Teacher	Maths	N/A	Science
8. Liana	24/F	0	Teacher Trainee	Chemistry	Living Skills	N/A
9. Farzana	23/F	0	Teacher Trainee	Biology	Living Skills	N/A
10. Syahril	26/M	3	Teacher	Maths	N/A	N/A

Note:

MUET is an abbreviation for Malaysian University English Test for Malaysian students who wish to pursue a first degree programme in local universities. MUET subject is offered for form 6 students as a preparation for them to sit for the test.

As noted earlier in Chapter 3, the school is an example of a CoP where groups of teachers with common interest and shared practices mutually engage in collaborative works and socially relate to each other (Butler et al., 2004; Hennessy et al., 2005; Skerrett, 2010). Importantly, in a CoP, people do things together, negotiate their joint enterprise, and share common repertoire (Wenger, 1991). Therefore, this background information is important to contextualise participant's responses and positions within the school's CoP, and their membership with several CoP (i.e., English teachers CoP, Maths and Science CoP, student teachers CoP and ICT leaders CoP). For example, data pertaining to subjects taught and administrative position held

may be found to relate to how teachers positioned themselves in different CoP within the school's CoP. This would allow further examination of the concept of multi memberships in the CoP. Background information relating to their previous experiences also provides a basis in understanding how teachers in this study form or shape their identity and it might also relate to their trajectories of learning in the school's CoP. Therefore, a short profile of each participant is presented next.

5.2.1 The Principal

The school principal, Kamarul, graduated with a Master in Education from a Malaysian university. He started his teaching career in 1983 with specialization in Mathematics. In year 2000, he became an officer at the district education department. He started his leadership career as principal in 2005 at one secondary school called Kembara Secondary School (pseudonym). He then was transferred to Perdana Secondary School in 2007 as a potential principal to lead a Cluster School project. In 2009, he successfully led the school and achieved the Cluster School recognition.

Kamarul revealed that during his early career in teaching, "no one talked about ICT" at school. According to him, only in year 2000, ICT in education became popular with the introduction of Multimedia Super Corridor (MSC). However, at that time he was not teaching at school, but attached to the district Education Department, and therefore he was not in interested in knowing or learning about ICT. In addition, during the time he was attached to the district Education Department, administrative tasks were mostly done manually. There was no online system for education administration purposes at the district or state levels, and computers were only used for basic word processing tasks such as for preparing letters and simple reports.

When he became a principal in 2005, he started to realize the need to use ICT. However, he mentioned that the use of ICT in Kembara Secondary School was not the same as in Perdana Secondary School due to lack of facilities. Therefore, at that time he did not put an emphasis on the use of ICT among teachers. When he came to Perdana Secondary School, he was "culturally shocked" in terms of technology as he had limited understanding of "what a Smart School is and how to manage a Smart School?" He later realized that one of the important aspects of the Smart School is to

integrate digital technologies in teaching and learning. He learned about the importance of integrating digital technologies in the Smart School through reading and studying the Smart School policy. He also discussed and learned about Smart Schools and how to manage a Smart School from the ICT coordinator, other teachers and peers who joined Perdana Secondary School earlier than him and had experienced the Smart School program with the late principal.

Through the interviews, it was apparent to me that the principal had a positive attitude towards the importance of integrating digital technologies in the classroom. He shared his concerns that there were few teachers in Perdana Secondary School who were very advanced in terms of their digital technologies skills and use, and some teachers with poor skills in using ICT. In response to this concern, he emphasised that teachers needed to be guided in their ICT usage. Further discussion about the principal's policies and his involvement in shaping the digital technologies integration practice is Perdana Secondary School is discussed further in the next chapter.

5.2.2 The ICT teachers

Zakuan had 21 years teaching experience and had been teaching in several schools before joining Perdana Secondary School in 2004. Zakuan started his teaching career with a Certificate in Education. He then pursued his Diploma in Education and also a Bachelor Degree in Education (Educational Technology) from a Malaysian university. Zakuan taught the ICT subject and was also the ICT coordinator at Perdana Secondary School. At the state and district levels, he was also an ICT trainer. As an ICT coordinator, he was responsible for ensuring that ICT facilities at the school were in good condition and could be used by teachers for teaching and learning. He also had responsibility to ensure that all teachers received necessary ICT training. Importantly, he noted that one of his responsibilities as an ICT coordinator is to ensure that the "culture of ICT" is nurtured among teachers and students in the school.

Another teacher, Rasyidah, also taught the ICT subject. Rasyidah was the head of the ICT panel. Previously, Rasyidah was teaching Maths in the Perdana Secondary

School. As she graduated with Bachelor in Education (Information Technology) in 2005, she started to teach ICT. At the district level, Rasyidah was an ICT evaluator. At school, Rasyidah was appointed as a *'data'* teacher, that is, a teacher who was in charge of the school's data and statistics. As a '*data'* teacher, Rasyidah was responsible for managing, collecting, processing, recording, and reporting all school data and education information. It includes teachers' data, students' data, non-teachers' data and also the school's profile. At school, Rasyidah worked closely with Zakuan as they are both from the same ICT panel. Because they were the only two ICT teachers in the school; most issues related to ICT were under their knowledge and supervision.

5.2.3 The English Teachers

The two English teachers who participated in this study are Raihan and Azlina. At the time of data collection, they were both 27 years old, and had 4 years of teaching experiences. Both Raihan and Azlina graduated with Bachelor of Education in Teaching English as Second Language (TESL). Azlina graduated from a Malaysian university while Raihan received his bachelor degree from a twinning program between one Malaysian teacher training institute and one university in Australia. For both of them, Perdana Secondary School was their second school and they were transferred to this school in January 2011. This means that when they were interviewed for this research, they had been in the current school for about four to five months. They were considered as newcomers in the school.

At Perdana Secondary School, they taught English subjects for Form 3 and Form 4 students. Apart from teaching English subjects, Raihan and Azlina also advisors to the students' committee. Raihan was an advisor to the student prefect committee whilst Azlina was an advisor to the school's hockey team. Azlina also became a hockey coach at the school and district levels. Although they were new teachers, both Raihan and Azlina had been appointed as advisors to the school's English Debate Team and they were responsible for coaching the team for a debate competition that was scheduled to be held in July 2011.

When Raihan started his teaching career in 2008, he was posted to a rural school in Sabah, located in East Malaysia. Raihan's previous school was a small school in a rural area with only 300 students, and only 30 teachers. According to him, the school environment was mainly "traditional" with very limited technology facilities in place. He admitted that in the previous school, he was not incorporating ICT in his teaching and learning because of the lack of ICT infrastructure, and also because many students were "not capable of having ICT" due to low economic income. He was comparing Perdana Secondary School with his previous school. He said that Perdana Secondary School was properly equipped with ICT infrastructure and therefore teachers in this school needed to integrate digital technologies. He was very excited to talk about ICT during the interviews and according to him, in this school, he was trying his best to "incorporate as much of ICT" in his lessons as possible.

Azlina also started her teaching career in 2008 and had been teaching in one secondary school in Langkawi, a small island located at the northern part of Peninsular Malaysia. According to Azlina, her previous school was a newly developed school, opened in 2005. She judged that her previous school was "more up to date" and a "kind of new definition of school" in terms of the ICT facilities compared to Perdana Secondary School. She further explained that, because the school was newly developed, "ICT is already being part and parcel of our life, so when the school opened, the facilities are kind of brand new, and it's more towards ICT". In this regard, Azlina was defining what a new school should be, that is, equipped with suitable ICT facilities. When Azlina talked about her digital technologies integration practices during the interviews, she frequently referred back to her practices and experiences at the previous school. These provided valuable insights into her trajectories of learning, and the influence of her previous experiences into her current digital technologies integration practices, that are discussed further in the next chapter.

5.2.4 The Science and Mathematics Teachers

The three teachers who participated in this study and were attached to the Science and Mathematics panels were Iskandar, Hanita and Syahril. Iskandar and

Hanita are senior teachers with 10 years teaching experience. Syahril had only 3 years teaching experience, and thus was still considered a junior teacher. Hanita and Syahril however, are new teachers in Perdana Secondary School, because they just started teaching in Perdana Secondary School in 2010.

Iskandar graduated in 1994 in Chemical Engineering from United Kingdom. Soon after completing his degree he worked in industry. He had seven years industrial experience in engineering and had been working in a few places, both in Peninsular and West Malaysia. He left the industry in 2000 to pursue a Post-graduate Diploma in Education, in a Malaysian teaching institute due to economic reasons. Upon receiving his Diploma in Education, he started teaching in Perdana Secondary School since 2002. In 2009 to 2010 he took study leave to pursue his Master degree in one Malaysian university. He just returned to teach again in Perdana Secondary School in January 2011. He taught Chemistry and Physics for Form 6 (pre-university level) students. Other than that, he also teaches Malaysian University English Test (MUET) subject for Form 6 students.

Iskandar has a deep interest in computing. He was exposed to computers in his schooling since around 1983. At that time, he was living in Singapore. He started to learn a programming language called Basic and his father was the one who always encouraged him to learn about computers. Because of his interest in computing, he used part of his monthly allowance for personal tuition on computing. He recalls that he had started to develop a program using Basic on an IBM personal computer. When he was doing his first degree in the United Kingdom, he started using Apple Macintosh computers. According to him, since using Apple, he could never change to another platform. He claims that his interest in computing has influenced his teaching practices and he tries his best to integrate digital technologies in his teaching and for the student learning.

Another Science teacher involved in this study is Hanita. She received her Bachelor degree in Accounting from a Malaysian university. After completing her undergraduate studies, she enrolled in a Graduate Diploma in Education program, specializing in Mathematics and Science. She then started her teaching career and had been teaching in several schools for the past 10 years. After a few years of

teaching, she pursued a postgraduate degree in Master of Science (Education). Because of her background in both Mathematics and Science, Hanita could teach both subjects. Previously, she was teaching the subject of Science at Perdana Secondary School, but starting from January 2011 she teach Mathematics for Form 3 and Form 4 students. This is a normal practice within Malaysian school where teachers have to teach several subject according to their options.

In terms of technological background, Hanita recalls that she was not very interested in ICT or technology related topic in the beginning of her teaching career. However, since her involvement in the ETeMS project and after completing her Master's degree, in which she took a subject pertaining to ICT in education, she realised the importance of using ICT in teaching and learning. Since then, she started to improve her ICT knowledge and skills and whenever she has the opportunities, she tries to integrate ICT in her teaching and learning.

Another teacher within the Science and Mathematics department involved in this study was Syahril, 26 years old. He teaches Mathematics subject (Additional Maths) for form 4 students. Because Maths teachers are grouped under the Science and Mathematics panel, he received the invitation to participate in this study distributed by the principal through the panel. Unlike other teachers, Syahril did not provide his educational background in detail. He just mentioned that he received his Bachelor degree from a Malaysian university. When I first met him to arrange for the interviews, he mentioned that he was not practising digital technologies integration in his teaching on a regular basis because of the nature of Additional Maths subject that requires lots of calculation. He did mention the use of a graphic calculator, which is considered as digital technology for teaching. Considering that Syahril was also a member of the Science and Mathematics panel and his minimal digital technologies integration practices, I decided to include him in this study, first to add to the perspectives of multiple memberships in school's CoP and second, to gain some insights from a teacher who minimally integrated ICT in his teaching practices.

5.2.5 The student-teachers

There were two student-teachers who participated in this study, Liana and Farzana. Liana was 24 years old, and Farzana was 23 years old when this study was conducted. Liana graduated with a Bachelor of Science (Chemistry) from a university in the United Kingdom, whilst Farzana graduated with a Bachelor of Science (Microbiology) from a Malaysian university. Upon completion of their Bachelor studies, they both enrolled in a two years Postgraduate Teaching Diploma program at a teacher education institution in Malaysia to qualify them to teach in a Malaysian school. When this study was conducted, they were in their final year of the Postgraduate Teaching Diploma program.

Liana and Farzana were attending their teaching practicum at Perdana Secondary School when this study is conducted. The practicum took place for about three months at the school. In their Graduate Teaching Diploma program, Liana and Farzana were specializing in Science subjects. Liana chose Chemistry as her first teaching option, while Farzana chose Biology. Both Chemistry and Biology subjects are under the Science department within the school. As they were also required to choose a second subject area in their Graduate Teaching Diploma program, they both chose Living Skills subject called "Kemahiran Hidup" as their second teaching option. The Living Skills subject comprises hands on or vocational modules such as basic electronics, crafting, sewing and gardening. The aims for this subject are to expose students to basic vocational skills.

As they were teaching Science subjects, Liana and Farzana were identified to be members of the Science department and therefore they received the invitation to participate in this study. Although at first my study did not aim to involve student teachers, their involvement was important as it provided additional insight through the variation of the CoP membership. The involvement of student-teachers was also found to be important to showcase teachers' multi membership in the school's CoP. As Perdana Secondary School hosted several student-teachers during the year, this involvement from student teachers was important to illustrate the learning processes in the school's CoP from multiple teachers' perspective.

5.3 Teachers' membership in the school's CoP

Earlier in this thesis (see chapter 3, section 3.3), it has been argued that teachers are members of a school's CoP. It was also argued that within a school's CoP, there might be other CoP that exist based on teachers' mutual engagement, joint enterprise, and shared repertoire related to their teaching subjects. This was substantiated by an analysis of the data in this case study. The following Figure 5.1 outlines teachers' multi memberships in subject focused or localised CoP that exist based on teachers' engagement, enterprise, and repertoire related to their teaching subjects that will be discussed further in Chapter 7.

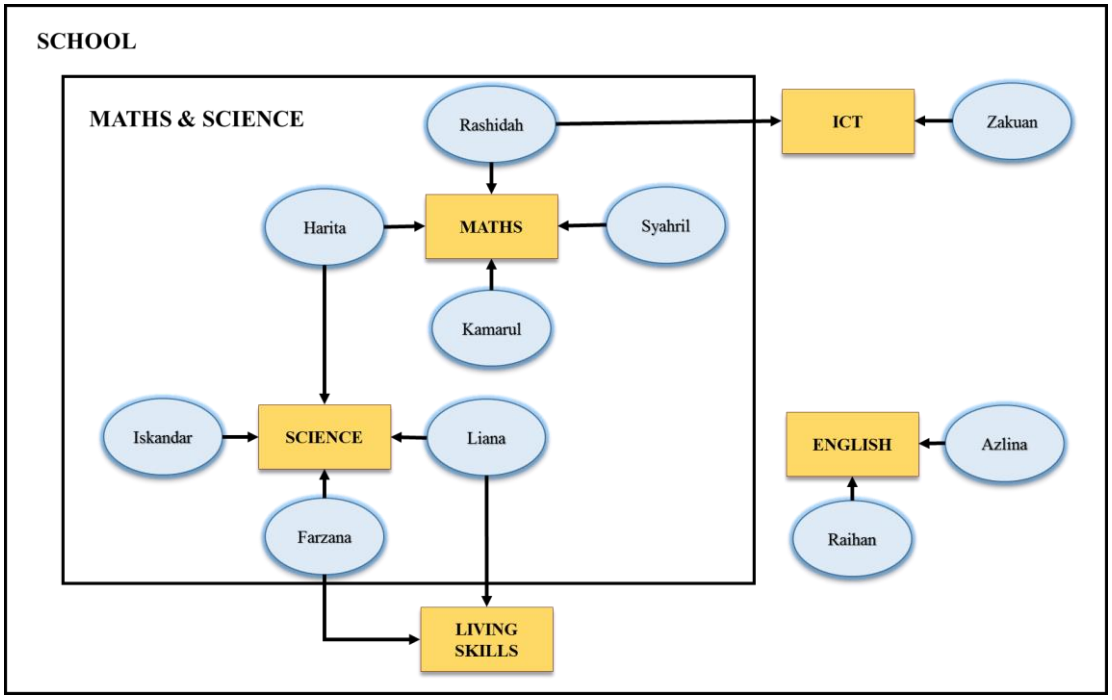

Figure 5-1: Teachers' memberships in subject focussed CoP

The data gathered from teacher's background information showed that there were multiple CoP that exist within the Perdana Secondary school's CoP. As found in this study, there were at least four types of a localised teachers CoP that exist within the school's CoP, that are:

i) Departmental CoP (i.e., Science and Maths CoP, Language CoP, Social Sciences CoP)

ii) Subject focused CoP (i.e., Science CoP, Maths CoP, English CoP, Living Skills CoP)
iii) Administrative or leaders CoP (i.e., ICT leaders CoP)
iv) Special CoP (i.e., student-teachers CoP)

Within the school's CoP, teachers are members of a particular subject CoP. For example, all Mathematics and Science teachers are grouped under the Mathematics and Science department. In this regard, all Science and Mathematics teachers (i.e. Hanita, Syahril, Iskandar, Liana and Farzana) were also members of at least two teachers CoP; their own subject focused CoP (either Maths or Science) and also the departmental CoP which was the Mathematics and Science CoP.

Teachers may also become members of two or more subject focussed CoP. For example, with reference to the teacher's profile (see section 5.2.4), and as illustrated in Figure 5-1, Hanita was a member of the Science CoP and also Mathematics CoP. The student teachers, Liyana and Farzana also members of two subject focussed CoP, the Science CoP and Living Skills CoP.

Apart from the subject and departmental groupings, teachers also belong to a specific CoP within the school community. For example, the principal, the ICT coordinator and the ICT teachers were considered as members of the ICT leaders CoP as they were responsible in managing and administering ICT related policies, support and activities within the school.

Apart from becoming members of particular subject focussed CoP, and members of departmental CoP, student teachers were also considered as members of a special CoP that is the student-teachers CoP. There were also other student-teachers in the school who were teaching different subjects. As student teachers shared an enterprise in their practical training program, they were strongly connected to each other as student-teachers and shared unique characteristics as a student-teachers CoP.

These CoP that exist within the school support the argument that teachers may become members of multiple CoP within the school's CoP itself. This is consistent with previous studies that found within the larger school's CoP, there were smaller CoP, such as teachers' curriculum grouping and student-teachers community

(Hodkinson & Hodkinson, 2003; Woodgate-Jones, 2012). Members of a particular group defined their membership and how they were strongly aligned and connected to each other within their localised CoP through the negotiation of joint enterprise, mutual engagement and shared repertoire. Further discussion on how teachers' involved in the joint enterprise, mutual engagement and shared repertoire of their localised CoP is provided in Chapter 7.

The following discussion focuses on some elements of CoP, such as the concepts of peripherality and legitimacy, newcomers and oldtimers, apprentices and power related to teachers' membership in the school's CoP.

In my study, the existence of multi memberships in the school's CoP supported the notion that participation in a CoP are dynamic, for example, Hanita's participation in the Science CoP gradually became less since she stopped teaching Science in 2011. As she started to teach Maths, she moved into the Maths CoP, became more engaged and competently participated in this new CoP to be able to perform and fulfil her Maths teaching scopes and responsibilities.

However, because she had just started teaching Maths, Hanita was more comfortable and confident to share her views and experience as a member of the Science CoP, she mostly provided examples of her Science teaching. She rarely talked about her Maths teaching unless specifically asked to provide examples on that particular subject. This showed that her experience strongly linked to her participation the Science CoP as compared to her participation in the Maths CoP at the time the interviews were carried out. In this sense, Hanita had built a strong identity as a Science teacher based on her previous experiences in teaching Science, and at the same time developing her competency into the Math teachers CoP. In this process, she continued her trajectories of learning and shaping her identity as a Math teacher.

Raihan and Azlina both belonged to the English CoP. They were new to the CoP because they just joined the school in January 2011, and the data was collected in April 2011, suggesting that their memberships were still at the periphery. At the time the interviews were conducted, they were still finding ways to get along with other teachers, especially those from different departments. Their identification as newcomers can be seen in their responses. Azlina, for example mentioned, "I'm still

working on it because actually I don't know where to get all those things, because I am still new in this school" and "I don't know, maybe it just me who does not know about this school yet". In these instances, Azlina repeatedly identified herself as a newcomer. She was struggling in finding ways to gain access, especially when in relation to digital technologies resources and facilities.

By contrast, Raihan was more comfortable with the new teaching environment and the new school. He had no problem in building a relationship with other teachers and to seek help and advice whenever he needed. This can be seen in the following quotes by Raihan:

> Teachers here are fantastic. They are very helpful. They love new guys. They accepted new teachers with open arms... whatever we have in our mind that we need further clarification we can just walk up to them, ask them on how to do things and they will be glad to teach us…

Other teachers, Iskandar, Rasyidah and Zakuan are senior teachers, with more than 10 years teaching experience. From the CoP perspective, they were considered as old timers. This was reflected in the interviews, in which they noted they were very comfortable with the school environment. They were also excited to talk about their current practices in the school as well as their past experiences.

Although Iskandar was a senior teacher based on his years of teaching experience in Perdana Secondary School, he was actually in a transition period because he just returned from two years study leave. He was adjusting himself to the current situation. But it seemed he had no problem in accessing the school's technology resources based on the past experiences in the school. His advanced knowledge in computers and technology made him comfortable to teach using digital technologies with whatever resources he had. It was mentioned by the principal in another interview, that in the Science panel, Iskandar was one of the teachers who had demonstrated good digital technologies integration practices. The principal also mentioned Iskandar's capability and potential in mentoring or guiding the "junior teachers", or the newcomers.

Farzana and Liana were both teacher trainees at the school. As their main teaching subject was Science, they were members of the Science CoP. At the same time they were also members of the Maths and Science CoP at the panel level. They were also members to Living Skill's CoP as they also taught this subject as the second subjects during their internship.

The relationship between Liana and Farzana was intense and strong within the student teachers CoP, as they mostly used the words "we" and "us" to refer to themselves during the interviews. As an observer, I viewed this closeness and togetherness between Liana and Farzana as mutual support to each other, as they were the only two student teachers of Science at the school when this study was conducted.

Being in the school for a short period of time (about two months), gave them less opportunity to legitimately participate as core members in the CoP. In this sense, their participation in the school's CoP was more peripheral. During this short period of time they had to fulfil the requirements to become a certified teacher. Also, they had to learn the school's culture and build their identity to become good teachers once they graduated. In this sense, as student-teachers, Liana and Farzana also gained benefits from their membership in the school's CoP, although only as peripheral members.

Liana noted: "We are here for only 5 to 6 weeks. There's nothing much that we can do. But, I think this is the best opportunity for us to develop our teaching skills". In this regards, Liana develop her teaching skills by observing what other teachers did. For example, Liana observed other teachers way of doing things by attending other Science and Living Skills teachers lesson. She said:

> I learn from other Science and Living Skills teachers on how to manage and control the classroom. By attending their classes, I can see how different teachers handle their lesson, their voice control, and their classroom activities.

Also, through the observation, Farzana and Liana were aware of the use of courseware, and learned how to use it. Liana said:

> I see other teachers using courseware provided by the Ministry of Education. So I learn to use courseware in my teaching. I learn it myself, but if I have problem I will ask other teachers.

She continued to reveal her knowledge and awareness of the courseware, and how she could use the courseware in her teaching:

> For the Chemistry subject, the courseware covers both Form 4 and 5 syllabus. It is organised according to the chapters, for example, in Chapter 1, there are lesson, activities and learning outcomes, and what students should learn and achieve from that chapter. Most Science teachers use the courseware, including Chemistry or Biology teachers. There are lots of diagrams and lots of materials that we can use from the courseware.

These are examples of how student-teachers participated in the school's CoP. As they were expected to learn how to integrate digital technologies in their teaching practices, they took the advantage of utilizing the digital technologies that was available in a Smart school. In that sense, their participation and engagement in the school's CoP, although only at the periphery, was very important, as they learned and practiced their teaching skills and knowledge they had learned at the university level. This participation in the school's CoP could be seen as an apprenticeship program in which junior teachers starts the participation process as newcomers, learning from the senior teachers or the oldtimers. This social interaction and collaboration among the newcomers and the oldtimers are essential components of situated learning that involves both "absorbing and being absorbed" in the communities of practice (Lave & Wenger, 1991, p. 97). This finding also corroborated Glazer and Hannafin's (2006) study that claimed through apprenticeship, student-teachers develop new knowledge, skills and resources with the support from senior teachers.

Although membership in a CoP does not require any structure or formalization (Wenger, 1998), in this case study, the school's principal, Kamarul had the administrative power to provide access or membership to all CoP that exist within the school's CoP. This is particularly relevant in the school's communities, in which he was the school leader and had the responsibility to supervise all subject panels in the school.

From the interviews, it was found that in terms of the subject-based CoP, Kamarul demonstrated strong membership with the Maths CoP, because of his background in Mathematics teaching. Even though he was not teaching Maths because of his administrative position, this membership and belonging was reflected during the interviews, in which he mostly connected himself to the Maths CoP, by providing examples related to Mathematics teaching. He also talked about his involvement in the Mathematics teachers' panel.

As the principal, Kamarul also had strong administrative power and influence in the ICT teachers group that included Zakuan and Rasyidah. Zakuan had a strong administrative relationship with the principal in terms of technology matters, mostly because of his position as an ICT coordinator. He had access to all ICT resources and matters in the school. Other than acting as an ICT coordinator, Zakuan also taught the ICT subject and became the ICT trainer at the school, district and state level. Rasyidah was an ICT teacher and the head of ICT panel, and therefore, she worked closely with Zakuan in ICT related tasks and programs. In many cases related to ICT, Zakuan and Rasyidah were advisors to all teachers in the school. During the interviews, the principal sometimes directed me to refer to Zakuan or Rasyidah if I wanted to know more about the technology facilities available at school, or the ICT activities that the ICT leaders has planned.

Zakuan and Rasyidah also mentioned the principal's involvement and support for the school's ICT programs. For instance, Zakuan noted; "In the ICT team, we have the ICT coordinator, ICT teacher and computer technician. The principal also plays an important role in ensuring the ICT culture is nurtured in this school."

This suggested that Zakuan and Rasyidah were strongly connected to each other as members in an ICT leaders CoP, together with the principal, Kamarul. This membership however, was not only based on a shared practice of the ICT group members who were responsible for ICT related matters, but also influenced by the departmental structure of the school's CoP.

5.4 Conclusion and chapter review

Wenger (1998) theorized that participation in a CoP does not require any formal structure or membership. However, an individual or a group of people demonstrate shared practices in a CoP, which is reflected through their joint enterprise and mutual engagement in the communities (Wenger, 1998). In this study, the most apparent reason that could explain teachers' CoP formation and membership was the shared practices in subjects taught by the teachers. In this case, a teacher who is a member of a school's CoP, also belongs to other CoP, such as the curriculum grouping CoP, student-teachers CoP and ICT leaders CoP.

It has been argued that membership in CoP lack of formalization and not merely based on any organizational structure (Akerson, Cullen, & Hanson, 2009). This is noted by Wenger (1998) that such organizational structures cannot guarantee the organic and shared practices of its members. In this particular school however, the departmental arrangement of teachers and leadership roles contributed to their CoP memberships. This is consistent with previous studies that argued teachers are forming their communities of shared practice through mutual engagement and within specific curriculum groupings (Cobb et al., 2003; Habhab-Rave, 2008; Hodkinson & Hodkinson, 2003; Skerrett, 2010). Hodkinson and Hodkinson (2003) for example identified the Arts departments a smaller teacher CoP, within a wider context of the school's CoP in one secondary school in the United Kingdom. However, it is important to stress that in my study, the CoP emerged not as an organisation, rather by the shared practices of its members, driven by the same interest that they shared as a teacher in a same curriculum department.

Further analysis and discussion of how teachers in this study were more connected in terms of their mutual engagement, joint enterprise and shared repertoire within a localised teacher CoP (i.e., the departmental CoP, subject-focussed CoP, students-teacher CoP and ICT leaders CoP) is in Chapter 7. The next chapter discussed on the findings related to teachers' digital technologies integration practices.

Chapter 6 Teachers' digital technologies integration practices

This chapter provides a discussion of the findings related to teachers' digital technologies integration practices. I first provide an analysis of what digital technologies tools and applications were used by teachers in their teaching practices, also, how teachers use digital technologies in their teaching. The pressures and barriers in integrating digital technologies are then analysed and discussed in relation to teachers' negotiation of their digital technologies integration practices.

This chapter provides the preliminary analysis of teachers' digital technologies integration which provides background information for further analysis of teachers' learning to integrate digital technologies, teachers' identity formation and the role of brokers for integrating digital technologies that is discussed in the next chapters.

6.1 Teachers' digital technologies integration practices in the classroom

From the CoP perspective, participation is an active process that reflects how we interpret and interact with the environment around us to pursue the joint enterprise (Wenger, 1998). In my study, the joint enterprise is related to teachers' accountability to integrate digital technologies in their teaching. Therefore, teachers' digital technologies integration practices have been interpreted as part of teacher's participation and reification in their school's CoP to achieve the joint enterprise. As participation and reification complement each other (Wenger, 1998), in my study, teachers' daily teaching practices using digital technologies is a reflection of their reification, providing abstract and concrete meaning of their engagement to pursue the joint enterprise (Wenger, 1998).

Analysis of the data revealed that teachers used a range of technological tools and applications in their teaching and learning practices. In terms of the technological tools (i.e., hardware), teachers mostly mentioned the use of computers and LCD projectors as their common digital technologies integration practices. This suggests

that teachers are mainly concerned about the availability of basic facilities and hardware to be able to use or integrate digital technologies in their classroom. Teachers also mentioned several applications that they normally used in their teaching and learning. These include Microsoft Power Point, courseware provided by the Ministry, and some application or materials downloaded from the internet. The following Table 6-1 summarises digital technologies tools and applications mainly used by teachers in this study. From the CoP perspective, these technological tools and applications used and mentioned by teachers are some form of reification, a process of providing experience or using tool to perform an action (Wenger, 1998).

Table 6-1

Digital tools and applications used by teachers

	Raihan	**Azlina**	**Iskandar**	**Hanita**	**Liana**	**Farzana**	**Syahril**
Audio	/		/				
Video	/	/	/				
Internet	/	/	/	/	/	/	
MS Power Point	/	/	/	/	/	/	
Courseware			/	/	/	/	
Graphic Calculator							/

It is important to note that my study did not intend to assess the level of teachers' digital technologies integration by categorizing them into several groups as what was described in the Levels of Technology Use Framework (Moersch, 1995) and in the stages and descriptions of levels of use (Straub, 2009) as discussed in the literature review (see section 2.6). However, initial analysis of teachers' digital technologies use is important to showcase their participation and reification in the school's CoP to integrate digital technologies, and to achieve the joint enterprise. Therefore, the following analysis of how teachers' use digital technologies and applications in their teaching and learning approach is presented and discussed based on Inan & Lowther (2010) and Wan Ali et al., (2009) studies.

6.1.1 Using technology for instructional preparation and delivery

The common instructional strategy using digital technologies adopted by teachers was the presentation tool namely Microsoft PowerPoint which they used to assist in their teaching. This was integrated with other media or digital technology resources, for example, Liana, a student-teacher mentioned:

> I mainly use PowerPoint in my teaching. If I use the Internet, it's only to get materials such as video clips, or to get some information to be used with the PowerPoint slides.

Liana indicated that she also used other media such as video clips and other materials downloaded from the Internet and integrated them into Microsoft PowerPoint presentations. Other teachers such as Azlina, Raihan and Farzana also indicated that they mostly used Microsoft PowerPoint in their teaching, and used other media such as audio and video downloaded from the Internet, and integrated it in the Power Point presentations.

Apart from using audio and video with a presentation tool such as Microsoft PowerPoint, some teachers were using audio and video solely as part of their instructional deliveries. This was evident among the English teachers who commented:

> Sometimes I project a movie. Then we will do the critical thinking on the movies. (Azlina)

> When it comes to the listening and speaking part, we have to provide them with stimulus, for example, a song, or show them a video clip, or perhaps show them movies. (Raihan)

In these examples, Azlina and Raihan used audio and video as part of their instructional deliveries and strategies. Azlina used movies to stimulate student's critical thinking about a particular movie by discussing and writing about how the movie should be ended or how they want the movie to be ended. In this instance, she also developed creative thinking process among students with the use of digital

technologies. Similarly, Raihan used song or video clip as a stimulus in his listening and speaking classes.

Similar to the English teachers, the Science and Maths teachers also used presentation tools or other applications to support their instructional delivery. It was mentioned by Hanita that: "I used courseware provided by the Ministry. ... Other than that, I prepare my own slides using Power Point and present it to the students." The Science teachers also had an option to use the courseware provided by the Ministry since the introduction of ETeMs program. The use of courseware was also discussed by all the Science and Maths teachers involved in this study during the interviews, including Iskandar, Liana and Farzana, and supported by the principal and the ICT coordinator.

This finding supported Inan and Lowther's (2010) study that found teachers mainly used digital technologies to facilitate the delivery of information. Also, according to Wan Ali, et al., (2009), these examples of digital technologies used among teachers is categorised as ICT as hands-on experience in which teachers teach with the aid of ICT which includes the use of computer, courseware, software or the Internet.

Teachers in my study also revealed that they used printed materials either prepared by them or materials that were downloaded from the Internet to assist the teaching and learning process. Azlina and Hanita, for example prepared worksheets for students to do exercises. These worksheets were prepared using computer software such as Microsoft Word or Microsoft Power Point. Other than preparing the worksheets themselves, teachers such as Hanita and Syahril downloaded materials from the Internet, made copies and distributed them to students. When accessing materials from the Internet, Hanita preferred to access materials prepared by other teachers (i.e., excellent teachers) from other states, as she recognised their materials as suitable to be used with her students. According to Wan Ali, et al., (2009) this kind of digital technologies usage could be categorised as ICT as printed resources in which teachers distributed printed materials to the students as teaching aids. This is also part of teachers using digital technologies for instructional preparation as suggested by Inan and Lowther (2010).

The findings from my study went beyond what Wan Ali et al.'s, (2009) study among Malaysian Smart School teachers. My study reveals that teachers also integrate ICT during the instructional delivery, which was not found by Wan Ali et al, (2009). The following examples show that teachers integrated DIGITAL TECHNOLOGIES in student learning.

> I also ask them to write an essay. Hmm.... to type an essay using computer. (Azlina, English teacher)

> Sometimes, students do use Power Point for their presentations on drama, on short stories, or poems. (Raihan, English teacher)

> I sometimes asked my students to gather information of certain topics from the Internet, bring it to the class and we discussed about it. (Iskandar, Science teacher)

In these instances, Azlina, Raihan and Iskandar not only used digital technologies in their instructional delivery processes. They also involved students' with the hands-on experience and preparation using digital technologies. Azlina integrated digital technologies in her teaching by asking students to write an essay using computer application such as Microsoft Words. In another instance, Raihan conducted group presentations where students had to prepare and present using computer applications such as Power Point. In these processes, students were involved in collaborative works, so learned from each other and found resources to come up with their best performance or presentation which would be graded by teachers. This suggests that teachers in this study also adopted student-centred approaches in their digital technologies integration practices, so students took active part in the use of digital technologies. This is also consistent with Inan & Lowther (2010) who suggest that students should be involved in the digital technologies integration process.

6.1.2 Digital technologies as learning tool for improving teaching strategies

In my study, some teachers demonstrated their deeper understanding of using digital technologies as learning tool and were able to talk about their pedagogical strategies and beliefs (Ertmer, 2005; Pajares, 1992) in using digital technologies. For

example, it was found that Azlina and Raihan integrated digital technologies in their teaching for stimulating students' critical thinking. Azlina espoused her belief that digital technologies could stimulate student's thinking by reflecting on what she did in her previous school:

> Once we watched Toy Story 3. What I did was, I played the movie until half the way, and then I paused, and I asked them to list down the characters they found until that half of movie. Then I asked them to talk a little bit about the characters that they liked so far, [pause] and then I asked them to predict what is going to happen next in the movie. Then towards the end of the movie, I asked them whether they like or not the ending of the story and if they don't how would they want the story to end. So, that's an example of how I use a movie to stimulate student's thinking. (Azlina, English teacher)

Raihan also used digital technologies for stimulating students' thinking, especially for teaching listening and speaking of English language. He noted:

> When it comes to the listening and speaking part, we have to provide them with stimulus, for example, a song, or show them a video clip, or perhaps show them movies, ... So, most of the time, when I have to do these activities, I would bring them to the viewing room, show the clip, give them the questions, and by reference to the clips, the stimulus, they can answer it.

In these instances, Azlina and Raihan espoused their pedagogical beliefs that the use of digital technologies could stimulate student's critical thinking. This belief was enacted in their practices through the use of multimedia such as audios and videos. These findings suggest that some teachers in this study have a good knowledge and experience about how digital technologies should be integrated into curriculum to facilitate teaching and learning (Ertmer, 2005).

Up to this point, it has been shown that teachers mainly use digital technologies for facilitating information delivery in the classroom, for preparing teaching materials and for improving teaching strategies. Teachers were mainly using basic digital technologies facilities such as computer and LCD projectors in the classroom. The applications used were mainly presentations such as Microsoft Power

Point and the Internet. Only Science teachers used courseware provided by the Ministry to assist their teaching. The use of courseware and presentation tools such as Microsoft PowerPoint found to be used widely for teaching among Malaysian teachers (Keong, Horani, & Daniel, 2005; Lau & Sim, 2008, Majeed & Yusoff, 2015) and yet found to be common in this study. This study also corroborated with Inan and Lowther's (2010) study that found teachers primarily use "technology for instructional preparation, technology for instructional delivery, and technology as a learning tool" (p. 138). In my study, all of these elements of digital technologies used were evidenced in teacher's digital technologies integration practices.

From CoP perspectives, teachers' ways of using digital technologies are part of teachers' participation and reification of their digital technologies integration practices. As noted by Wenger (1998), reification is a "process of giving form to our experience by producing objects that congeal this experience into "thingness" (p. 58). In this regard, teachers in my study used different technological tools and strategies in their teaching and learning practices. Discussion of the use of digital technologies tools such as computers and LCD projectors by teachers reifies the objects and processes (activities) involved in teachers' enterprise of integrating digital technologies. Teachers were mainly concerned about the availability of basic facilities and hardware to be able to integrate digital technologies in their classrooms. Some teachers however were competent in their digital technologies integration practices, as they were able to use digital technologies in more creative and stimulative ways. This provides evidence that teachers were involved in communities of practice that existed in the school

6.2 Teachers' barriers in integrating digital technologies

Although teachers in my study were only using basic digital technologies facilities such as computers and LCD projectors, and some common applications such as Microsoft Power Point and the Internet, they were trying their best to integrate digital technologies in their teaching practices. Teachers however faced many challenges or barriers in their efforts to pursue the joint enterprise of integrating digital technologies. Ertmer (1999) found that teachers were mainly concerned about

the contextual or organizational factors that influenced their digital technologies integration or what is called as "first-order barriers", or "obstacles that are extrinsic to teachers" (p. 50).

Two factors related to first order barriers have been identified in my study; (i) lack of technology facilities and maintenance support for integrating digital technologies, and (ii) lack of time for preparation. In relation to these factors, there was also an issue related to student's readiness to learn in digital technologies integrated lesson as a result of lack of digital technology facilities.

6.2.1 Lack of facilities for integrating digital technologies

Several researchers have found that the success of teacher's technology integration is influenced by the availability of ICT resources and support (Md Yunus, 2007; Mumtaz, 2000; Pelgrum, 2001; Wan Ali et al., 2009). In my study, teachers also highlighted the lack of technology facilities as the main reason why they did not integrate digital technologies, or why they could not easily integrate digital technologies in their teaching and learning. This was evidenced in the following quotes:

> We don't have [data] projector in the classroom. So here I haven't do anything using ICT actually accept for that email thing. (Azlina, English teacher)

> [Technology] facilities in the classroom are very limited. No LCD [projector], so it is difficult to use computer in the classroom. (Hanita, Science and Maths teacher)

> I don't use laptop in the classrooms. The power supply is insufficient and the Internet service is pretty bad. We only have white [projection] screens in some classrooms, and only one or two portable [data] projector that is working properly. (Syahril, Maths teacher)

In these instances, Azlina, Hanita and Syahril stressed that the lack of facilities especially on the availability of data projectors in the classroom makes it difficult for them to integrate digital technologies in their lesson. Although teachers in Perdana Secondary School can bring their own laptop and borrow portable data projectors

from the ICT department, teachers rarely do that. This is because the portable data projectors available were very limited and teachers had to make bookings if they wanted to use it.

Another issue regarding the use of portable data projector was the suitability of the classroom itself. This was noted by Azlina:

> I asked about the [data] projector. But they said it's somewhere with the ICT teacher and I have to do a booking. But the place itself, I don't know where I can use the projector. In class, I don't think I can use the projector clearly because you know it don't have the [projection] screen. Then the class here is quite bright, so it's not suitable to use [data] projector in the class.

In this instance, Azlina not only faced difficulty in getting access to the data projector, but she was also concerned about the suitability of using portable data projectors in the classroom because of the classroom condition itself. The same issue was raised by Hanita, who had been teaching Science in the previous years, and was currently teaching Maths. She mentioned that when she was teaching Science subjects in previous years, she could easily use digital technologies in her Science teaching because all Science labs were equipped with data projectors. But when she started to teach Math, she felt that it was difficult for her to use digital technologies in the classroom because the facilities were not provided.

In another instance, Syahril, a Mathematics teacher who admitted that he minimally used digital technologies his teaching, also perceived that the lack of facilities and resources influenced his digital technologies integration practices. He noted:

> I did my practical training in Penang. That school had lots of good facilities, Internet connection, data projectors, and computers. But this school lacks such things. That's why I don't really integrate ICT in my teaching here.

These findings suggest that teachers were concerned about the importance of having a classroom that was properly equipped with necessary digital technologies facilities.

It also appears that in my study, the lack of digital technology facilities not only affected teachers in their digital technologies integration in the classroom, but also students' willingness to learn in an ICT integrated classroom. Azlina mentioned students' lack of access to the digital technologies as a factor influencing her digital technologies integration practices as follows:

> Not all of the students are willing. Let's say I want them to use Power Point to do a presentation, not all of them will have the access to computer. I don't know, especially for those staying at the hostel, they always give reason like "teacher, we don't have computer, we stay at the hostel". So I guess the students were pretty much influencing the teachers whether to use ICT or not.

Another issue that closely related to the availability of digital technology facilities raised by the teachers was about the maintenance of the facilities itself. Even though there were some facilities such as computers and data projectors available at school, teachers were frustrated that some of the facilities available cannot be used because it was out of date or lack of maintenance. Hanita said:

> Some of the LCD [data projectors] that we have are already broken, the bulbs, or whatever they call it, are very expensive to be replaced. So, I think proper maintenance is important; otherwise it's difficult for us to use the facilities.

Iskandar also discussed the same issue, relating the importance of having well maintained and upgraded facilities with his experience in the industry:

> The main concern here is we have to always update our knowledge about technology to suit with the current scenario. Because what we have learned before, for example, when I was in the industry, normally the one that we learn during our degree is quite obsolete in today's industry. Similarly in this school, the computer we use today, it's almost obsolete tomorrow. Because the maintenance and also the upgrading are very slow, that's why sometimes we being stagnant there.

Iskandar also noted that most of the computers available in the schools were provided during the Smart School projects. Since the project was started a decade ago, in 1998, most of the computers have become outdated; not operating well and some

were just abandoned because no proper maintenance and replacement systems were available.

Interestingly, because the facilities that were available are limited, and maintenance is not always available, there were teachers who did not want to be blamed for any damages and therefore chose not to use the resources available at school. This was noted in Syahril's response:

> I use whatever sources that I have at home, print the materials out and make lots of copies for the students... I'd rather not use the school resources much, because once it broken, my head will be on the chopping board. People talk.

Up to this point, it can be seen from the teachers' responses that issues related to the lacked of digital technology facilities and the lack of maintenance and support had become part of teachers discourse or reification of practice (Wenger, 1998) in the school communities of practice. Teachers in this school community shared a belief that the availability of the digital technologies is important in order for them to use digital technologies in their teaching and learning. Although Perdana Secondary School is a Smart School that is supposed to be well equipped with digital technology facilities for teaching and learning (Abdullah, 2006; Multimedia Development Corporation, 2005), this study revealed that this was not the case. Although the facilities available in the school might have been better compared to other non-Smart Schools, teachers in this study perceived that the availability of digital technology facilities were not good enough to enable them to integrate digital technologies in their teaching and learning. Issues related to lack of digital technology facilities for integrating ICT in teaching and learning was a major finding in previous studies conducted in Malaysian schools (eg: Md Yunus, 2007; Wan Ali et al., 2009) and still evident in my study.

6.2.2 Time constraints for preparation and implementation

Another frequently cited factor or barrier to technology integration among teachers is lack of time (Bauer & Kenton, 2005; Cuban et al., 2001; Cher Lim & Khine, 2006; Vannatta & Fordham, 2004). This includes lack of time for preparation of digital materials and also implementation of lesson using digital technologies. In

my study, factors related to lack of time for integrating digital technologies were also notable. For example, Raihan was concerned about time constraints in preparing the materials. He noted that*:* "One thing you should know about [Perdana Secondary School] is this school is a very, very busy school. So, I think the biggest challenge is time."

Interestingly, Raihan also revealed that the lack of time (first-order barrier) is associated with his pedagogical beliefs (second-order barrier) on what teachers should do when they want to use technology in their teaching. This could be seen in the following extract when he continues to discuss about the needs of time:

> Teachers need some time to go through a few mediums of IT, to go through a lot of materials, to find out the suitable one and then for them to evaluate on the effectiveness of the materials, only then they can consider of using it or integrate it into their classroom teaching and learning process. However, you have to be very, very fast if you want to do that because as you can see teachers are running down and up the stairs, having to be at two or three places at the same time.

Teachers also discussed time constraints for implementing digital technologies based lesson in the classroom. Azlina for example, was frustrated that her plan to do a weblog project with her students was not successful due to access and limited teaching hours to implement the project. According to Azlina, she tried to do blogging once, but it was a failure because most of the students did not have access to the Internet and they have limited time in school to do the project during the English hours. Azlina mentioned that:

> You know what, the most is double period which is only 80 minutes, on normal day, but on assembly day, less than 80 minutes, so to prepare the things, the tools like 5 to10 minutes, and then for the students to come into the room [ICT lab], another 5 to 10 minutes. So, there's no many times left.

Hanita also discovered that the short teaching period constraint her to use ICT in the classroom: She noted:

> If you want to use [computer and data projector] in the classroom then you have to set it up... it already takes your time. Then you have to control the class. The ICT facilities are expensive, so it's difficult to have it. But now it should be no problem because most of the teachers have their own computer [notebook or laptop]. But the data projector is not available in the classroom. That's the problem.

The lack of proper facilities in the classroom had consequently influenced teacher's decision on how to conduct their lesson, and teachers associated the lack of facilities with the constraint of time. This is noted in Syahril's response: "In the classroom, I prefer doing 'chalk and talk'. One period is only about 30 to 40 minutes. Setting up computer and other things are just time consuming".

Issues related to time constraint as discussed by Hanita, Azlina and Syahril were very much related to the digital technology facilities because they mostly discussed the time involved in setting up the digital technologies. In this regard, they suggested that if the digital technology facilities were ready in every classroom, they might have no difficulties in integrating digital technology in their teaching. However, these issues were not always straightforward. For example, although Science teachers have been prepared with teaching materials in the form of courseware provided by the Ministry, issues related to time constraint still occur. This was noted by Iskandar:

> The use of courseware started in 2003, for Physics and Chemistry subjects. ... But, the thing is, sometimes it just a simple topic, but they take so long, consume a lot of time, so I stop using it. So, now I only choose a few topics that suits the time slot and suitable for my students. I am not depending on the courseware all the time.

In this instance, although Iskandar had the advantage of having the courseware or hands-on materials from the Ministry, he still had an issue regarding time for preparation and implementation. Because the courseware has been prepared by non-educational companies, on an ad-hoc basis, issues related to instructional design occurred. In this regard, Iskandar and other teachers using the courseware needed to be selective on the contents or materials they wanted to use, and have to use materials that suited the time allocation for their lesson.

This challenge that teachers face in integrating digital technologies was similar to what was found by Cher Lim and Khine (2006) in Singaporean schools. They found that teachers were having difficulty conducting lessons using ICT within short fixed time periods due to l ICT problems. Although in their study, the digital technology facilities such as computers and LCD projectors were ready to be used by teachers (computer and data projector available in the classroom), teachers still had issues related to time constraints.

Up to this point, my study found that teachers mainly reported two major obstacles or barriers that they have to negotiate in relation to their digital technologies integration practices. These barriers were lack of digital technology facilities and maintenance support of the digital technologies, and time constraints for preparation and implementation of digital technologies integrated lesson. Consequently, these barriers influenced teachers' participation and reification in the school's CoP in terms of their actual technology integration practices. In relation to previous studies, these barriers that teacher's faced are mainly first-order barriers, in which teachers believed that to be able to integrate technology in the teaching and learning, sufficient access to hardware and software is needed (Cuban et al., 2001; Ertmer, 1999). The findings of this study are also consistent with findings from previous studies that reported lack of technology resources and support, and lack of time for preparation and implementation hampered teachers' technology integration practices (Keong et al., 2005; Lau & Sim, 2008; Md Yunus, 2007; Mumtaz, 2000; Pelgrum, 2001; Wan Ali et al., 2009).

From the CoP perspective, these barriers perceived by teachers are part of their participation and reification of their digital technologies integration practices in the school communities of practice. It also part of teacher's negotiated enterprise of integrating digital technologies in this particular school's CoP. In negotiating this enterprise, teachers have to consider all of these factors or barriers to plan and implement their digital technologies integration, to what extent they should integrate digital technologies and why they could or could not integrate digital technologies in their teaching practice. In this regard, the way teachers respond and enact to these barriers is also part of teacher's negotiation of the joint enterprise, mutual engagement

and shared repertoire (Wenger, 1998). This is further analysed and discussed in the next chapter.

6.3 Conclusion and chapter review

In this chapter, it was shown that teachers use several digital technologies in their teaching. It was found that the most common use of digital technologies in teachers' teaching practice were for instructional delivery and preparation. This includes using presentation tools such as Microsoft Power point, combined with other media gathered from the Internet to assist the instructional process. Also, teachers used digital technologies for improving their teaching strategies such as for stimulating students' critical thinking using the audio and visual media.

In their shared practice of integrating digital technologies however, teachers faced several barriers related to lack of digital technology facilities, especially in the classroom. Teachers also reported having time constraint for preparing and implementing digital technologies in their teaching. These findings are consistent with previous studies conducted in Malaysia (Cheok & Wong, 2016; Cheok, et al., 2017; Ghavifekr et al., 2016; Kaur & Hussein, 2015; Lau & Sim, 2008; Md Yunus, 2007; Raman & Yamat, 2014, Wan Ali et al., 2009) and other countries regarding the barriers that teachers face in integrating digital technologies (Bauer & Kenton, 2005; Cuban et al., 2001; Dotong et al., 2016; Ertmer, 1999; Cher Lim & Khine, 2006; Mumtaz, 2000; Pelgrum, 2001; Vannatta & Fordham, 2004). These barriers have influenced teachers' participation and reification in the school's CoP in terms of their actual digital technologies integration practices.

As my study explored teacher's practice and learning to integrate digital technologies from the Situated Learning and Communities of Practice perspective, discussion about what teachers do with digital technologies in their teaching and the associated barriers expressed by teacher were actually part of their reification of practice (Wenger, 1998). Teachers were all aware of their enterprise of integrating digital technologies. However, because membership in CoP is not homogeneous, and there were several social and cultural factors, such as teachers' beliefs and values, institutional needs and pressures, there were variations in their responses and how they reified their actions towards the negotiated enterprise. Further analysis on how

teachers' negotiate their enterprise of integrating digital technologies as part of their learning in the school's CoP is discussed in the following chapter.

Chapter 7 Teachers learning to integrate technology in school's CoP

In Chapter 5, I introduced how within the school's CoP, teachers in Perdana Secondary School became members in multiple CoP based on their departmental, subject focussed and special group membership within the school, called as 'localised CoP' in this thesis. It is important to note that these localised CoP emerged naturally "by the sustained pursuit of a shared enterprise" (Wenger, 1998, p. 45). In addition, membership and relationships in communities of practice are sustained through mutual engagement or "shared ways of engaging in doing things together" (Wenger, 1998, p. 125) and ongoing development of shared repertoire. This chapter further discusses how teachers within their localised CoP learn to integrate digital technologies in the school's CoP from the analytical perspectives of the joint enterprise, mutual engagement and shared repertoire (Wenger, 1998). Throughout the chapter, the findings are discussed in relation to previous literature, as well as framed within the theoretical perspective of Situated Learning and Communities of Practice.

In a school setting, a joint enterprise can be achieved through mutual engagement in which teachers respond to the general norms, such as the standards or the institutional needs (Cobb et al., 2003). In responding to the joint enterprise of integrating digital technologies, teachers mutually engage with each other by doing things together (Wenger, 1998) and through sharing in an activity (MacBeath, 2003). In the process of negotiating meaning of the joint enterprise and through mutual engagement, teachers use and create communal resources and strategies, or a shared repertoire to resolve recurring problems, and also to understand their own routines or ways of doing things in the CoP. These concepts have been discussed in Chapter 3.

Through observation, document archives and interviews it was found that teachers' enterprise of integrating digital technologies was most strongly aligned or shared when considered in their localised CoP (i.e., subject focussed CoP, student-teacher CoP and ICT leader CoP). Consequently, each teacher's localised CoP involved mutual engagements and produced shared repertoires that were unique to their shared practices, values and needs. Therefore, in this chapter, the findings on

teachers' joint enterprise, mutual engagement and shared repertoire are discussed according to the localised teachers' CoP; the English teachers' CoP, Science and Maths teachers' CoP, student-teachers CoP and ICT leader CoP.

7.1 English teachers' CoP

Within the English teachers' CoP, it was found that teachers' negotiation of the joint enterprise of integrating digital technologies was influenced by rival pressures and values such as the needs of integrating digital technologies as highlighted in the Smart School's policy. In addition, teachers valued "time" as important to enable mutual engagement and active participation in the teachers' CoP. Also, it was found that teachers developed repertoire of strategies for integrating technologies. These findings are discussed next.

7.1.1 Enterprise shaped by rival pressures and values

The analysis of the interview data reveals that the English teachers responded positively to the enterprise of integrating digital technologies in the Smart School. When they were asked to express their response towards the national needs of integrating technology, both Raihan and Azlina expressed their positive agreement with the Malaysian Smart School's policy that teachers should integrate ICT in their lessons. It was noted by Raihan, "I totally agree with the government proposal that teachers should integrate ICT in the classroom". While Raihan provided a direct response, the other English teacher, Azlina noted her agreement to the needs of integrating technology based on the everyday needs and availability of ICT, as follows:

> I think the use of ICT will help a lot in our teaching, and the students [learning] as well. Since we are now in the year 2011, and everything out there is basically on ICT so I guess the students should and must know about ICT.

In their responses, Raihan and Azlina also revealed a joint enterprise or a view that ICT is important in facilitating the teaching and learning process, and to make

classroom learning more interactive and enjoyable. This can be seen from the following quotes:

> If you see a picture, it just a picture, you will learn a little bit by looking at a picture. However, if you look at a [video] clip, let say for 30 seconds, you will learn a lot more, and it is more interesting compared by just looking at a picture. It is more colourful and the student should enjoy it. (Raihan)

> We should integrate this ICT thing in our teaching because ICT is fun, if it just the traditional way of teaching, the students will tend to get bored easily, so ICT here and there can bring more colours in teaching. (Azlina)

In this instance, Raihan perceived that the use of different ICT media would facilitate students' learning differently. He was positive about using digital media such as video clips in facilitating students' learning, since students could 'learn a lot more' compared to only using a picture. Similarly, Azlina believed that the use of ICT in the classroom would make the lesson 'fun' if compared to the 'traditional way of teaching'. Both Azlina and Raihan provided an example of why they perceived ICT as important in facilitating teaching and learning, as well as to make lesson more interesting, interactive and enjoyable.

Raihan also perceived that the use of ICT technology would facilitate teachers' role in the classroom, in which teachers could easily manage the lesson or the delivery of information using digital technologies. He further explained that:

> It makes our teaching more interesting, and actually it's a bit helpful if you use ICT in your class, instead of just standing in the class, in front of all the students, and writing at the whiteboard in front of them, and explaining to them using your own voice. You can use IT to be in charge of all those things. Show them something. Just by the click of the mouse you can change the topic, you can change the title, you can change everything, so I think it helps the teacher mostly and also make the lesson fun.

In the above responses, Raihan and Azlina not only expressed their agreement with the policy of integrating digital technologies, as part of the negotiated enterprise (Wenger, 1998) in the school's CoP but they also espoused their pedagogical beliefs

of what ICT can brings into teaching and learning (Ertmer, 2005; Ertmer, Addison, Lane, Ross, & Woods, 1999). In these examples, both Raihan and Azlina also suggested that teachers should move from teacher-centred approaches to more technology-based approach through the use of ICT in the classroom.

The beliefs that ICT would be beneficial in teaching has influenced both Raihan and Azlina's enterprise of integrating digital technologies, and in turn influenced their practice. It was notable from the interviews that they both proposed using ICT to stimulate student's critical thinking in an English lesson, either for teaching writing, listening or speaking. The following provides an example of how Azlina used digital technologies to stimulate student's thinking:

> Once we watched Toy Story 3. What I did was, I played the movie until half the way, and then I paused, and I asked them to list down the characters they found until that half of movie. Then I asked them to talk a little bit about the characters that they like so far, [pause] and then I asked them to predict what is going to happen next in the movie. Then towards the end of the movie, I asked them whether they like or not the ending of the story and if they don't how would they want the story to end. So, that's kind of example of how I use movie to stimulate student's thinking.

This example provided by Azlina however, was based on her previous digital technologies integration practices in the previous school. Azlina further clarified that she would like to integrate this strategy in her teaching practice in the current school, however due to several reasons such as lack of facilities and time constraints (as discussed earlier in section 6.2) she was not able to implement this pedagogical strategy at Perdana Secondary School.

Similar to Azlina, Raihan discussed his teaching practices in using ICT media to stimulate students' thinking for the English lesson;

> When it comes to the listening and speaking part, we have to provide them with stimulus, for example, a song, or show them a video clip, or perhaps show them movies, ... So, most of the time, when I have to do these activities,

> I would bring them to the viewing room, show the clip, gives them the questions, and by reference to the clips, the stimulus, they can answer it.

In these instances, both Azlina and Raihan valued the positive impact of using ICT media such as audio and video recordings to stimulate students' thinking for particular learning areas within the English subject. These quotes also show that even though Azlina and Raihan may use different strategies in using ICT in their teaching, as teachers in the English CoP, they shared a common understanding of how they could make an English lesson more interactive and enjoyable using ICT. This understanding was shaped by a shared practice of English teachers' CoP through the experience and common knowledge of using ICT for teaching English.

To this end, these findings have suggested that, for the English teachers, their enterprise of integrating digital technologies was mediated by several pressures and values. Firstly, the enterprise that ICT is important in facilitating the teaching and learning process was influenced by the needs of integrating digital technologies as highlighted in the Smart School's policy. Secondly, their positive values towards ICT and desire to make lesson more interesting and enjoyable have also influenced their enterprise of integrating digital technologies. Thirdly, the enterprise that digital technologies in the classroom is important to stimulate student's thinking was shaped by their shared understanding and value of what digital technologies could offer to make English lesson more interactive and engaging for their students.

7.1.2 The value of 'time' in teachers mutual engagement

In terms of teacher's mutual engagement in the English teachers' CoP, the data gathered from the interviews with Raihan and Azlina revealed that in spite of the constraints of time for teachers to regularly meet together to collaborate in the planning, designing and integrating of digital technologies, there is evidence that sharing did occur.

When teachers were asked if there were any shared activities among teachers in the same department such as in preparing lesson plans or developing teaching materials for ICT integration, Raihan said "for something related to integrating ICT, I don't think so". Azlina mentioned that a "lesson plan is prepared individually". As

the interviewer, I could see that the teachers had a limited understanding of CoP as a concept, so it was necessary for me to ask further questions about teachers' collaborative works and sharing in activities.

In later responses, it became clear that they were in fact involved in mutual engagement in their localised CoP in a variety of ways. Also, it is important to note that Raihan and Azlina were both newcomers to the school (less than 6 months when the interviews were carried out), therefore their responses about the lack of shared activities for integrating digital technologies among teachers in the English CoP only referred to first term of the schooling session. In the first three months of schooling teachers are involved in lots of planning activities, including departmental meetings and strategies for integrating digital technologies in a Smart school, so these responses and findings from the English teacher participants were unexpected.

Further analysis of the interviews data revealed that teachers in the English CoP valued 'time' as important to be able to do things together and involved in shared activity. As an example, when Raihan was asked about how important he thinks it is for teachers in a same department to work collaboratively or to do things together in their digital technologies integration practices, he noted that:

> Yeah, if you're provided with more time, if you're not too busy doing other stuff, and we only have to concentrate on preparing and delivering the teaching, I think we will have time to do some collaborative works during the school hours. ... I think, rather than using the time for sitting together and discussing on this high tech stuff, I think most of the teachers here choose to be in charge of their own classroom, prepare things on their own, at their suitable time.

In another interview with Azlina, she also stated 'time' as the major reason for the lack of collaborative work among teachers.

> Mostly because of time constraints, today for example, when I am free at this hour, other English teachers will have class, in the evening the other teachers will be having other co-curricular activities, and I'll be having mine. So, it's

> quite impossible for us to sit together. So basically they do their part, I'll do mine, then we exchange, or we combine the work.

In these quotes, it is obvious that teachers perceived 'time' as a major constraint limiting their engagement in the English teachers' CoP. As a consequence, teachers sometimes chose to work individually in completing several tasks towards achieving the enterprise of integrating digital technologies. Although teachers sometime work individually to complete their tasks related to digital technologies integration, they already have an understanding of what they need to do or the enterprise that they dealing with, such as when Azlina said "they do their part, I'll do mine, then we exchange, or we combine the work". In this sense, their individual work is a small part of the shared practices or problems that they are dealing with. From the CoP perspective, the ways that teachers chose to complete their task are also part of teachers' negotiation of the enterprise of integrating digital technologies through the creation and development of shared repertoire (Wenger, 1998) as discussed next.

7.1.3 Developing repertoire of strategies

Even though Raihan and Azlina claimed that teachers in the English CoP did not regularly meet to plan ICT related activities due to time constraints, they revealed that teachers in the English CoP did have a joint understanding of what needed to be done in the CoP and also a repertoire of strategies to achieve the joint enterprise of integrating technology. Raihan said:

> We do have discussions from time to time. We discuss what we want to teach, how we are going to teach, we do share materials, but most of the time we have to be on our own. We are so busy with other stuff so we don't have much time to sit together.

Similarly, Azlina mentioned that:

> We do not sit together to plan activities using ICT but we normally do it individually then we exchange our work with each other. For example, I did a

module for Form 3 students and I shared it with my other friends also teaching Form 3. And so did they. We do it on our own and we exchange it.

There is evidence therefore, that teachers in the English CoP involved in a mutual engagement to achieve the joint enterprise of integrating digital technologies. As noted before, as teachers in my study have a limited understanding of the CoP concept, they valued 'sitting together' as a means of mutually engaging with each other, although it not necessarily important to be at the same space at the same time to be involved in the shared practice of a CoP.

Regardless of the time constraints, Raihan and Azlina pointed out that they planned, discussed, shared materials and exchanged information with each other. In doing so, Raihan and Azlina had negotiated the conflict between the competing values of being together and limited time by developing a shared repertoire of strategies such as coming together to plan for the integration of digital technologies, then preparing the materials individually and finally coming back together to discuss or share the resources. This finding suggests that teachers in the English CoP were involved in mutual engagement and negotiate their enterprise of integrating digital technologies through several strategies. This is what a CoP is. As teachers in the same curriculum grouping, they have their own way of doing things and to work together towards achieving the enterprise of integrating digital technologies which were unique to the English teachers CoP.

7.1.4 Developing and using shared ICT resources

Apart from developing a shared repertoire of strategies for integrating digital technologies, teachers in the English CoP also valued the use of shared ICT resources that were unique to the English teachers CoP. Azlina revealed that the English department had some ICT resources that could be used together by other English teachers such as movies, drama and stage plays which were stored in compact disc format. Azlina believed that the use of ICT resources such as the movies would help teachers' digital technologies integration practices especially for teaching English literature. She said that "teaching literature is not that easy, to ask the student to read the text. So, if there's a... you know... video or clip on that piece, it will help much".

This suggests that Azlina valued the important of having shared repertoire of resources within the English teachers CoP to facilitate the teaching process using digital technologies. Also, it was noted by Raihan that:

> We do share materials, for example, we exchange movies or songs that can be used in the classroom. We share some websites. You know, if I was to surf the web and if I were to stumble upon a good site that can be used to help our teaching, I sometimes promote it to fellow teachers.

This is supported by Azlina, who said that:

> Actually we have CDs for movies dramas, stage plays. ... Our head of department shared with us literature notes, in the CD and distributed to us.

These examples suggest that teachers in the English CoP valued ICT resources and materials as a shared repertoire unique to their localised CoP that could be used together to integrate technology in their teaching practices. From the CoP perspective, the value expressed by Azlina and Raihan on the use of ICT resources, also suggests that teachers in the English CoP shared a mutual understanding of the importance of having and developing a shared repertoire of resources in the form of ICT media and tools that could be used in their technology integration practices.

Teachers' involvement in the development of shared repertoire of strategies and resources suggested that teachers in the English CoP mutually engage with each other, even though they might not have realized the actual process. This is consistent with the CoP perspective that argues members of a community create and use a shared repertoire as a result of mutual engagement and through negotiation of a joint enterprise (Wenger, 1998).

Up to this point, it can be concluded that for the English teachers CoP, there were two major findings in terms of their joint enterprise, mutual engagement and shared repertoire in relation to their technology integration practice and learning to integrate technology in the school's CoP. First, teachers in the English CoP had negotiated a joint enterprise of integrating digital technologies influenced by a rival pressure; the need to respond to government and school priorities in digital technologies integration for facilitating teaching and learning; the teachers' desire to

use digital technologies for making lesson more interactive and enjoyable, and the pedagogical beliefs for stimulating student thinking.

Second, teachers in the English CoP had come up with a mutual understanding of what need to be done within their own CoP in order to integrate digital technologies in their teaching. Even though teachers perceived that they might lacked of mutual engagement among teachers in the English CoP due to time constraint, teachers have developed a shared repertoire of strategies such as coming together to plan for the integration of digital technologies, then preparing the materials individually and finally coming back together to discuss or share the resources. Teachers in the English CoP also valued the use of shared ICT media and resources such as movies and video clips in improving their digital technologies integration practices.

This finding from the English teachers' CoP is consistent with Wenger's (1998) theorization that a joint enterprise "is not just a stated goal, but creates among participants relations of mutual accountability that become an integral part of the practice" (p. 78).

7.2 Science and Maths teachers' CoP

Within the Science and Maths teachers' CoP, it was obvious that their enterprises for integrating digital technologies were shaped through involvement in the Smart School and EtEMS project. Teachers within the Science and Maths CoP also valued the courseware provided by the ministry as a medium of shared repertoire. These findings are discussed next.

7.2.1 Enterprise shaped through involvement in Smart School and EtEMS project

Similar to the English teachers' CoP, the Science and Mathematics teachers' joint enterprise also revealed that they valued the importance of ICT in facilitating teaching and learning. For instance, Hanita, who taught both Science and Maths subjects stated:

> We need ICT to prepare our lessons. In terms of teaching, in Science, I think we need to use ICT, especially to help in explaining some difficult concepts in Science. In Maths, because it involves lots of calculation and explanation, so mostly we need to teach manually [using whiteboard]. There is a balance. I'm not saying that we must use ICT, but we need to balance them.

In this instance, Hanita not only valued the importance of ICT in facilitating the teaching and learning process, but she also believes that teachers need to use ICT accordingly, depending on the suitability of the lesson.

For the Science and Mathematics teachers, their joint enterprise was shaped through not only involvement in Smart School programs but also through participation in the English for Teaching Mathematics and Science (EtEMS) program started in 2003. With the implementation of EtEMS program, all Science laboratories were equipped with a data projector and computer, and most teachers in Science and Mathematics panel were provided with a laptop and courseware.

It was mentioned by the Science and Maths teachers that they received special training compared to teachers from other departments in terms of ICT since the implementation of the EtEMS program. As the Ministry of Education provided more courseware to support teachers teaching of Maths and Science in English, teachers were provided with training program in two major areas; first, in improving their English for teaching Science and Maths, and second, in using ICT media, including courseware to facilitate their teaching. In this regard, the knowledge gain from the training has also shaped their use of ICT in the classroom. According to the principal and the ICT coordinator, the Science and Maths teachers were among the higher users of ICT in the school communities. For instance, it was noted by the principal:

> In this school, because we have the EtEMS program, the Science and Maths panel are leading in terms of the ICT use... Since the implementation of the EtEMS program, we got LCD [data projector] and lots of software [courseware] to be used by Science and Maths teachers. So, the Science and Maths teachers should have no problem in using ICT during their lesson.

This suggests that the special training program designed for Science and Maths teachers (i.e., the EtEMS program) impacted on their digital technologies integration practices, together with the provision of ICT facilities, science labs equipped with data projectors, teachers provided with laptop and courseware. In this regard, using courseware provided by the Ministry of Education for facilitating the instructional delivery was one of the teaching strategies adopted by Science and Mathematics teachers in their digital technologies integration practices.

However, in adopting the strategy of using ICT, teachers of Science and Mathematics needed to negotiate certain issues such as suitability of the materials and the digital technologies that consequently shaped their enterprise joint. It was noted by Hanita that:

> I only choose a few topics that suit my lesson plan. I'm not using the courseware all the time. Some of the topics are too long, and our lesson is only 40 minutes, so we have no time to use all materials from the courseware.

Similarly, Iskandar noted:

> Sometimes, I used the CD or software given by the ministry. I integrated a bit of audio, video, and sometimes I used past years programs or modules. But I'm not depending solely on the ICT media. Normally, even though I use ICT, I still use the whiteboard. Because for Chemistry especially for the form 6, it's not only about the knowledge… the content knowledge, it's involving lots of calculation, so I have to integrate the use of ICT with the whiteboard.

In these excerpts, Hanita and Iskandar's decision to use courseware or other tools provide examples of how they involved in a joint enterprise or "a socially negotiated understanding of what is important, what needs to be done and what is good enough" (Henderson 2007, p. 51) about using the courseware. Although teachers were provided with ICT resources and tools that could facilitate their teaching, they had to set up a proper plan and strategies that suited their teaching objectives. As a consequence, for the Science and Mathematics teachers, this provision of technology and special training from the EtEMS program shifted their enterprise from 'integrating ICT' to 'integrating ICT in appropriate ways', that is, making choices

about the most appropriate technology for the lesson, whether to use ICT or something else.

7.2.2 Courseware as a medium of shared repertoire

The use of courseware among the Science and Maths teachers not only shifted their enterprise of integrating digital technologies, but it also became one of the important shared repertoires for the Science and Maths teachers CoP. Because only the Science and Maths teachers were provided with the courseware to assist in their teaching, this courseware became shared repertoire unique to their CoP. This theme emerged from the interview data when the term 'courseware' was frequently mentioned by all Science and Maths teachers involved in this study. Also, as previously discussed in section 6.1 and outlined in Table 6-1, all Science and Maths teachers, including the student teachers involved in this study (except Syahril) used courseware in their teaching practice.

Importantly, for the Science and Maths teachers, the courseware acted as an object or medium of shared repertoire that mediated their learning process within the CoP, in which teachers learned with each other how to integrate digital technologies through interaction and discussion that surround the courseware. Hanita said:

> For the Science subject, many of us used courseware in our teaching. Our Science labs are all equipped with the LCD [data projector], so we can use ICT, and the courseware in the lab. So, sometimes we talk to each other about what topics in the courseware to use, and we also share other materials.

The Science student teachers also learned about integrating courseware through interaction and discussion with other Science teachers. It was noted by Liana and Farzana:

> We are encouraged to use courseware in our teaching. I've tried a few times but you know, it's something new for me, many things that I need to explore first before using the courseware. So, I sometimes discuss with other student teachers about using the courseware or just ask my teacher advisor. (Liana)

> I normally use Power Point in my teaching, because that's what I learned during my course. Here, my teacher advisor told me to use courseware in my teaching. But, I never used courseware before. So, if I have problem I'll get his advice, or I ask other teachers that are good in using courseware. (Farzana)

These quotes suggest that for the student-teachers in Science, even though their participation was peripheral, they took the opportunity to seek advice from other community members regarding the use of ICT in their teaching, especially on the use of courseware, one of the mediums of shared repertoire in the Science and Maths CoP.

It was also evident in this study that through the analysis of teacher's documents (i.e., lesson plans and teaching materials), the courseware or the educational materials provided by the Ministry of Education are important ICT resources in the Science and Maths teachers CoP. For example, when teachers were asked to provide examples of teaching materials that included ICT pedagogies or tools, most of the Science and Maths teachers provided me with either a copy of the courseware or some snapshots of the materials taken from the courseware, integrated in a Power Point presentation or outlined in their lesson plans. This suggested that the courseware has become an important ICT tool and pedagogical strategies of integrating ICT in their teaching, or a medium of shared repertoire that engage teachers in a shared practice and learning to use ICT within their CoP.

For the Science teachers CoP, their enterprise of integrating digital technologies was mainly shaped by their involvement not only in the Smart School program but also in the more unique program that caters the needs of Science and Maths teachers in teaching these subjects in English medium facilitated with ICT media, i.e. the EtEMS program. The provision of digital technology facilities and special training program unique to the Science and Maths teachers has shaped their enterprise from not only 'integrating digital technologies', but 'integrating digital technologies in a proper way' as a result of negotiation, interaction and engagement. In this process, the special educational materials or courseware available within the CoP has become an important medium of shared repertoire enabling teachers' digital technologies integration practice and learning in their CoP.

7.3 Student teachers' CoP

Within the student teachers' CoP, it was evident that their enterprises for integrating digital technologies were shaped through their participation and engagement in the localised CoP within the school as well as in the global CoP outside the school setting. Also, their engagement in integrating digital technologies was mediated by the use of new media technology such as Web 2.0 technologies. These findings are discussed next.

7.3.1 Participation within and outside the school's CoP

The student teachers in Science and Living Skills, Liana and Farzana were engaged in a joint enterprise of integrating technology and believe that ICT is important in facilitating their teaching and learning. The enterprise was shaped through their participation and engagement in the localised student-teacher's CoP and Science teachers CoP within the school's CoP, and the globalised student- teacher CoP outside the school setting such as their university or training college group.

The following section provides some examples of how Liana and Farzana participated in the localised CoP. They were involved in discussion with other student teachers and learned from other in-service teachers on how to perform in their teaching practice. Liana said: "If we have problems or anything, we will discuss together. We also ask other teachers, especially our teacher advisors". Similarly, Farzana noted: "Normally, if I have problems related to teaching I will ask other student teachers first. Or, I will get advice from my teacher advisor".

Liana and Farzana also took the opportunity to seek advice from other Science CoP members regarding the use of ICT in their teaching. Liana said: "Sometimes, we meet with other Chemistry and Biology teachers; they suggested us to use courseware for student's exercises". As newcomers, they valued the roles of the old-timers; in this case their teacher advisors, or other senior teachers in the same departments. They together have built mutual relations of engagement (Wenger, 1998), through discussion and interaction with other community members within the student-teachers CoP and the Science CoP, situated within the localised school setting.

Interestingly, Liana and Farzana also revealed that their enterprise of integrating digital technology was also shaped through interaction and discussion with other student-teachers beyond the school's CoP. Liana said:

> I stay at a teachers college hostel, together with Farzana and other student teachers. So, every day we talk to each other about our practical training. Mainly we talk about experiences and problems at school. We discuss [data projector] facilities because everybody wants to use Power Point. We are encouraged to use Power Point by our lecturers and the school. So, problems related to [data projector] and teaching and learning were things that we always discuss. In this school, the [data projector] facilities are good, but some other schools have very limited facilities.

Although they were teaching at different schools, they had a joint understanding of what they should and could do (Wenger, 1998) using digital technologies in their teaching. The use of data projectors and Power Point for example had become shared repertoires of practice that connected them together in their negotiation of the enterprise of integrating digital technologies. Also, together with other student teachers, outside the school's CoP, Liana developed a shared repertoire of practice through discussion and conversation of their experiences and problems (Wenger, 1998) within and outside her school's CoP. The 'Power Point' and 'data projector' have become the tools, and also part of their discourse when it came to negotiating the enterprise of integrating digital technologies. Consequently, this participation and involvement in shared practices had contributed to their learning on how they could use digital technologies in their teaching.

The existence of multiple student teachers' CoP within the school's CoP and outside the school's CoP, including the online CoP were stressed by Liana when she mentioned:

> We discussed many things, including ICT. We asked on how to do this and that? Those who know will give their answer or advice. So, there are communities, not only the community in this school, but also online community. There are friends from the schooling age, also my current [student teachers] friends in these communities.

This finding suggests that for the student teachers, their participation and engagement in the CoP were not limited within the school community itself. They also participated in an external student teachers CoP beyond the school setting. The implication of this finding suggests that membership in a shared practice beyond the school environment is important in shaping their digital technologies integration practices. This is consistent with Wenger's (1998) theorization that membership and participation in the CoP could be within the local or the global perspective.

7.3.2 Social media as a medium of engagement

As Liana and Farzana were connected in both localised and wider CoP of student teachers, it was interesting to know how they connected or mutually engaged with other members. As the use of Web 2.0 technology and the online social media such as Facebook and Yahoo Group has become popular in Malaysian society, Liana and Farzana took advantage of this technology and integrate it in their learning, by get connected with student teachers' communities outside the school's CoP. Liana said:

> We share information and materials with other friends who are currently doing practical training. We meet and discuss 'face to face'. But in the evening, I mostly used online medium to communicate with them. I use Facebook or Yahoo group.

Similarly, Farzana also used online medium to interact and engage in any discussion related to her practical training with other student teachers outside the school:

> At school or the teachers college, we learn from each other through daily conversation and discussion. We also use Facebook and email for communicating and exchanging materials, especially with friends that are doing practical training in other schools or states.

The student teachers chose to use social media such as Facebook and Yahoo Group to connect with each other, especially when they want to communicate with members from the global communities. The use of Web 2.0 technology and social media has opened up a connection between multiple communities of practice, acted as

a boundary object or a form of reification that provides connections between members (Wenger, 1998). This finding also corroborated with emerging research on virtual or online communities of practice for teachers' professional learning development (Henderson & Bradey, 2008b; Looi et al., 2008; Thang et al., 2011).

7.4 ICT leaders' CoP

Within the Perdana Secondary School's CoP, it was obvious that their enterprises for integrating digital technologies were shaped and influenced by the policies and administrative imperatives mandated by the ICT leaders. This is discussed next.

7.4.1 Policies and administrative imperative

The three participants in the school ICT leadership CoP, Kamarul, Zakuan and Rasyidah, like teachers in other CoP involved in this study, felt that digital technologies should be integrated into the processes of teaching and learning. However, the ICT leader participants also revealed that the CoP had a number of joint enterprises. For example, the ICT leaders felt that digital technologies (commonly referred as ICT by the teacher participants) should be used by teachers and other staff for administrative tasks. The principal (Kamarul) noted:

> The use of ICT should holistically involve teachers, students and administrators, and not only for teaching and learning. In administration aspects, we also emphasize on the use of ICT, including for mailing purposes, collecting data, prepare examination records and reports, and also for disseminating information to parents.

The use of digital technologies in the daily tasks of teachers at Perdana Secondary School was also discussed by an ICT teacher (Rasyidah) as follows:

> Other than using ICT for the teaching and learning in the classroom, teachers in this school also use ICT for the classroom management. For example, teachers use Microsoft Excel to record their student's marks.

The ICT coordinator (Zakuan) also shared the same understanding. He noted:

> In this school, we use ICT in all aspects of the school's activities. Teachers are encouraged to integrate ICT in their teaching and learning. The school's clerks also use ICT in the daily tasks.

These examples from the ICT leaders suggest that, while the belief that digital technologies should be used for teaching and learning as well as for administrative functions was a direct response to the Smart School's policy, this joint enterprise was in response to their need to account for teachers' work, combined with a shared understanding that digital technologies is needed to facilitate teachers and other staffs easily complete their administrative tasks. In this case, the ICT leadership group adopted the Smart School policy and combined it with its own administrative needs.

7.4.2 The value of localised teachers' CoP for the ICT leaders

The value of localised teachers' CoP within the school also influenced the ICT leaders' joint enterprise. This can be seen in the following quote in which the principal describes a meeting of core and peripheral members of the ICT leadership group:

> Just before you came, I had a meeting with the ICT coordinator and head of panels (departments) discussing computer rooms. We planned to fully equip the rooms with necessary technologies so that our teachers can use the rooms to access materials. We also proposed that each panel come up with their own website so that we could upload teaching materials to the website. For example, there was a school that came up with Mathematics materials for weak students, to help them, so that they can at least pass the subject. We can use those materials, and we can come up with our own materials and put it on the websites where teachers from other schools could access it. We want to do this through the panels. (Kamarul)

In this example, the principal indicates that the leadership group valued digital technologies to 'access materials' and that it was desirable for teachers to create, upload and share their own materials. Although the focus on materials reveals a

blinkered understanding of the role of digital technologies in teaching and learning, importantly, the ICT leaders CoP valued the existence of teachers CoP (i.e. departmental or subject focussed CoP) in the implementation of digital technologies integration activities.

The potential value of teachers' CoP in supporting activities that contributed to teachers learning to integrate digital technologies was also put forward by the ICT coordinator. He noted:

> We give the opportunity to each panel (department) to plan ICT activities according to their needs. For example, each panel can plan for internal ICT courses. If we plan the ICT courses for them, it might be not suitable with their needs. So, we give them the opportunity to come up with their own plans. (Zakuan)

The above quotes from the ICT leaders suggest that they valued the existence of the smaller or cohesive teachers CoP (i.e. subject focussed CoP) in the implementation of digital technologies integration within the school. The ICT leaders also believed that each teacher's CoP has their own unique needs when it comes to learning about digital technologies integration. This finding from the ICT leaders CoP also corroborated the previous analysis of teachers' CoP (i.e., English teachers' CoP, Science teachers' CoP and student teachers' CoP) that suggest each localised teachers CoP negotiated different enterprises of integrating digital technologies based on their own unique values and needs.

The ICT leaders also see that teachers work collaboratively within their localised CoP and therefore, learning to integrate digital technologies should also start within their own CoP through regular meeting and planning. Zakuan stressed:

> The administrators or the principal himself always encourages teachers to work collaboratively in their departments. It means, during the panel meeting, they should plan their own ICT capacities and needs. They have to plan how to include ICT in their curriculum. They should come up with one or two activities related to ICT, such as conducting a course for teachers in the department or developing teaching and learning materials. So, every

> department is asked to come up with their own activities. If they have problems, they solved together, or they will refer to me.

This evidence corroborated with the findings discussed in the previous sections, in which each teacher's CoP plans their own ways to mutually engaged with each other in negotiating the enterprise of integrating digital technologies. Also, teachers within their localised CoP have developed and used a repertoire of strategies that were unique to their needs. This was supported by the ICT leaders, when they also agreed that it is important for teachers to work collaboratively within their own departments to plan and prepare teaching activities using digital technologies.

To this point, it can be concluded that the ICT leaders' joint enterprise of integrating digital technologies was influenced by the Smart School policies and also their own needs and functions as the ICT leaders, to ensure that the school community implemented digital technologies integration successfully through localised teachers CoP. An obvious finding from this study is that the implementation of digital technologies policy within the school is mediated by the varied and unique needs of the school community of practice.

7.5 Conclusion and chapter review

In this chapter, it has been shown that teachers enterprise of integrating technology was most strongly aligned or shared when considered in their localised CoP (i.e., subject focussed CoP, student-teacher CoP and ICT leader CoP). Within the localised CoP, teachers involved in mutual engagement and produced shared repertoires that were unique to their shared practices, values and needs. The findings on teachers' participation and learning to integrate digital technologies in school's CoP are summarised in the following figure that illustrates the relationship between joint enterprise, mutual engagement and shared repertoire with teachers' learning from the analytical perspective of Communities of Practice (see Figure 7.1).

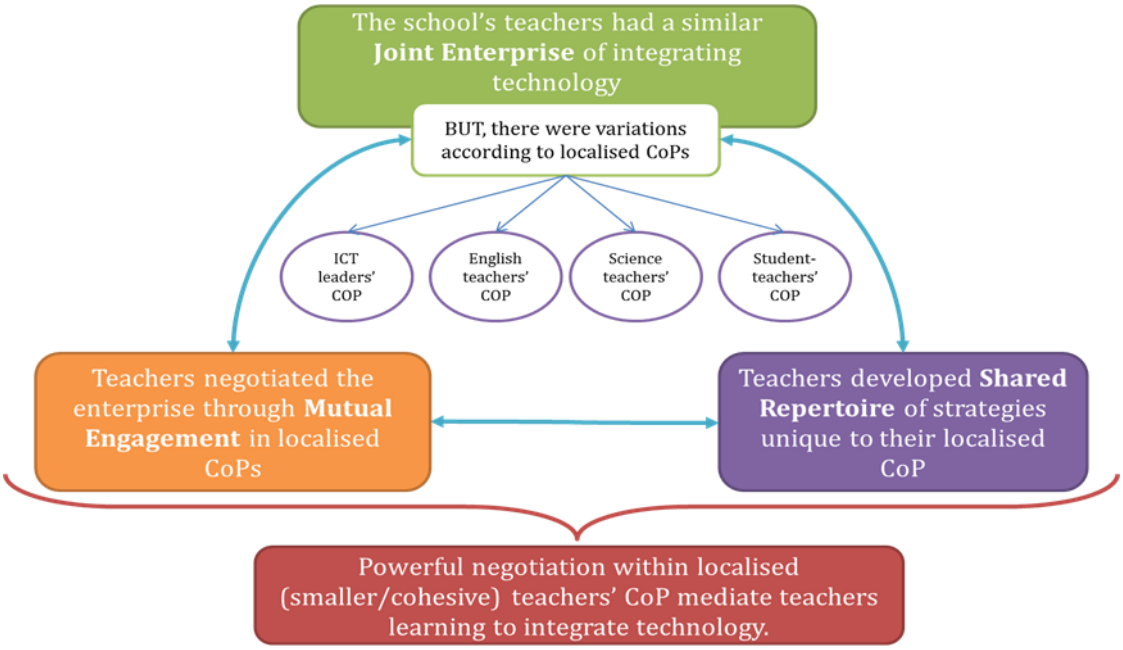

Figure 7-1: Relationship between Joint Enterprise, Mutual Engagement and Shared Repertoire with teachers' learning in localised teachers' CoP

As illustrated in Figure 7.1, the findings of my study suggest that although teachers at the school had a similar joint enterprise of integrating digital technologies, there were variations in their enterprise which teachers negotiated through mutual engagement in their localised CoP (i.e. departmental, subject focussed and special group CoP. Through the mutual engagement and negotiation of the joint enterprise, teachers used and developed shared repertoire of strategies that unique to their localised CoP. In other words, as a group, teachers are connected with each other based on their shared practice in the localised CoP. However, within the similarity that they shared, they have variations in the joint enterprise, the way they mutually engaged with other and the repertoire of strategies that they shared. The finding suggest that the powerful negotiation that happened within localised or more cohesive teachers' CoP mediates teachers' learning to integrate digital technologies. The implication of this finding is that teachers' professional learning to integrate digital technologies should consider the various values, pressures and unique needs of each teacher CoP.

Chapter 8 Teacher's identity formation in school's CoP

This chapter discusses the findings related to teachers' identity formation in the school's CoP. In this chapter, I first provide a brief discussion of how 'identity' is defined and theorised in Wenger's Communities of Practise. Second, I provide an analysis of two teachers' identity formation, Raihan and Iskandar. While I found that there was a collective sense of identity and understanding among teachers in the CoP on the need for a new learning approach to using digital technologies, I have chosen to provide a detailed analysis of these two teachers since they developed the sense of identity expected of a Smart School teacher who is enthusiastic and committed in their digital technologies integration practice.

The analysis and discussion in this chapter answers the following research question; "What is the role of identity formation and its relationship to teacher's digital technologies integration?"

8.1 Identity as a learning trajectory and negotiated experience: Cases of two teachers' identity

Wenger (1998) stressed that "issues of identity are an integral aspect of a social theory of learning and are thus inseparable from issues of practice, community and meaning" (p.145). Wenger (1998) also argues that a focus on identity "narrows the focus onto the person, but from the social perspective" (p. 145).

As discussed earlier in Chapter 3, trajectories of learning refers to the histories of one learning experienced that incorporate the past and the future (Wenger, 1998). Trajectories of learning provide a concrete formation of how identities are negotiated through engagement in the communities of practice. The trajectories of learning may shape one's identity by the knowledge and skills we acquire and shapes the knowledge and skills we seek to develop (Battey & Franke, 2008). This suggests that our identities are influenced by where we come from and where we believe we are going.

According to Wenger (1998) negotiated experience is when "we define who we are by the ways we experience ourselves through participation as well as by the ways we and others reify ourselves" (p. 151). It is important to note that identity formation is shaped through participation in the CoP and involvement in the negotiation of joint enterprise, mutual engagement and shared repertoire. Therefore, these three elements, and other related CoP components such as participation and reification, which have been analysed and discussed in Chapter 6, are also discussed in this chapter where necessary.

In relation to Wenger's (1998) theorization of identity, the following sections provide an analysis of two teachers who have shown that their digital technologies integration practices were influenced by their learning trajectories and their negotiated experience.

8.1.1 Raihan: Identity as negotiated experience

Throughout Raihan's data, it was evident that he integrates digital technologies in his teaching practice in several ways. Raihan and other teachers in my study use digital technologies for instructional preparation and delivery, as well as a learning tool for improving teaching strategies.

It was also obvious during the interviews that among other teachers, Raihan was very excited to discuss his digital technologies integration practices. Raihan was confident with his capacity to integrate digital technologies and therefore he repeatedly mentioned his passion for using digital technologies; that he has tried to integrate digital technologies and will continue to integrate digital technologies in his teaching practice. In his interviews he commented that:

> … It's crucial for me to find ways to integrate ICT as much as possible.
>
> I personally voluntarily use ICT or technology in my teaching and learning…
>
> I believe that I could successfully integrate ICT in my future teaching…
>
> … I am motivated to use technology in my teaching and learning…

Raihan was also viewed as effective and capable of integrating digital technologies by other teachers, and the principal. For example, another English teacher who participated in this study, Azlina, mentioned that Raihan was the most outstanding teacher in terms of the digital technologies used in the classroom among the English teachers. Although he was only a newcomer, he already had recognition from the principal for his digital technologies integration practices. Kamarul said:

> We have an Islamic Education teacher [name mentioned was deleted] who is creative in using ICT. She used mind mapping approaches and developed a module using ICT. We also have some junior teachers that are very keen to integrate technology. Raihan, for example is quite excellent among the English teachers. He used materials from the Internet, video clips and Facebook in his teaching.

In this sense, Raihan's engagement and participation in the school's CoP has given him "experience of participation" (Wenger, 1998, p. 150), and importantly, the recognition that he received from the community members was a reification or evidence of his participation in the school's CoP.

Within Raihan's data, there are some themes that emerge to describe his identity formation towards integrating digital technologies which are part of his negotiated experience in the school's CoP. These include his attitudes towards digital technologies, motivation to integrate digital technologies and the conflict and tension that he faced to integrate digital technologies. These are discussed next.

Positive attitude towards digital technologies

As discussed earlier in Chapter 7 (see section 7.1.1), the Smart School policy influenced teachers' joint enterprise in integrating digital technologies in the school's CoP. For Raihan, besides responding to the Smart School policy, he voluntarily used ICT in his teaching and learning. He claimed that:

> I would say that I personally voluntarily use ICT or technology in my teaching and learning whether it's stated in the curriculum or not. It gives so much help

> and it will make the lesson more meaningful. I think we can achieve more by using ICT in the class instead of relying on pen and books.

This quote suggests that Raihan's perception of the usefulness of digital technologies and his positive attitude towards digital technologies has influenced his integration practices. This finding is in line with the Technology Acceptance Model (TAM I and TAM II) (Davis, 1989; Davis et al., 1989; Venkatesh & Davis, 2000; Venkatesh et al., 2003) that suggested teacher's perceived usefulness of a technology influence their attitude towards technology, and in turn influence teacher's intention to integrate digital technologies in their practice. Importantly, from the CoP perspective (Wenger, 1998), Raihan's positive attitude towards technology is a sense of identification in the CoP, in which he is able to negotiate the joint enterprise of integrating technology with other teachers in the school's CoP. As discussed earlier in Chapter 7 (see section 7.1), within the English teachers CoP, Raihan shared an understanding that technology is important in teaching and learning to make classroom learning more interactive and enjoyable.

The analysis of the interview data also revealed that Raihan's positive attitude was influenced by his own learning experience when he was a school student. He noted:

> When I was a student about 10-15 years ago, it was quite boring. Honestly, it was quite boring because when you go to school, it is just the teacher and you. However that changes when it comes to English, because sometimes the teachers will bring us to the viewing room to listen to a few things like songs or conversation, things like that. It's help. It's help to brighten up the situations, however for most of the time it was still boring. ... Because I've gone through that boring period for 11 years, I think when it comes to the students nowadays, we have to spark their interest, they have a lot of fun being at home, in front of television, when they come to school, if they find that schooling time is boring they might not want to come to school. So, I think it's crucial for me to find ways to integrate ICT as much as possible.

The learning approaches that Raihan had experienced in the past influenced his attitude and thinking, and consequently shaped his identity in integrating technology. Raihan said:

> Students nowadays, you need to be friends with them, instead of the way we were taught during our school period. Previously the teachers are teachers, not your friends. The scenario has changed, where now we have to be their friend, to be able to teach them. You have to know what their interests are, and you know when you get them their interest, it's like you already get a fish on your hook. ... Students would like to have ICT in the class. Yeah, it's fun. Nobody can say that ICT is boring. Even if you show the kids a cartoon [movie], they will appreciate it, they will love it, and hence making your teaching and learning process better.

In this example, Raihan expressed his pedagogical belief that teachers should be more creative and innovative to attract students' attention, by knowing their interests. In this regard, Raihan believed that students would appreciate teachers using digital technologies in their teaching approach or as pedagogical tools. He said:

> I know that I have to learn a lot more, but I believe that I could successfully integrate ICT in my future teaching and learning so that my students will enjoy more, and they will perform better, and they will, you know have much more information compared to the traditional way of teaching.

Although Raihan admitted that he still needs to learn more about digital technologies, he firmly trusted his ability to integrate technology successfully in his future practice, for the benefit of his students. Importantly, Raihan is keen to continue his technology integration practices. In this regard, Raihan shaped and reshaped his identity and positive views about integrating technology through negotiation of meaning along his trajectories of learning (Wenger, 1998).

Motivation to integrate digital technologies

Motivation is one of the important factors that influence teacher's digital technologies integration. Many have proposed that for teachers to integrate digital technologies they need some kind of motivation, either intrinsic or extrinsic motivation. Intrinsic motivation is related to teachers' attitude and beliefs towards digital technologies. This motivation can be developed through teachers "curiosity and a desire to find new ways to teach and excite students" (Schrum, Shelley, & Miller, 2008, p. 7). Meanwhile, extrinsic motivation could be developed through providing rewards and equipping technology facilities to teachers.

Interestingly, in this study, Raihan's motivation to integrate digital technologies was attributed to his beliefs that digital technologies are beneficial to student's learning and achievement. Raihan also reported that by using digital technologies in the classroom, students will be more engaged and creative in their learning process, such as being able to use different media during their classroom presentation. Raihan claimed:

> My motivation is the smile and the laughter of the kids, whenever I show something and the students said, "Oh Sir, this is good, we love this one." That make me feel good and I am motivated to use technology in my teaching and learning.

Within Raihan's data, it was also evident that he has built a positive attitude towards the importance of using digital technologies, which has motivated him to integrate technology. Raihan noted:

> I like to plan further ahead. If I think the best way to conduct the class is by using ICT I will very much go for it. Unless if there is hindrance or something happen that will not allow me to use ICT at the particular time, well, that's another story.

Importantly, the positive attitude and motivation that he holds for integrating digital technologies has driven Raihan's interest in improving his digital technologies integration skills and knowledge:

> I was thinking about taking a course during the school break to gain more knowledge on how to build a webpage. Because I feel like by using a webpage, in this school where I would say 99% of the students are IT literate, …I can help them with their studies, their homework probably they can have discussions there, and I can post to them their homework, give them notes on the web so it's accessible to the students 24/7, instead of just, you know, having interactions during the class period.

Raihan had an understanding of what he could do with the website, however because he had little knowledge of the technical aspects of building the website, Raihan was willing to learn by attending a course at his own expense.

An important finding from this case is that a teacher's positive attitude and motivation is important in the development of teachers learning to integrate digital technologies and consequently in building their identity. This finding on Raihan's motivation to integrate digital technologies is also consistent with previous studies (e.g. Hadley & Sheingold, 1993; Schrum et al., 2008), that found teachers' attitude and belief in the benefits that digital technologies could bring to the students' learning motivated them to use digital technologies regularly and to acquire new knowledge and skills for integrating digital technologies into their teaching practice, even though they have to use their own resources and money.

Conflict and tension for integrating digital technologies in the CoP

Although Raihan considered the benefits that students will gain and students' satisfaction as the key motivation in his digital technologies integration practices, he also revealed that there were some tensions ingrained in the school's CoP that could de-motivate him and other teachers. He commented:

> It's better to have the equipment ready for us to use it whenever we want rather than we have to shout for it. ... If we have all this equipment ready in the classroom then we can easily use ICT along the way. Knowing that "this room is not free", "you can use it next week", then the following week, "the room is also not free", is very frustrating. At the end, teachers just give the students handouts.

In this quote, Raihan considered the lack of school infrastructure support, in terms of technology facilities as a motivating factor in teacher's digital technologies integration practices. These tensions were considered as barriers to integrate digital technologies by most teachers in this study as discussed earlier in Chapter 6 (see section 6.2). Raihan further noted that:

> I would like to see every class in this school having a [data] projector so that we don't have to fight over who is going to occupy the computer room or viewing room to use ICT. So that every student can have fair and equal chances of enjoying their lesson.

These examples have revealed that there was a tension in Raihan's effort to integrate digital technologies due to the limited infrastructure and facilities. There was also a conflict between the resources needed by the individual in the CoP, with the institutional or policy demands for integrating digital technologies. From Raihan's perspective, these tensions have de-motivated teachers in their digital technologies integration practices. However, from the CoP perspective, these kinds of tensions and conflicts are part of the CoP shared practices, and can contribute to the individual and social development enhancement (Wenger, 1998).

When there were tensions and conflict in the school's CoP, teachers were actually negotiating these problems through mutual engagement, to improve the school environment and teachers' practice. This could be seen from the following quotes in which Raihan realised the teacher's role and potential to tackle the tension and conflict, by reifying what they should contribute to the CoP.

> It is our role as a teacher. We have to start the ball rolling. And I think it's time to try to influence other people around us to also use ICT in their teaching. Because I think if all teachers are keen to use ICT in teaching and learning, we will have more power to push the school's administrator to provide us with the necessary equipment and facilities.

Raihan developed his capacity to also influence other teacher's digital technologies integration, because he believed that teachers should work together to solve the problems related to facilities. The implication of this finding is that

individual teacher's identity formation could influence identity of their communities. As identity is an important aspect of learning, these processes of identity formation will be an important factor to mediate teachers learning to integrate digital technologies in the school's CoP.

As a conclusion, Raihan's identity and attitudes to integrate digital technologies was shaped by several intrinsic factors; his positive attitude towards digital technologies and his motivation to integrate digital technologies and his personal learning experiences in the past. Through the negotiated experiences and further involvement in the school community of practice, Raihan developed his identity to integrate digital technologies successfully in his teaching and learning. As Wenger (1998) argued, identity as a negotiated experience is when "we define who we are by the ways we experience ourselves through participation as well as by the ways we and others reify ourselves" (p. 151). In this sense, Raihan developed his self-image, or his identity of integrating digital technologies, shaped by his experiences and knowledge, combined with his positive attitude and motivation towards digital technologies. These experiences, knowledge, attitudes and motivation were shared with other teachers through his involvement in the negotiation of joint enterprise, mutual engagement and shared repertoire in the English teachers' CoP as well as in the school's CoP as a whole.

8.1.2 Iskandar: Identity as learning trajectory

Another teacher participant who was quite outstanding in digital technologies integration practices was Iskandar. As discussed in Chapter 6, Iskandar and other teachers in this study used technology for instructional preparation and delivery, as well as learning tool for improving teaching strategies (see section 6.1). It was evident from the documents that he provided to me that he integrated technology in his teaching effectively. As an example, in one of his lesson plans, Iskandar incorporated computer simulations as the technology tool to assist the teaching and learning process. He first viewed a computer simulation on the process of 'collision and explosions' to the students. Then, he discussed the concept of 'impulsive forces' with the students based on the simulation, so that students could gain better understanding of the concept 'impulsive forces' (Iskandar's Lesson Plan, 25/04/2011).

Throughout Iskandar's data, there were numerous examples of how his personal identity influenced his technology integration practice. The analysis of interview data and Iskandar's documents revealed that Iskandar's identity was mainly shaped by his learning trajectory that is discussed next.

Trajectories of learning

As noted by Wenger (1998), trajectories of learning incorporate the past and the future that can be experienced by individual in the CoP. It was evident from the interviews, that Iskandar's identity to integrate digital technologies was developed through his trajectories of learning; ongoing knowledge of digital technologies and his past learning experiences on computer and digital technologies. Iskandar claimed:

> I think my attitude and use of technology in teaching and learning are influenced by the knowledge and experience that I have had since my early age. From the beginning, my passion is more into computing. I was exposed to computers since 1983.

Iskandar had a deep interest in computing since the very beginning of schooling, when he was living in Singapore. He started his trajectories of learning about computing and digital technologies then. He first learned a programming language called BASIC and started to develop a computer program using BASIC. He was exposed to IBM based personal computers and later on he started using Apple Macintosh, but he is also able to use Microsoft Windows platform.

Iskandar tried his best to integrate digital technologies, especially after he was exposed to the Smart School program in 1999. It was also obvious to me that among other teacher participants in this study, Iskandar was the most knowledgeable and passionate about digital technologies. He mentioned that "my passion for the technology itself motivates me to use technology a lot in my teaching". Importantly, his passion not only motivated him to integrate technology in his teaching, but also in gaining more knowledge about technology.

Throughout Iskandar's data, there was evidence of his involvement in a continuous learning about technology in general, and technology for teaching and

learning in particular. Iskandar noted, "I always update my knowledge about technology". As with other teachers in this study, Iskandar learned to integrate digital technologies in many ways, including from the Internet or the "web news". Iskandar also took the opportunity to learn more about digital technologies integration through several training and courses offered by the school and the Education Department. He also attended several training program specially designed for the Smart school teachers, and during the ETeMS program.

Importantly, Iskandar continuously learned about digital technologies integration through active participation in the school's CoP. Although he was a senior teacher, he kept learning about integrating digital technologies through observation and interaction with other teachers at school. As an example, reflecting on his involvement in Perdana Secondary School, he commented that he liked the idea of having an informal mentor for coaching teacher's digital technologies integration.

> We don't have a specific program on mentoring or coaching. But, we have an excellent teacher in our [department]. I teach under her. She is not officially appointed to become a mentor, but I learn a lot from her.

This statement encouraged me to further explore his learning trajectories, to know how he related himself to other teachers within the school's CoP, and how this relationship built upon his identity. I asked him what he learnt from the excellent teacher he perceived as his 'mentor', and if there was anything related to digital technologies in particular. Iskandar noted that:

> I learned from her the way that she doing her work and how she organized her work. She did integrate technology a little bit in her teaching, but actually she was teaching Math, so there was a big gap in terms of the content that we are teaching. But, for me, the most important thing is to pick up on the positive part, especially on how to use a particular method in teaching Math or Science subjects. Then, I incorporate what I already have with the method that she's been using, to see whether in works or not with my students.

In this quote, there was a strong evidence to suggest that Iskandar has built up a relationship with other community members which is an important element for

teachers to be involved in mutual engagement of the CoP. Also, the participation in the school's CoP through forming relationships and involvement in an interaction with other teachers is an important process of teachers' informal learning and identity formation in the school's CoP.

Knowledge for integrating digital technologies

Iskandar's data also showed that through his trajectories of learning, he built his competency and knowledge for integrating technology. It was evident that he possessed the components of knowledge for integrating technology in teaching and learning; the technological knowledge (TK), pedagogical knowledge (PK) and the content knowledge (CK) as suggested by (Harris, Mishra, & Koehler, 2009; Mishra & Koehler, 2006). The following interview scripts provide an indication of how Iskandar demonstrated his knowledge in these three areas.

Interviewer: *Could you provide me with some examples of how you use technology in your teaching and learning?*

Iskandar: *I normally integrate the use of ICT with the traditional whiteboard. ... I have different methods of doing calculations. Normally I introduce students with what I called magic box. I put together the numbering, or the numerical figures, to ask the unit of the calculation in the box….*

Interviewer: *So you draw the 'magic box' on the whiteboard? Why don't you use computer application?*

Iskandar: *Yes, for the calculation part, I still use whiteboard because it easier to show students on how to do the calculations.*

Importantly, in this example, Iskandar demonstrated the integration of these three knowledge domains as follows:

(i) Technological content knowledge (TCK) - Iskandar was able to choose an appropriate technology tool (video clip) to introduce the concept of a specific content areas (speed).

(ii) Pedagogical content knowledge (PCK) - Iskandar stated the appropriate approach to conduct a lesson on a specific content area and learning outcome. He used video clip to stimulate student thinking and

then used the 'magic box approach' (draw on a white board) to show how to calculate the speed using a specific formula.

(iii) Technological pedagogical knowledge (TPK) -Iskandar was able to make a decision on what suitable technology media to be used in his teaching approach, and provided justification on his decision of using the traditional whiteboard over the digital technologies for teaching the calculation part.

However, there was no evidence to suggest that Iskandar possessed the core intersection of the knowledge that is the technological pedagogical and content knowledge (TPACK). If Iskandar was able to use a computer application to conduct the 'magic box' approach, and if the use of the computer will change student's learning instead of just using a whiteboard, he might be considered to have the technological pedagogical content knowledge (TPACK).

Since Iskandar's data showed that he was competent in the technology, and able to demonstrate his pedagogical consideration of the technology for a specific content area, this finding provides an insight that future research that uses CoP as the theoretical lenses could also capture teacher's TPACK from the social cultural perspective. Iskandar showed that the competencies and knowledge that he had in these three areas has contributed to his identity in integrating digital technologies. He was able to make a decision on the most appropriate digital technologies to be used, and when he can use other tools in his teaching. All of these were influenced by his trajectories of learning.

Importantly, this finding corroborated with Battey and Franke (2008) who claimed that "identity is shaped by the knowledge and skills we acquire and shapes the knowledge and skills we seek to develop" (p.128). In the school's CoP, this knowledge and competency was reified in Iskandar's digital technologies integration practices, and this participation constantly leads to the development of his identity (Wenger, 1998).

To this point it can be concluded that Iskandar's trajectories of learning built his competency and knowledge about digital technologies and consequently shaped his digital technologies integration practices. Wenger (1998) argues that identity is "a

constant becoming" (p.154) through the trajectories of learning. A trajectory is a continuous motion that has a momentum of its own in addition to a field of influence (Wenger, 1998). Iskandar's identity was developed as a learning trajectory; defined by where he came from, what experience that he had and where he is about to go (Wenger, 1998). These trajectories of learning have strengthened Iskandar identity of participation in the school's CoP. He incorporated his past experiences into his current teaching practice. He was also motivated to continuously integrate digital technologies in his future practice.

This finding is consistent with Wenger's (1998) theorization that a community can strengthen the identity of participation of its members in two related ways:

1) By incorporating its members' past into its history – that is, by letting what they have been, what they have done, and what they know contribute to the constitution of its practice.
2) By opening trajectories of participation that place engagement in its practice in the context of a valued future. (p. 215)

In the case of Iskandar, he not only built his identity for integrating digital technologies as an individual, but in his participation in the school's CoP he opened up his trajectories of learning within the community. These findings also corroborate with Olsen's (2010) study that conceptualize teachers' learning as a holistic approach in an ongoing and situated environment. Olsen (2010) also argued that teacher's identity formation integrate the experiences of the past and present, and is the result of teacher's personal learning and experiences, blended together with the ongoing practice in the current CoP.

8.2 Shaping and re-shaping of identities in the school's CoP

As mentioned before, among all teachers who participated in this study, only Raihan and Iskandar were strongly articulate and responsive to questions related to their sense of identity. However, within all teachers' interview data, there was evidence to suggest that teachers shared the identity of a Smart School teacher. Also, from the interview data, it was found that there was a mutual understanding among

teachers of the need for a new learning approach in their professional development, which consequently could contribute to their identity formation to integrate digital technologies.

As people construct their identities in relation to the communities in which they participate (Kajee, 2008; Wenger, 1998), the following sections analyse and discuss how teachers as collective members of a school's CoP built their identity as Smart School teachers and how the needs of teachers' professional learning based on CoP approach and the school culture can further be developed and shaped through participation in teachers' CoP.

8.2.1 The identity of a Smart School teacher

The school context and conditions can influence teacher's identity formation (Battey & Franke, 2008; Lasky, 2005). As stated in the Situated Learning (Lave & Wenger, 1991) and Communities of Practice (Wenger, 1998) perspectives, the social and cultural context of the CoP influenced the social practice of its community and therefore influenced its member's participation in the shared practice. In my study, it was evident that teachers considered the school being a Smart School as an important context in influencing their attitude towards digital technologies integration.

This can be seen from the ICT leaders' perspectives that it is important for the teachers at Perdana Secondary School to demonstrate the identity of Smart School teachers. The principal noted:

> In this school, teachers have to be more responsive towards ICT, because teachers from other schools see our school as a role model. They expect us to be more competent in using ICT as we're teaching in a Smart School. I always mentioned during teachers meetings that we have to use new teaching strategies using ICT, and differentiate the way we learn before with the way students should learn now.

Although the ICT leaders may have revealed an ideal view of the Smart School teachers' identity, this was negotiated and shared with other teachers, so that teachers in the school were aware of the joint enterprise of integrating digital

technologies in the school's CoP. This view was shared by Azlina, Raihan and Iskandar. For example, Azlina noted:

> Hence the name, Smart School, so all teachers should be smart in teaching and in using ICT for teaching. We should not have any problem at all, dealing with integrating ICT in teaching.

Similar to the principal's view, Azlina's reification of the negotiated joint enterprise of integrating digital technologies may suggest an ideal view of the Smart School teachers' identity where teacher's as Perdana Secondary School should not have a problem in integrating digital technologies. This however was constrained by the limited resources that teachers have to face in their digital technologies integration practice as discussed earlier in Chapter 6 (see section 6.2.1)

The student-teachers, Farzana and Liyana also agreed that the Smart School context influenced their teaching practice. They perceived that it was an advantage for them to be placed in a Smart School that had better technology facilities compared to other schools. Although they admitted that Perdana Secondary school still lacked some technology facilities, they also knew they could use more digital technologies in their teaching compared to their friends in other schools. Liyana noted:

> It is an advantage to have our practical training in this Smart School. I have friends in other schools that do not have ICT facilities there. So, they have difficulties. They have to prepare teaching materials on 'mahjong' paper. It takes time, compared to using computers. I'm motivated to use ICT in my teaching because both students and teachers can gain benefits.

Liyana perceived that having digital technologies in the classroom is an advantage for her to develop the teaching materials easily and it helps her in keeping students' attention and focus of the lessons. In this sense, her motivation and confidence in using digital technologies were shaped by the experiences and the facilitation that she and the other student teachers had in the Smart School.

These examples show that the school context, in particular the Smart School environment, can influence teachers practice for integrating digital technologies. At the very least, teaching in the Smart School influenced teachers thinking that they should adapt their practice and align their identity toward integrating digital technologies.

8.2.2 School culture and digital technologies learning

Previous studies have found that the school context and culture are important in shaping teacher's learning and identity formation (Battey & Franke, 2008; Lasky, 2005). Dufour (1997) claimed that teacher's attitudes, behaviours, expectations, and beliefs constitute the group norms for establishing the school's culture. From the CoP perspective, these norms of the school's culture are also important elements of a community, as they reify the participation and nonparticipation of its members (Wenger, 1998). As discussed in the earlier example of Iskandar and Raihan's identity formation, their attitudes and beliefs towards digital technologies have influenced their participation in the school's CoP, reified through their digital technologies integration practices.

The ICT leaders, Kamarul and Zakuan agreed that it is important to nurture and sustain the culture of digital technologies integration within the school environment. As a principal, Kamarul expected teachers to work collaboratively towards achieving the enterprise of integrating digital technologies. He also believed that teachers at Perdana Secondary School consistently use and integrate digital technologies in their teaching despite the limitations that they faced, such as the limited resources and support. Similarly, Zakuan supported the importance of school culture in integrating digital technologies. He mentioned that "ICT should become part and parcel of teachers' daily activities". In this regard, the school administration supported the national vision of integrating digital technologies and encouraged teachers to take active role in achieving this enterprise. Zakuan noted:

> We ensure that, firstly, the ICT facilities are in a good condition and can be used by teachers in the teaching and learning. Secondly, we make sure that

> teachers get enough training on ICT, and thirdly, we ensure that the ICT culture is embedded within teachers and students activities.

It was clear that the ICT leaders have a strong enterprise for the success of integrating digital technologies and provided the necessary support that teachers need for integrating digital technologies. The ICT leaders also believed that the digital technologies culture should be part of the overall goal of digital technologies integration, and they were positive about the current development of the school culture for integrating digital technologies. The ICT coordinator mentioned:

> Since this school has become a Smart School, there are differences in our ICT culture compared to before. Now, ICT has become part of teacher's and students' activities. Also, ICT is not separated from the teaching and learning process anymore.

The culture of integrating digital technologies in the Smart School was also mentioned by the principal:

> The Smart School vision for integrating technology is ongoing. It does not stop after all schools are supplied with computer. Having the culture of Smart School is more important. That's what we're into now. We want our teachers to use ICT in their everyday tasks, and optimizing the use of ICT in their teaching and learning.

In my informal observations in the school, there were several scenarios that suggested there was a positive culture towards the use of digital technologies at Perdana Secondary school. Two examples are given here, based on my observation notes.

<u>Scenario 1: In the teachers' cafetaria</u>

> I was sitting in the school cafeteria (teachers' area) while waiting for one of the teacher participants who agreed to meet me to discuss the research and to arrange for an interview… There was a group of male teachers (5 of them) sitting at a table next to me, having some drinks and meals, and conversation about an incoming school program. Zakuan (the ICT coordinator) joined the

> teachers group. As they continued their conversation, one teacher asked Zakuan's opinion about a new computer system that he planned to buy. Another male teacher joined the conversation. Mostly they talked about the technical aspects of a computer. One teacher expressed his frustration about the problems with Internet access in the school to the ICT coordinator. He mentioned his difficulty to download materials from the Internet for teaching and learning. (Researcher field notes, 7/03/2011)

Scenario 2: In the staffroom

> I was sitting in a staffroom to wait for one of the teacher participants for an interview. The staffroom located 20 teachers from different subject areas, mostly English teachers and Social Sciences (History, Geography and Islamic Education) teachers. While I was waiting for about 15 minutes, I saw three teachers were doing their work on a laptop, while the others were preparing materials for their lesson or marking their students' exercises. There were several conversations happening among the teachers, mostly about students discipline and school activities. Within the 15 minutes, there were a few teachers who came in and out of the staffroom. I observed two teachers talking to each other and sometimes pointing to the laptop screen. It was not clear to me the details of their conversation, but I could see the laptop screen, and it was the Microsoft Excel program open on the screen. I also heard the teachers mentioned 'marks', 'percentages', 'grades', and 'sorting'. I believed that the teachers were recording the students' marks using the computer as the students had finished their tests for the first term. (Researcher field notes, 19/04/2011).

In these examples, the digital technologies such as 'computer' and 'Internet' were part of their discourse in the school's CoP. The 'laptop' and 'Microsoft Excel' program has become an object or reification tool of their practice. These objects reified a view of the activity teachers were involved in using digital technologies, in this example how teachers went about recording students' marks. As Wenger (1998) noted, "reification shapes our experience, and it can do so in very concrete ways. Having a tool to perform an activity changes the nature of that activity" (p.59). These examples provide evidence that teachers were involved in ICT related activities, and there was a

positive culture of ICT in this school, that shaped teachers' technology integration practice.

In addition, in the analysis and discussion of teachers' participation in the school's CoP that involved negotiation of the joint enterprise, mutual engagement and shared repertoire, there was evidence to suggest that teachers engaged with each other in planning, designing and sharing materials using ICT. All of these social practices and culture in the school's CoP significantly shaped teachers' participation and reification in their technology integration practice.

It can be concluded that in this study, the school culture includes digital technologies as part of teachers' daily activities, discourses and functions and is important for the alignment of teachers' identities. This is because alignment coordinates an individual's activities within broader structures and enterprises, allowing the identity of a larger group to become part of the identity of the individual participants (Wenger 1998). The importance of school culture in teachers' learning is also consistent with previous studies. Dufour (1997) claimed that the school's culture that includes attitudes, behaviours, expectations and beliefs that constitute the group norm are an important element in teacher's professional learning. The school culture and context is also important in shaping teachers' identity, especially for the new teachers (Flores & Day, 2006). Teachers also have a shared set of beliefs about integrating digital technologies within their school setting that is influenced by the school culture and condition (Hermans, et al., 2008). In my study, the school culture was found to be important for the improvement of teachers' digital technologies integration as it shapes teachers' identity for integrating digital technologies.

8.2.3 CoP approach in teachers' professional learning

Teachers in the Smart School also negotiated their need for more sustainable learning approaches so they could successfully integrate digital technologies in their teaching. The analysis of data revealed that teachers expressed common themes related to their professional learning needs to integrate digital technologies as discussed in the following sections.

Customised learning approach

Teachers expressed a need for more flexible and customised teacher professional learning approaches when related to integrating digital technologies, designed according to the teachers' localised CoP needs and values. The need for more customised learning approach was mainly pointed out by the Science teachers. As Hanita noted:

> We know how to use the computer and the LCD [data projector]. We use Power Point and courseware. But sometimes, we have no idea on how to integrate some new applications into our own subject area.

Iskandar also expressed his concern about the need for more customised professional learning approaches to suit the content area based on his experience of attending the Smart School training program as follows:

> Certain courses that we attended were very useful to be applied in the classroom. But I think they should have divided us into smaller groups. Because normally what they do, in the case of Smart School training, they gather together all teachers from primary school and secondary school in one session, for all subject areas. It's quite difficult, because the knowledge that we teach in primary and secondary school, it's quite different. Even in secondary school, the content for lower forms and the upper forms is different. Different subjects also have different approach. So, there is a big gap there, when they conduct the courses together. It's not easy to differentiate.

Hanita and Iskandar revealed that many teachers had basic knowledge of using computers or digital technologies for teaching and learning, such as the data projector and presentation tools. However, they both emphasized that teachers need more knowledge on how to integrate digital technologies within specific subject areas, or in terms of the technological pedagogical content knowledge (TPACK) (Harris et al., 2009; Koehler, Shin, & Mishra, 2012; Mishra & Koehler, 2006).

Throughout the data, it was found that teachers believed Perdana Secondary School had the potential to provide flexible and customised learning approaches and these needed to be strengthened. According to the ICT coordinator, the school tried to

implement digital technologies integration related programs that suited each subject department's needs. For example, there was a training program planned by the Science department on using blogs for Science teaching and learning. Teachers valued this kind of professional development program to enhance technological and pedagogical knowledge. Hanita noted:

> Our [Science] department will have a workshop on how to use [web] blog soon. Some of us know how to build a blog but some don't. I sometimes download materials from the State Education Department blog and website, but some teachers don't know how to do that. Hopefully we can learn how to develop our own blog and how we can integrate the use of blogs in our Science teaching from the workshop.

Within the Science teachers CoP, there was a clear view that teachers were concerned about the pedagogical aspects of integrating digital technologies into a particular subject. In this regard, teachers needed customised professional development to be provided within the school, connected and situated within their day to day practices.

Continuous learning opportunities

Analysis of the interview data also revealed that teachers valued opportunities for learning through informal discussion, observation and mentoring. This theme was particularly evident among the junior teachers or the newcomers, including the pre-service teachers.

Most of the teachers in this study showed a positive response towards the idea of 'mentoring' for teachers to build their identity in integrating digital technologies. But most teachers wanted informal mentors rather than formal. As discussed earlier in Chapter 7 (see section 7.2.1**)** Iskandar valued the role of an informal 'mentor' in his digital technologies integration practice. In another example, Azlina commented:

> I think the mentoring program should not be formal… For something related to integrating ICT, I think the ICT teacher can just come and tell the new teacher "ok, you can use this thing and where to get that thing or how to use

> the ICT room, or when you can use the room." That would help very much because the new teacher would be a bit shy at the beginning (laugh). So she or he would not know where to go. Even during my first day here, since the teachers room is separated to the department, so I didn't know most of the teachers, and I didn't even know who the ICT teacher is.

Views on the importance of having more opportunities for informal and continuous learning were also shared by the student teachers, Liana and Farzana. As newcomers, they valued the opportunities of informal learning in their trajectories of becoming a teacher. They learned many things during their practical training in this Smart School, especially about classroom management and the pedagogical aspect of teaching Science. All of this learning occurred informally through discussion with their teachers' advisors and other teachers in the school's CoP. As discussed earlier in Chapter 6 (see section 6.3.3), in their participation in the school's CoP, they took the opportunity to learn from other through informal observation and discussion, although only at the periphery. For them, the opportunity to participate in an informal learning in the Smart School environment was very beneficial.

Although informal learning did occur in the school's CoP, such as through informal discussion, observation and sharing in an activity, teachers demanded that this culture of informal learning should be improved and sustained within the school's CoP. Hanita and Iskandar valued the concept of 'in house training'; in which teachers were sent to a formal professional development program and then shared the skills and knowledge that they gained with other teachers in the school. Hanita and Iskandar commented that the 'in house training' was a good opportunity for teacher learning, however they revealed that this approach has faded from the school culture because of time constraints and limitations of infrastructure. Hanita noted:

> Supposedly teachers that attend PD training conduct 'in house training' for other teachers. But, because of the time constraints and difficulty to gather all teachers, there's not much 'in house training' being conducted lately. Basically, what we do now, if we attend any PD training, we just share the materials that we got from the training with other teachers. Sometimes

> teachers just make photocopies or copy them to thumb drive if the materials are in soft copy format.

In response to teachers' concern about the 'in house training', Zakuan, the ICT coordinator clarified this matter as follows:

> It's true that we do conduct 'in house training' at school. Previously, teachers who return from a PD course have to conduct 'in house training' at the school level, or at least at their own department. But, lately it's difficult to have teachers who are willing to conduct 'in house training' anymore because it's not compulsory, so teachers choose not to do it. And it's become our role now, I as the ICT coordinator and Rasyidah as the ICT teacher, we sometimes conduct trainings related to ICT for our teachers.

Although teachers valued the 'in house training' as part of an informal learning process, and would like to have this kind of training regularly, some teachers came up with an idea that teachers' informal learning should occur in other several ways within the school's CoP. As an example, Iskandar noted:

> Excellent teachers should initiate this kind of 'in house training'. Well, they do conduct training, but only if it's part of the school program. I think we should go beyond that. Just share the knowledge with others. ... We can have a small group discussion, or informal sharing time. But, it's not a culture in this school. Everybody is busy with their own work.

Iskandar commented that the school should encourage teachers to implement the 'in house training' from time to time, not only for teachers who attended the PD program outside the school, but among teachers who have expertise in the area. Iskandar also came up with an idea that the teachers should have 'small group discussion' or invest their time in 'informal sharing' activities. However, Iskandar's concern was that it might be difficult to have such activities as teachers are busy with their work and may not be able to be part of the learning activities.

As noted earlier in Chapter 6, teachers in this study had limited understanding of the CoP concept, and even though they valued 'sitting together', as a mean of mutually engaging with each other. Iskandar valued informal learning approaches

such as 'small group discussion', or 'informal sharing time', but he expected all teachers to be at the same place at the same time for the learning to occur. The implication of this finding is that teachers should be introduced with the CoP concept so that they can realise the importance of sharing the knowledge in the situated environment of their school setting. This is consistent with the CoP theory (Wenger, 1998) that through participation in the CoP, teachers can actually learn from each other. In addition, based on the CoP perspective, teachers can design their own learning activities and environment that suit the need of their localised teachers CoP.

8.3 Conclusion and chapter review

In this chapter, it has been shown that there are multiple factors that influence teacher's identity formation in the school's CoP for integrating digital technologies. The findings from two teachers' cases, Iskandar and Raihan, suggest that these teacher's trajectories of learning and their negotiated experience are important factors in shaping teacher's identity to integrate digital technologies. Their learning trajectories and experiences have shaped their attitudes, values and beliefs towards digital technologies as well as their motivation to integrate digital technologies. Also, they have built upon their competency and knowledge about digital technologies. All of these factors have shaped their identity in becoming a teacher who is capable of integrating digital technologies successfully in the teaching and learning.

This finding not only supported Wenger's (1998) theory of identity but also previous literature on identity, including for example Kwan & Lopez-Real (2010) and Lasky (2005). Lasky (2005) claims that teacher identity is about "how teachers define themselves to themselves and to others" (p. 901). It also involves aspects of individual teacher capacity, personal commitment, a willingness to learn, individual beliefs, subject area and pedagogic knowledge (Lasky, 2005). In my study, it was obvious that all of these norms and values for teachers' identity were developed, shaped and reshaped through participation in the school's CoP, influenced by the learning trajectories and the negotiated experience teacher's bring into the school's CoP.

It was also found that within the collective context of teacher's participation in the school's CoP, there were several factors or approaches that together teachers considered as important in developing their identity to be professional teachers, able to integrate digital technologies successfully in their teaching. These include:

(i) The importance of a positive culture related to digital technologies integration within the school

(ii) The need for customized and relevant teacher professional development programs situated in the school context.

(iii) The need for more informal and continuous learning opportunities

These findings suggest that the teachers' need a new approach to professional learning that is informal, continuous and customised according to teachers' needs and values. This is consistent with the characteristics of situated learning (Lave & Wenger, 1991) and communities of practice (Wenger, 1998). The continuous learning approach for all teachers is important for sustaining learning in communities of shared practice. Therefore, it is important for the school administration to consider these approaches in teachers' professional learning program that seek to change teachers' practice in their digital technologies integration. Although from the CoP perspective learning cannot be designed, it "can be recognized, supported, encouraged, and nurtured" (Wenger, 1998, p. 229). The development of teachers' professional learning from this social cultural perspective is very important, as teachers continue to develop their professional identity through participation and involvement in their communities. These findings also support previous research that argues that teachers' professional development needs to look for an alternative approach from the social cultural perspective such as the Communities of Practice that could make teachers' professional learning more meaningful and successful (Borko, 2004; Butler et al., 2004).

Chapter 9 Brokering and boundary creation in school's CoP

This chapter discusses the findings related to the role of brokers in the school's CoP in influencing teachers' technology integration. As noted by Lave and Wenger (1991), the role of a broker in a CoP is to "introduce elements of one practice into another" (p. 105). Wenger (1998) elaborates the roles of brokers as follows:

> Brokers are able to make new connections across communities of practice, enable coordination, and – if they are good brokers – open new possibilities for meaning. Although we all do some brokering, my experience is that certain individuals seem to thrive on being brokers: they love to create connections and engage in "import-export," and so would rather stay at the boundaries of many practices than move to the core of any one practice. (p. 109)

Within the school's CoP, teachers, leaders, or students can be brokers who are "able to make connections across communities of practice and open new possibilities for meaning" (Hadley & Sheingold, 1993, p. 465). However, in order for brokers to be able to introduce new knowledge or practice, their role "requires enough legitimacy to influence the development of a practice, mobilise attention, and address conflicting interests" (Wenger, 1998, p. 109).

In my study, the data revealed that all teacher participants have the potential to broker practice from their multi membership. However, further analysis of the data indicated that the ICT leaders, especially Zakuan and Rasyidah had a greater impact in their roles to broker practice due to their skills and recognised position in the ICT leadership in the school as discussed next.

9.1 The role of ICT leaders in brokering teachers' digital technologies integration

There is evidence that the ICT coordinator (Zakuan) and the ICT teacher (Rasyidah) who are members of the ICT leaders CoP played an important roles as 'brokers' to influence teachers from other localised teachers' CoP (i.e. English teachers CoP, Science and Maths teachers CoP, and student teachers CoP) in their technology integration practice. Zakuan and Rasyidah had the potential to influence teachers technology integration in terms of (i) empower teachers' mutual engagement, joint enterprise and shared repertoire to integrate technology, and (ii) support and sustain the development of teachers' knowledge and skills for integrating technology. These findings and the implications to teachers' technology integration in school's CoP are analysed and discussed next.

9.1.1 Empowering teachers' mutual engagement, joint enterprise and shared repertoire to integrate digital technologies

Within the school's CoP, it was anticipated that the ICT leaders, especially the ICT coordinator would have an important role in influencing teachers' technology integration practice. This expectation is in accordance with the roles of the ICT coordinator documented in the Smart School policy as follows:

> The [ICT] coordinator's task will be to support teachers and the principal in deploying multimedia and other technologies in the Smart School. The coordinator should be an experienced teacher who also understands how best to use technology for gathering information, instruction, managing, and communicating. The coordinator will also need to assist the principal in managing software applications and in liaising with technical support staff for the maintenance and upgrading of IT facilities. (Smart School Project Team, 1997, p. 14)

The task to support teachers' technology integration practices implies that the ICT coordinator at Perdana Secondary School should influence teachers' technology integration practices both technically and pedagogically. Within the school's CoP, this role was understood by Zakuan (the ICT coordinator), as he noted:

> We ensure that, firstly, the ICT facilities are in a good condition and can be used by teachers in the teaching and learning. Secondly, we make sure that teachers get enough training on ICT, and thirdly, we ensure that ICT is embedded within teachers' and students' activities.

This view was also shared by Rasyidah (the ICT teacher):

> Our role in the ICT department is to ensure that teachers receive necessary support to integrate technology. I worked closely with the ICT coordinator in any ICT training programs conducted for teachers in this school.

Throughout the interviews, Zakuan and Rasyidah mostly used 'we' and 'our' to refer to the members of the ICT leaders CoP, which included the principal and the ICT technician. As members of the ICT leaders CoP, Zakuan and Rasyidah understood that they were responsible for ensuring that teachers in the Perdana Secondary School are provided with necessary support to integrate technology in their teaching. Although this supportive role was one of the official tasks of the ICT coordinator and the ICT teacher within the school's CoP, this role had become an enterprise shared by the ICT leaders CoP, including the principal (Kamarul):

> As the school leader, I have to ensure that teachers are provided with enough ICT facilities. I have to admit that we're still lacking the latest technology, but from time to time, I discuss with the ICT coordinator and other teachers what we can improve...

This understanding about their role shared within the ICT leaders CoP mandated them to function as brokers, to influence the technology integration practice of other teachers. In the negotiation of this enterprise, the ICT leaders find ways to increase technology integration in the school's CoP, by providing necessary technology support to all teachers CoP.

As discussed earlier in Chapter 6 (see section 6.3.4), in the negotiation of the enterprise of integrating technology within the school's CoP, the ICT leaders developed repertoire of strategies, together with teachers from other CoP to improve technology integration practice of the school. In doing this, the ICT leaders valued the existence of the smaller or cohesive teachers' CoP (i.e. curriculum grouping of

teachers) in the implementation of digital technologies integration activities and strategies within the school's CoP. In this process, the ICT leaders had empowered teachers' participation within their localised CoP, to mutually engage with each other and develop a repertoire of strategies to achieve the enterprise of the school's CoP of integrating technology. This is reified through the implementation of ICT related activities planned by teachers and conducted within teachers' localised CoP, guided and facilitated by the ICT leaders, as evident in the following example.

At Perdana Secondary School, each localised teachers' CoP (i.e. departmental based CoP, subject focussed CoP, and special group CoP) was given opportunities to plan their own activities related to the use of digital technologies to suit their unique values and needs. For instance, within the Science and Math teachers CoP, Iskandar, Hanita and Syafiq were looking forward to attend a weblog training program that they already planned at the department level to be conducted in June 2011. They were expecting that they would learn how to use weblog effectively for teaching Science and Maths from the training. It was planned that the ICT coordinator (Zakuan) and the ICT teacher (Rasyidah) would become their trainers. In an interview with the ICT coordinator, Zakuan expressed his belief that through the localised activities, such as training conducted at the department level, "teachers would learn on how to integrate ICT in their own subject area" more effectively. This example showed that as teachers mutually engaged in a localised teachers CoP to plan their own teacher development program, brokered by the ICT leaders, they were involved in a valuable learning process situated in their school environment.

9.1.2 Supporting and sustaining the development of teachers' knowledge and skills for integrating digital technologies

One of the ICT coordinator and ICT teacher's roles in the school's CoP is to become a "trainer" in the ICT training programs conducted within the school. However, within the ICT leaders CoP, the ICT coordinator and ICT teacher understood that the role of a trainer is beyond teaching teachers how to use ICT tools and application, but more importantly, they should become a facilitator in developing teachers' pedagogical knowledge and skills in using ICT in their subject area. The ICT coordinator noted:

> We provide them with the basic knowledge of ICT, or the application that they want to learn. Together, they come up with strategies on how to integrate the application into their teaching, because they know more about their subject area. We guide them where necessary.

This role as a facilitator was also understood by the ICT teacher, Rasyidah, who was also responsible for training and guiding teachers' use of technology. Rasyidah commented:

> Well, of course during the training we teach them some basic ICT skills, how to use a particular tool or application such as the weblog that teachers want to learn. But, during the training, normally teachers will come up with questions related to their own subject, such as how to integrate the particular tools or application that we learn during the training in their own teaching. So, from there we will discuss the pedagogical aspect of using ICT in particular subject area.

In these instances, it was obvious that Zakuan and Rasyidah shared an understanding of their role to facilitate the teachers' learning process to integrate technology, as they always work together as the trainers. Importantly, they encouraged teachers to be involved in a mutual engagement (work together with other teacher) and come up with a shared repertoire (teaching strategies) in their technology integration practice (joint enterprise).

The impact of this facilitative role of the ICT coordinator and ICT teachers in brokering teachers' technology integration practice was acknowledged by other teachers. Teachers perceived that Zakuan and Rasyidah played this role continuously, not only during the training programs as discussed above, but also in their daily participation in the school's CoP. As an example, Hanita stated:

> I do ask other teachers if there is anything I need to know about ICT. But I mostly ask the ICT people. If there is problem with the computer or data projector, I just ask the technician, or Zakuan. They are very helpful.

Although teachers in my study mostly gained advice about technical aspects of using technology from the ICT members in their daily participation in the school's

CoP, there is evidence that teachers were involved in more serious conversation about technology for teaching, in the training programs facilitated by Zakuan and Rasyidah. As an example, Hanita discussed what she had gained from the training program conducted by Zakuan and Rasyidah.

> We learn about the basic things of using programs or software... because many of us didn't know how to use it. But, along the way, we also learn how to integrate the program in our teaching... and of course, after the training we can always follow up with them.

This view was also supported by Iskandar when he revealed that he preferred to have ICT training conducted in the school facilitated by Zakuan and Rasyidah, as teachers can easily refer to them if they have any issue in their later application of the program or software that they learn from the training. This finding suggests that Zakuan and Rasyidah were acknowledged as the ICT specialist by teachers from other CoP, making them legitimate peripheral participants in other teachers CoP. In this regard, their involvement in other teachers CoP were understood by their skills, responses, and roles.

The implication of this finding is that the facilitation of learning brokered by Zakuan and Rasyidah is important in influencing teachers' digital technologies integration practice. Through this process, teachers are gradually shaping their digital technologies integration practice, and improving their skills through mutual engagement. In other words, by mutually engaging with each other in the school's CoP, teachers share their knowledge and experiences to develop repertoire of strategies for integrating digital technologies. This happened within their own localised CoP during the training programs facilitated by the ICT coordinator and ICT teacher. This finding connects with previous literature that suggests learning is best supported over time (Borko, 2004; Looi, Lim, & Chen, 2008). For example in mastering technical skills in relation to teaching, it would not happen with just one off training sessions. It requires time to shape teacher's attitudes and identity to successfully integrate digital technologies. Therefore, it is important to develop teachers' knowledge and skills for integrating digital technologies through continuous

learning which would sustain teachers' professional development (Borko, 2004; Butler et al., 2004; Henderson, 2007; Looi, Lim, & Chen, 2008).

The ICT leaders in Perdana Secondary School also played an important role in developing teachers' knowledge and skills for integrating technology. This role was reified through their involvement in the planning and development of digital technologies related activities, as well as in their interaction and discussion with other teachers in the school's CoP. However, within the interview data, it was obvious that within the ICT leaders CoP, Zakuan (ICT coordinator) played this role to a greater extent than Rasyidah (ICT teacher) and Kamarul (the principal).

Teachers in my study also agreed that Zakuan was the main person to be referred to by all teachers in the school, especially when they faced problems related to ICT. The Science and Maths teachers, and the English teachers who participated in this study identified Zakuan as the "ICT person", "ICT trainer" or "ICT facilitator". This suggests that teachers acknowledged Zakuan's roles in developing their technology integration practice.

Rasyidah also perceived Zakuan as having the capacity to broker other teachers' technology integration practice, when she said "most teachers refer to the ICT coordinator for help or advice related to ICT. Sometimes, I also refer to him. For me, he has lots of knowledge on ICT that we could refer to". This view was supported by other teachers. The English teachers (Azlina and Iskandar) acknowledged that Zakuan was their main "point of reference" when they faced problems related to digital technologies at school. The student teachers (Farzana and Liyana) also reported that they always referred to Zakuan for ICT related problems as they regarded him as the "person in charge" of ICT.

It was also evident that Zakuan played his role in developing teachers' knowledge and skills about digital technologies, which consequently shaped teachers technology integration practice. For example, in one of my observations (See chapter 7, section 7.2.2, Scenario 2 for the full transcript of the observation note), Zakuan's role in the school's CoP was able to spark teachers' conversations about digital technologies. As the teachers regarded Zakuan as someone that they could talk to about digital technologies, the teachers tended to change their conversation topics into

a focus on digital technologies when Zakuan was around. Teachers also took the opportunity to ask him about ICT related problems. Through this interaction and discussion, teachers participated in informal learning to develop their knowledge about using technology. They also came up with a shared repertoire as they discussed how to solve their problems together.

In another observation, shown in the following extract, I found that Zakuan encouraged teachers to find alternatives to solve their problems, as a way of developing teacher's knowledge in using digital technologies.

Observation note extract: In the ICT coordinator's office.

> I was having a conversation with Zakuan after an interview session with him, and a female teacher [not a participant in this study] came to his room. The teacher showed an external data storage (a thumb drive) and told the ICT coordinator that she was unable to retrieve the data in the drive. She also mentioned that she urgently needed the data as it was for her lesson. At that moment, I was anticipating that the ICT coordinator would have a quick look and try to scan the thumb drive to diagnose the problem. However, Zakuan first asked the teacher "Have you scanned the thumb drive?" "What error message appeared when you tried to open it?" "Have you tried to open it using a different computer?" "Have you asked other teachers?" The female teacher tried to respond to Zakuan's questions, but it seemed that she had limited knowledge on the technical aspects of using ICT tool as she mostly responded that she didn't know and had "no idea". Only then, Zakuan took the thumb drive and told the female teacher that he would look at it later. (Researcher field note, 30/04/2013).

In this example, it was obvious that Zakuan had become a broker, when most of the time he tried not to directly solve the teacher's problem, but encouraged the teacher to find alternatives to solve her problems. This is consistent with Wenger's (1998) theory that the role of a broker in a CoP is not just to introduce or transfer knowledge, but more importantly to develop practice. In this case, the practice is not about the actual skill, but rather the ability to critically think how to solve a problem with technology. This finding also suggests that teachers in this school's CoP have an understanding of mutuality. They know Zakuan's role and skills and shape their practice when around him. This is an example of how Zakuan, as an ICT leader

became a boundary object in which his physical presence was a reification of the brokering role.

This finding on the roles of ICT leaders in the school's CoP connects with previous studies that argued peer teachers and the school leaders would be able to become brokers by making "connections across communities of practice and open new possibilities for meaning" (Hartnell-Young, 2006, p. 465). Teacher-leaders with advanced knowledge and skills plays important role to provide ongoing facilitation to other teachers. The facilitation provided by the teacher-leader is happened within the school's CoP during the school day so that any teachers who need help and support can reach them at any time. Teachers together develop new knowledge, skills and resources to be used in the classrooms (Glazer & Hannafin, 2006). In addition, previous study showed that there is a positive relationship between technology leadership with the effectiveness of management duties of teachers using digital technologies in school (Raman & Shariff, 2017).

9.2 Boundary encounters

The role of the ICT leaders to support and sustain teachers' digital technologies integration practice is not a simple task. As noted by Wenger (1998):

> It involves processes of translation, co-ordination and alignment between perspectives. It requires enough legitimacy to influence the development of a practice, mobilise attention and address conflicting interests. It also requires the ability to link practices by facilitating transactions between them, and to cause learning by introducing into a practice elements of another. Toward this end, brokering provides a participative connection – not because reification is not involved, but because what brokers press into service to connect practices is their experience of multi-membership and the possibilities for negotiation inherent in participation. (p. 109)

The process of brokering is complex and involved boundary encounters (Wenger, 1998). Within the school's CoP, the digital technologies itself has become a 'boundary' in teachers' technology integration practice. Some teachers in my study

tended to compare themselves with other teachers in terms of their technology used. Teachers like Azlina and Hanita perceived that they did integrate digital technologies in their teaching, and questioned why others did not. Hanita, a Science teacher noted;

> Those teachers who are not using ICT... may be because they do not know how to use it... or because our school doesn't have enough facilities, so some teachers choose to not use it in their teaching... or they prefer their traditional way of teaching... But these teachers participate in the ICT training programs... so I think they should know how to use ICT... at least the basics.

Meanwhile, Azlina argued that although technology might not be integrated in some teachers' teaching practice, through ICT related activities such as the training programs conducted within the school, they could connect with each other to understand and respond together to the needs of integrating technology.

From the CoP perspective, this situation can be called 'boundary creation' (Wenger, 1998), in which some teachers perceived that technology is part of their teaching, but at the same time seen as an obstacle by others. However, through the negotiation of meaning (joint enterprise), teachers in Perdana Secondary School, whether they integrate digital technologies or not in their teaching, are involved in mutual engagement, through understanding each other competencies, that is, "what each member can and cannot do and being able to tap into those skills and knowledge" (Henderson, 2007, p. 50).

As discussed earlier in Chapter 2, technology integration is not a simple task (Ertmer & Ottenbreit-Leftwich, 2010; Inan & Lowther, 2010; Vannatta & Fordham, 2004). Its complexity varies in several ways depending on its purpose or goals, such as for pedagogical or administrative purposes. It can also vary according to the educational goals or beliefs such as the learning theories we adopted. In this regard, the way teachers reify the use or integrate digital technologies in their teaching are varies from each other. In this regard, although the technology created a boundary between teachers within the school's CoP, it also provided a connection in teachers' digital technologies integration practice, reified in their actual practice.

9.3 Conclusion and chapter review

In this chapter, I have discussed my findings that within the Perdana Secondary School's CoP, the ICT leaders, Zakuan and Rasyidah had demonstrated their capacity as brokers. Their roles as ICT leaders and their expertise in technology were acknowledged by teachers. From the CoP perspective, they were seen as legitimate peripheral participants which abled to broker practices across communities. In brokering practices, they were able to empower teachers' mutual engagement, joint enterprise and shared repertoire to integrate technology. They were able to introduce new ICT knowledge and skills to teachers from multiple CoP within the school. The knowledge and skills were shared and developed with other teachers' CoP through a range of training programs and informal discussions.

Although the digital technologies integration practice also created a boundary between teachers within the school's CoP, it also provided a connection in teachers' technology integration practice, reified in their practice. The implication of this finding is that the facilitation of learning brokered by the ICT leaders and the boundary creations that appear within the CoP are important in influencing teachers' technology integration practice. Through this process, teachers are gradually shaping their digital technologies integration practice, and improving their skills through mutual engagement. In other words, by mutually engaging with each other in the school's CoP, teachers share their knowledge and experiences to develop repertoire of strategies for integrating digital technologies. The facilitative support provided by the ICT coordinator contributed to teachers' development of knowledge and skills for integrating technology. These processes consequently improve teachers' digital technologies integration practices.

This finding suggest that the ICT leaders of a school should be acquainted with to the CoP concept, so that they can understand their role as the brokers of practice, and consequently be aware of how powerful is their potential in influencing teachers' technology integration practice.

Chapter 10 Conclusion

My study yielded several important findings about the factors contributing to teacher's learning to integrate digital technologies through the lens of Communities of Practice theory. This final chapter draws together the key aspects of my study. The first section presents a summary of this study, followed by discussion of the overall findings on teacher's learning to integrate digital technologies from the social and cultural perspective of Situated Learning (Lave & Wenger, 1991) and Communities of Practice (Wenger, 1998). Second, the theoretical and practical significance, particularly in regard to teachers' professional learning within teachers CoP is discussed and recommendations for future teacher professional learning are highlighted. Finally, conclusions are drawn about the significance of this study for the improvement of teacher learning to integrate digital technologies in their teaching practice.

10.1 Summary of the aims and findings

My study aimed to develop understanding of how teachers learn to integrate digital technologies within their school environment. I explored the nature of teachers' learning to integrate digital technologies from the social cultural perspective of Situated Learning and more specifically Communities of Practice (CoP). My study focused on how teachers' participate, negotiate and interact in the school's CoP to enhance their competencies in using technology, in terms of their mutual engagement, joint enterprise and shared repertoire. I also explored how teachers change, shape and re-shape their practice and identities in relation to digital technologies integration as a result of participation in the CoP. The role of brokers who can bring changes in teachers' digital technologies integration is also discussed in my study. The main research question that shaped this study was:

How do teachers' participation in school's Communities of Practice (CoP) influence their digital technologies integration in the classroom?

In particular this study was guided by the following sub-questions:

I. How do teachers integrate digital technologies in their teaching?

II. What is the role of mutual engagement, joint enterprise and shared repertoire in mediating teachers' digital technologies integration?

III. What is the role of identity in shaping teachers' digital technologies integration?

IV. What is the role of brokers for improving teachers' digital technologies integration?

The findings of my study were organised into chapters according to the research questions as follows:

How do teachers integrate digital technologies in their teaching?

This question is discussed in Chapter 6. The findings from the data show that teachers used varied digital technologies tools and applications in their teaching. It was found that the most common use of digital technologies in teachers' teaching practice was for instructional delivery and preparation. This includes using presentation tools such as Microsoft PowerPoint, combined with other media gathered from the internet to assist the instructional process. Also, teachers in this study used digital technologies for improving their teaching strategies such as for stimulating students' critical thinking using audio and video media. Teachers' reported barriers in their digital technologies integration which mainly related to lack of facilities, especially in the classroom, and time constraints for preparing and implementing digital technologies in their teaching.

What is the role of mutual engagement, joint enterprise and shared repertoire in mediating teachers' technology integration?

Barriers that teachers faced in their technology integration (as discussed in Chapter 6) influenced teachers' participation and reification of their actual technology integration practices. This was revealed within teacher's mutual engagement, joint enterprise and shared repertoire in their localised CoP as framed in this research question discussed in Chapter 7.

It was found that teachers' enterprise of integrating digital technologies was most strongly aligned when considered in their localised CoP (i.e. subject focussed CoP, student-teacher CoP and ICT leader CoP). Within their localised CoP, teachers were mutually engaged and together produced a shared repertoire that was unique to their community's shared practices, values and needs. For the English teachers' CoP, their negotiation of the joint enterprise for integrating technology was influenced by the rival pressures and values such as the needs of integrating technology as highlighted in the Smart School's policy. For the Science and Maths teachers' CoP, their enterprises for integrating technology were shaped through involvement in the Smart School and EtEMS projects. For the student-teachers' CoP, their enterprise for integrating technology was shaped through their participation and engagement in the localised student-teachers' CoP and their subject focused CoP within and outside the school. Whereas, for the ICT leaders' CoP, their enterprise of digital technologies integration was shaped and influenced by the policies and administrative imperatives. This finding suggests that although teachers across the school had a similar joint enterprise of integrating digital technologies, there were variations in the way they reified the enterprise which teachers negotiated through mutual engagement in their localised CoP. In other words, as a group, teachers are connected with each other based on their shared practice in the localised CoP that were largely based on subject specialisations.

Within the similarity that teachers shared in their localised CoP, they had variations in their joint enterprise and the way they mutually engaged with others and the repertoire of strategies that they shared. This finding suggests that this negotiation that happened within localised or more cohesive teachers' CoP mediates teachers' learning to integrate digital technologies. For example, the "courseware" provided by the Ministry of Education had become shared repertoire for the Math and Science teachers in which they have to negotiate its usage in their digital technologies integration practice. For the student teachers, the use of Web 2.0 technology provided connection between members in the multiple CoP. This finding also suggests that through the mutual engagement and negotiation of the joint enterprise, teachers used and developed a shared repertoire of strategies that were unique to their localised CoP to overcome the barriers that they faced in their digital technologies integration

practices. The implication of this finding is that teachers' professional learning to integrate technology should consider the various values, pressures and unique needs of each localised CoP.

What is the role of identity in shaping teachers' digital technologies integration?

This question is discussed in chapter 8. The findings from the two teachers' cases (Iskandar and Raihan) suggest that teacher's trajectories of learning and their negotiated experience are important factors in shaping teacher's identity to integrate digital technologies. Their learning trajectories and the experiences that they had have shaped their attitudes, values and beliefs towards digital technologies as well as their motivation to integrate digital technologies. Also, they have built upon their competency and knowledge about digital technologies. All of these factors have shaped their identity in becoming a teacher who is capable of integrating digital technologies successfully in their teaching practice. In my study, it was obvious that teachers' identities were developed, shaped and reshaped through participation in the school's CoP, influenced by their learning trajectories and the negotiated experience teachers bring into the school's CoP.

It was also found that within the collective context of teachers' participation in the school's CoP, there were several factors or approaches that teachers in their communities considered as important in developing their identity. To be professional teachers who are able to integrate digital technologies successfully in their teaching, teachers highlighted the following factors:

(iv) The importance of a positive ICT culture within the school.
(v) The need for customized and relevant teacher professional development programs situated in the school context.
(vi) The need for more informal and continuous learning opportunities.

These findings suggest that teachers needed new approaches to professional learning that would be more informal, continuous and customised according to teachers' needs, values and subject specific teaching areas. Therefore, it is important for the school administration to consider these approaches in teachers' professional learning program that seek to change and develop teachers' practice in their digital

technologies integration. The development of teachers' professional learning from the social cultural perspective of Communities of Practice that is designed for informal, continuous and customised learning is very important, as teachers would continue to develop their professional identity through participation and involvement in their communities.

What is the role of brokers for improving teachers' digital technologies integration?

The role of brokers is discussed in Chapter 9. It was found that within the school's CoP, the ICT leaders had demonstrated their capacity as brokers across multiple localised teachers' CoP. Their roles as ICT leaders and their expertise in digital technologies were acknowledged by teachers, and they were seen as legitimate peripheral participants who were able to broker practices across communities. In brokering practices, they were able to empower teachers' mutual engagement, joint enterprise and shared repertoire to integrate digital technologies. They were able to introduce new digital technologies knowledge and skills to teachers from multiple CoP within the school. The knowledge and skills were shared and developed with other teachers' CoP through a range of training programs and informal discussions.

However, brokering processes are not simple and create boundary encounters. It was found that within the school's CoP, the digital technologies itself has become a 'boundary' in teachers' digital technologies integration practice. Some teachers perceived that digital technologies are parts of their teaching routines but others saw it as an obstacle. Also, some teachers tended to compare themselves with other teachers in terms of their digital technologies use. This kind of boundary encounter caused tensions and conflict in teachers' enterprise for integrating digital technologies. However, through negotiation of meaning, teachers are connected to the 'boundary encounters' related to their enterprise of integrating digital technologies. For example, through the training programs conducted within the school, facilitated by the ICT leaders, teachers are connected with each other to understand and respond together to the needs of integrating digital technologies. Whether they integrate digital technologies or not in their teaching practice, teachers are involved in mutual engagement, through understanding each other's competencies. Teachers were connected to an enterprise of integrating digital technologies, where teachers mutually

engage to understand each other's roles, functions and responsibilities towards handling the boundary encounters. The implication of this finding is that the facilitation of learning brokered by the ICT leaders and the boundary encounters that appear within the CoP are important in influencing teachers' digital technologies integration practice. Through this process, teachers are gradually shaping their digital technologies integration practice, and improving their skills through mutual engagement. In other words, by mutually engaging with each other in the school's CoP, teachers share their knowledge and experiences to develop repertoire of strategies for integrating digital technologies. The brokering of practices provided by the ICT coordinator contributed to teachers' development of knowledge and skills for integrating digital technologies. These processes consequently improve teachers' digital technologies integration practices. This finding also suggests that the ICT leaders of a school should be acquainted with the CoP concept, so that they can better understand their role as the brokers of practice. In other words, if they are aware of the principles of the CoP concept, especially the way in which they can act as brokers of practices and identity, they can be more effective in facilitating digital technologies integration in the school's CoP.

10.2 A model of teachers' learning to integrate digital technologies from the CoP perspective

This study has provided insights into how teachers learn to integrate digital technologies in their school's CoP and has supported Wenger's (1998) theorization that teacher's identity formation is central in a situated learning environment. I have found that teacher's identity formation is particularly crucial in teacher's learning to integrate digital technologies in their teaching and learning practices. It can be concluded that there are multiple factors that influence teacher's identity formation in the school's CoP for integrating digital technologies.

Despite teachers' involvement in the school's CoP, teachers were all aware of their enterprise of integrating digital technologies. However, because membership in a CoP is not homogeneous, I found several social and cultural factors, such as teachers' beliefs and values and institutional needs and pressures involved in this process.

There were variations in teachers' responses and how they reified their actions towards the negotiated enterprise. Importantly, teachers demonstrated that in their negotiation of the joint enterprise of integrating digital technologies, they were involved in mutual engagement and developed a shared repertoire of strategies that were unique to their localised CoP.

The relationship between several factors that influence teacher's identity to integrate digital technologies in the school's CoP is summarised in the following model (Figure 10-1). This model proposes that teacher's identity formation to integrate digital technologies in a school Communities of Practice is shaped by their learning trajectories and negotiated experiences, which consequently shaped their attitudes, values, and beliefs towards digital technologies as well as their motivation to integrate technology (as discussed in Chapter 8). Also, teachers built upon their competency and knowledge about digital technologies integration through participation in their communities of practice, by contributing to the process of defining the joint enterprise of integrating technology, mutually engaging with each other, and contributing to the development of the shared repertoire (as discussed in Chapter 7).

The model also proposes that to sustain teacher's identity of integrating digital technologies, positive ICT culture, informal, continuous and customised learning should be embedded in the teacher's professional development program (as discussed in Chapter 8). All of these would be better achieved through active participation and engagement of all community members. Also, it is important to consider the roles of potential members of the communities who may bring changes and new ideas or to "broker" digital technologies integration practice and negotiate the "boundary encounters" throughout (as discussed in Chapter 9).

It is important to note that in this model, the elements of joint enterprise (JE), mutual engagement (ME) and shared repertoire (SR) are relevant to all other factors that influence teacher's identity to integrate digital technologies in the school's CoP.

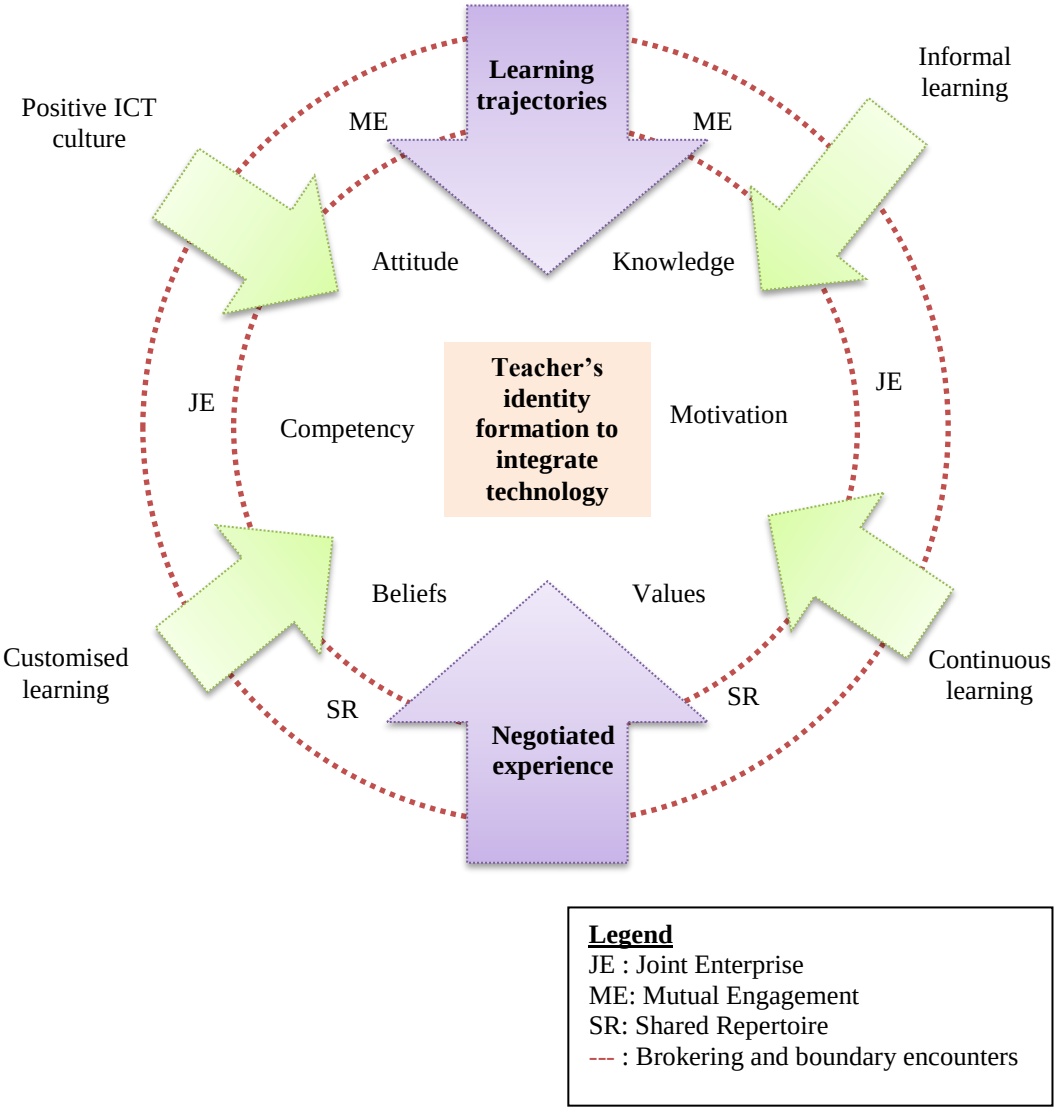

Figure 10-1: Model of teacher's identity formation to integrate digital technologies in the school's CoP

All of these CoP elements (i.e. joint enterprise, mutual engagement and shared repertoire) and the socio cultural factors found to be important from this study can better shape teacher's identity in becoming a professional teacher who is capable of integrating digital technologies successfully in the teaching and learning. This model therefore would be valuable to communities of professional learning to better design professional development programs by considering the elements of communities of practice, together with the identity dimensions and the role of brokers.

10.3 Significance of the study: New knowledge to inform future practice in the integration of digital technologies in the classroom

This study commenced in 2010 when issues related to digital technologies integration were considered critical in Malaysia. However, after seven years, recognition of the importance of integration of digital technologies in Malaysian schools is still ongoing amongst policy makers, education leaders and teachers. It has been noted by Abu Ziden (2017) that, "despite huge investment in Information and Communication Technology (ICT) over the past decade in various education initiatives, the potential of technology usage in Malaysian schools has not reached the desired outcomes among teachers and students" (p. 1680).

In addition, recent studies indicate that issues related to digital technologies integration remain important within the context of teachers' professional development. Dotong et al's., (2016) study of barriers to educational technology integration in classrooms within ASEAN countries including Malaysia concludes that "many secondary classroom teachers and academic administrators remain uncertain on how to implement new technologies to replace out-dated forms of classroom instruction" (p. 18).

In Malaysian schools, teachers are still facing continuous challenges in their digital technologies integration practice, mostly in relation to technology infrastructure and teachers still lacking technological and pedagogical knowledge (Cheok & Wong, 2016; Cheok, et al., 2017; Kaur & Hussein, 2015; Ghavifekr, Kunjappan, Ramasamy & Anthony, 2016). These studies conclude that despite teachers' positive attitudes towards digital technologies integration, teachers requires more facilitation to upskill their technological pedagogical knowledge to integrate technology successfully. Teachers mostly relate their need for technology facilitation with training programs. For example, Cheok, et al. (2017) concludes that:

> Technology innovations in schools must be accompanied with reliable and effective on-going support by providing what teachers need. Knowing the benefits of e-learning alone will not help accelerate the adoption process if teachers lack sufficient pedagogical and technological knowledge and skills. (p.30)

This current literature on teacher's technology integration practices within Malaysian schools indicates that teacher's professional development related to the integration of technology still requires ongoing attention. Therefore, the findings from my study are significant as they emphasise the multiple aspects of teachers' CoP that can support their professional learning.

10.3.1 Theoretical significance of the study

In terms of teacher's technology integration, the literature provided insights into some areas of research, for instance the Rogers diffusion and innovation focus on for understanding innovation adoption in corporate and education settings (Rogers, 1995; 2003). TAM and UTAUT focus mainly on teacher's acceptance, attitude and intention towards using technology (Davis, 1989; Davis et al., 1989; Venkatesh & Davis, 2000). Other literature focuses on barriers and conditions for technology integration (Ertmer, 1999; Ertmer & Ottenbreit-Leftwich, 2010), and the relationship between teachers' pedagogical beliefs and technology integration (Bai & Ertmer, 2008; Chen, 2008; Ertmer, 2005; Cher Lim & Chai, 2008; Palak & Walls, 2009). Recent research interest within the area of teacher's technology integration explores the list of knowledge (i.e. technology, pedagogy and content) that teachers should have to integrate technology successfully (Mishra & Koehler, 2006). While these studies provide valuable insights into factors and conditions that can influence teacher's technology acceptance and integration, the important issue of "How teachers learn to integrate digital technologies?" has been under examined.

In my study, I have demonstrated that by using the sociocultural theory of Communities of Practice that centres on social participation and identity formation (Lave & Wenger, 1991; Wenger, 1998), we can better understand how teachers negotiate their technology integration practices. Issues related to teachers' technology integration such as barriers and conditions for integrating digital technologies, teachers' attitudes towards digital technologies and teacher's pedagogical beliefs also emerged and have been discussed within these theoretical perspectives.

The findings have highlighted the importance of community learning in a situated environment to develop and sustain social practices and focused learning.

These findings support Lave and Wenger's (1991) and Wenger's (1998) theorization that learning is a social practice sustained through negotiation of joint enterprise, continuous involvement in mutual engagement and development of shared repertoire. This study has found that participation in school's CoP and teachers' localised CoP can provide the necessary support to improve teacher's learning to integrate digital technologies. The obvious finding from this study is that teachers within localised teachers' CoP are involved in social practice through mutual engagement with each other. Teachers negotiated their enterprise of integrating digital technologies and improved their digital technologies use in teaching and learning. Despite the barriers that teachers' faced in integrating digital technologies, teachers develop a shared repertoire of strategies, tools and ways of doing things through participation in the school's CoP. These consequently contributed to their digital technologies integration practices and learning.

The findings have added to the literature on teachers' digital technologies integration. They demonstrate that theoretically and methodologically, Situated Learning (Lave & Wenger, 1991) and Communities of Practice (Wenger, 1998) are valuable in understanding teacher's practice and learning to integrate digital technologies within the Malaysian context. Although the findings cannot be generalised to other contexts, this study shows that future studies seeking to understand teacher's learning to integrate digital technologies could consider Situated Learning and Communities of Practice as the theoretical lens.

10.3.2 Practical significance of the study

There are a number of implications for teachers' professional development and education policy regarding digital technologies integration that have emerged from this study:

i) The CoP that already exists at the school and department level whether it is realized or not by the communities' member should be strengthened and sustained as they provide a situated learning environment for teachers' learning to integrate digital technologies. This can be done through design for learning (Wenger, 1998). The principles of the CoP theory (i.e. mutual

engagement, joint enterprise and shared repertoire) should be introduced into teachers' communities so they are aware of the potential of designing learning underpinned by CoP theory to integrate digital technologies within the situated environment of the school. This is important to create emergent structures and continuity to accumulate experience and to continually negotiate meaning (Wenger, 1998) for integrating digital technologies. For example, the design for learning for integrating digital technologies at school should consider providing more opportunities to the ICT leaders and potential teachers who are capable to bring changes (i.e. brokering) to contribute actively to the digital technologies integration practice at the school's CoP. Also, teachers in school's CoP should be encouraged to negotiate their enterprise of integrating digital technologies and to make creative use of their existing repertoire (eg. courseware, lesson plans) and to engage in the development of new artifacts that can be used across multiple CoP.

ii) Teacher's digital technologies integration professional development programs designed at the department or school level should consider the potential and functions of a communities of practice (Wenger, 1998). As teachers within the school's CoP have different values and needs, and face several barriers and pressures in integrating digital technologies, the professional development programs should be designed and planned systematically and reflectively (Wenger, 1998) to achieve the joint enterprise of integrating digital technologies. For example, in Malaysia, Science and Mathematics teachers require skills and knowledge to integrate digital technologies using emerging digital tools. English Language teachers may need to explore the potential of using online technology such as blogs, wikis and digital storytelling tools to enhance students' creative thinking and writing. In this regard, teachers require more facilitation and support from the ICT leaders and peers to successfully integrate digital technologies in their teaching practice. By considering and understanding the potential and functions of the CoP, each member in the school's CoP would play their roles in the participation and reification of practice such as making sure that the shared repertoire (i.e. tools,

procedures, schedule, curriculum and policies) are in place, so that other teachers could work together around them.

iii) New approaches to teacher professional development that utilize emerging and Internet technology should be considered. As the function of a CoP requires working around shared repertoire, artifacts and cognitive tools to aid learning such as methods of categorization, organization, and planning (Knowles et al., 1998), these can be aided by processes, procedures, and technology (Wenger, 1998). This recommendation is in line with the previous literature that proposes online and blended CoP approaches for teacher professional development program (Seng & Kuo, 2014; Trust & Horrocks, 2017). Seng and Kuo (2014) proposed that "online CoP can become critical approach for teachers to their pedagogical knowledge and teaching skills" (p. 37). Trust and Horrocks (2017) argued that multiple means of engagement, online and face-to-face learning activities are critical elements that shape participation and learning in a blended community of practice. It was found in their study that participation in a blended community of practice creates reciprocal growth opportunities, in which teachers can develop as professionals across multiple domains (e.g. individual, classroom, school, blended community of practice) (Trust & Horrocks, 2017). This is common in many countries in the world where formal professional associations of teachers collaborate via online environment to improve their practice. Malaysian school's CoP should also consider this online and blended approach to better sustain the communication, interaction and collaboration among teachers.

iv) Departments, schools and the Ministry of Education should also consider designing programs that are customized and relevant to teachers' professional development situated in the school context, informal and providing continuous learning opportunities according to teachers' needs and values. The model proposed in this study (see section 10.2) that was underpinned by the social and cultural perspective of Communities of Practice (Wenger, 1998) together with the perspectives gathered from the members of the school's CoP (teacher participants) would be a valuable reference in designing the future programs

as it has included all the essential elements that teachers found to be important in developing their identity formation to integrate digital technologies.

10.4 Limitations of the study

There are limitations in my study because of the small number of participants involved. As this study was conducted based on a single case (embedded) design, it involved only ten teacher participants from one school in Malaysia. As a consequence, the findings are not generalizable to other teachers or schools. However, the decision was made to conduct one deep case study in order to develop comprehensive understanding of my research questions. I aimed to ensure rigor and quality in my research by applying what Yin (2002) sees as the critical elements of design quality: "construct validity, internal validity, external validity, and reliability" (p.19). I drew on Lave and Wenger (1991) and Wenger's (1998) established theoretical frames to ensure construct validity. I used thorough case study protocols and thick description to ensure external validity. Internal validity was developed through deep interviews with teachers, member fact checking, the inclusion of multiple voices from different departments in the school, and reliability through careful thematic analysis. Since these protocols have been applied, the findings could be used to inform the development of teacher's professional learning related to digital technologies integration in Malaysian schools and schools in other contexts. Merriam (1988) argued that qualitative case studies provide:

> … insights into aspects of educational practice [to] have a direct influence on policy, practice, and future research [and] … A case study approach is often the best methodology for addressing problems in which understanding is sought to improve practice. (pp. xii-xiii)

Ultimately, I wanted this research to contribute new theoretical insights into how digital technologies can be better integrated in schools as Hammersley (1987) claimed that "qualitative findings are best generalised to the development of theories and not wider populations" (p. 2).

10.5 Recommendations for future research

The findings from this study show that teacher's participation in communities of practice did develop their identity to better integrate digital technologies in their teaching and learning. However, there are multiple opportunities for further research that could deepen understanding of how teachers learn to integrate digital technologies through CoP. It is recommended that future research investigate specific aspects of Communities of Practice more deeply such as:

i. The role of brokers and boundary objects to fully understand the process of brokering and its boundary encounters for improving teacher's professional learning for integrating digital technologies.

ii. The mechanism of identity and mode of belonging (i.e. engagement, imagination and alignment) to better understand teacher's identity formation for integrating digital technologies within the situated environment of the community of practice.

Future research should also include a larger group of participants including students or teachers in other communities to yield more data and provide better insights into digital technologies integration within the communities of practice. Future studies could consider multiple case studies and larger groups of participants so that the findings may be applied in a wider context. International comparisons could also provide insights into how CoP is applied in contexts for example where teachers' professional learning includes work across clusters of schools or through professional associations.

10.6 Concluding statement

This thesis has addressed gaps in the current research literature in relation to how teachers learn to integrate digital technologies through CoP. When the research for this thesis commenced, there was a clear need in Malaysia to know more about how teachers were learning to integrate digital technologies, since the government had invested heavily in the Smart School's program. At the same time, there was also considerable interest amongst education researchers globally in Wenger's (1998) theory pertaining to the power of CoP to influence change and learning. In addition, researchers were questioning what factors lead to successful teacher professional development. My study has contributed new knowledge in each of these areas.

The scope and potential for learning through the integration of digital technologies in schools is increasing in complexity, with an ever broadening range of technologies such as augmented reality, mobile learning, gamification, coding and data visualization. There is great scope and potential for professional learning communities of committed teachers to implement changes that will improve students' learning, and engage them through digital technologies use. This study has shown that Communities of Practice can play a significant role in this work.

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Appendix A: Interview Questions.

1. Could you tell me about your teaching background and experiences?
    a. Do you have any professional background before joining teaching profession?

2. What training or professional development related to technology integration that you have attended?
    a. Any to be attended in coming months?
    b. Is there any other way you gain knowledge and experience related to technology use?

3. Could you describe about your technology integration practices?
    a. How do you use technology in your T&L?
    b. What software or technology tools that you frequently use?
    c. You can talk about your past and current practices.
    d. Is there any difference in your technology integration practices in the past with your current practices?
    e. Previous school compared to the current school?

4. How do your background, knowledge and experience in using technology influence the way you integrate technology in your teaching?
    a. Do you hold any administrative position at school, district or national level?
    b. How do your professional identity influence the way you integrate technology?

5. What challenges that you personally, and other teachers in general face for integrating technology?
    a. Constraints / factors hampering teachers to integrate technology?
    b. Facilities?
    c. How you deal with those challenges?

6. “Teachers are expected to integrate technology in T&L, and it has been highlighted in the education agenda either at the school, state or national level.” What is your reaction or response to this institutional aims and needs?
    a. What are the things that matters you or you think are important to integrate technology?
    b. What needs to be done and what can be taken for granted?

7. What about the expectation to integrate technology highly in a smart school?
    a. What do you think is the expectation of students and parents about this?

8. Could you describe any collaborative works that you normally participate with other teachers related to planning, designing and integrating technology?
    a. Eg: Preparing lesson plan together, discussing how to use technology in teaching, conducting in-house training, etc.

9. Is there any effort in using or creating communal resources (eg: tools, teaching materials, stories, etc.) for integrating technology with other teachers?
    a. How do these resources contribute / influence the way you integrate technology?
    b. Do you think that creating and using communal resources is important to increase teachers’ technology integration?

10. Is there any program or activity related to mentoring or couching in integrating technology in this school?
    a. In your opinion, how this kind of program could help you and other teachers to integrate technology?
    b. What is your involvement?
    c. Is there any knowledge sharing between newcomers and old-timers? How this happens?

11. Do you think that all teachers are positive about the needs to integrate technology in T&L?

a. Is there any teacher that reject / not in favor about integrating technology?
b. Do you see this as conflict? If yes, how do teachers in this school overcome this issue?

12. How would you describe the way you, or other teachers influence each other practices in terms of technology integration?
    a. Any role models?
    b. Anyone has a potential to become a change agent?
    c. What about the role of ICT coordinator / ICT teachers?

13. As a smart school, the vision for integrating technology has been highlighted in the curriculum and syllabus. How this policy influences your technology integration practices?

14. When preparing lesson plan or teaching materials, do you consider using technology as important in your planning?
    a. Do you refer to other teachers' lesson plan?
    b. Or any other teachers refer to you?

15. What is your vision for integrating technology in the future?
    a. How do you plan to achieve that vision?

Appendix B: Follow Up Questions.

1. I was informed that all teachers have to attend 7 days internal courses in a year. Out of those 7 days, 4 days are nominated for courses related to ICT. As far as you remember, have you attended any courses related to ICT since you teach in this school?
    a. What courses?
    b. How is the participation of teachers in those courses? Did all teachers get involve?
    c. How beneficial are those courses to you? Do those courses help you in your T&L?

2. From our previous discussion, it was obvious that facilities and ICT infrastructures are important in helping teachers to implement ICT in their T&L. I was informed that the science labs are all equipped with LCD projectors and computers. As an English teacher, do you see this as an advantage to science teachers to implement ICT better than other teachers?
    a. Do you feel that teachers other than science feel disadvantage because they do not get the facilities as much as what science teachers get?
    b. What do you think the administration should do to overcome this problem?

3. Based on my discussion with other teacher participants, it seems that the culture of informal learning related to ICT integration in this school is not so obvious and some said that “there is no such culture”. Even though the technology integration practices are quite high and good by some teachers, discussion or conversation about ICT is not popular among teachers in this school. Why do you think this happened?
    a. In your opinion, what make teachers feel that technology / ICT is not something fun or important to talk about in the daily conversation?

4. In your personal opinion, how do you see yourself, as a teacher in a smart school should integrate ICT in your T&L?
    a. Do you think that it is important to you as a teacher in a smart school to integrate ICT better compared to teachers from other schools (ordinary school)? Why?
    b. What do you think about your personal identity as a teacher in a smart school? Would your identity be different as a teacher in a smart school?
    c. How do your previous and current experiences help you to build / shape your personal identity as a teacher?

5. If you don't mind, may we talk about the incident that happened to you recently? You lost your laptop and all the teaching materials that you have prepared which stored in that laptop. How do you feel about it?
    a. How these affect your T&L process?
    b. What have you done to overcome this problem?
    c. Do you seek for sharing resources / ask for helps from colleague?

6. I was told that your colleague (xxx) is an excellence PI teacher who had come up with a mind mapping module for their subject using ICT. Did you aware of that?
    d. Did you discuss or talk about ICT to each other?
    e. What did you learn from each other?
    f. How you / she influence each other use of ICT in the T&L?