University of Southampton

FACULTY OF SOCIAL, HUMAN AND MATHMATICAL SCIENCES

Southampton Education School

The Role of Experienced Practitioners in Promoting Saudi Female Pre-service Teachers' Cognitive and Social Engagement in Learning to Teach with Technology through Participation in an Online Professional Learning Community

by

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BSc., MA

Thesis for the degree of Doctor of Philosophy

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Abstract

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Teacher education programmes are increasingly focused on engaging pre-service teachers in the process of learning to teach with technology. Learning to teach with technology is considered a complex process that requires pre-service teachers to engage both cognitively and socially. One of the possible approaches that can enhance pre-service teachers' engagement in the learning to teach is by engaging pre-service teachers in an online professional learning community (PLC) with experienced practitioners who are expert in-service teachers in the field of technology use in education. Therefore, this study seeks to explore the role of experienced practitioners in promoting Saudi female pre-service teachers' cognitive and social engagement in learning to teach with technology through participation in an online PLC. This study adopted a mixed method and experimental approach. Two practitioners and 76 female pre-service teachers participated in the study. The pre-service teachers were assigned to one of two groups, with 38 pre-service teachers in each group. The practitioners only participated in the experimental group.

The study was divided into three phases. The first phase investigated the role of practitioners in developing pre-service teachers' technological pedagogical content knowledge (TPACK). The results revealed that the experimental group had significantly higher scores in technological pedagogical knowledge (TPK) and TPACK than the control group. The interview findings show that practitioners increased pre-service teachers' awareness of up-to-date technology, technologies designed for specific subjects, the pedagogical affordance of technology, and factors that need to be considered during the use of technology. The second phase examined the role of practitioners in promoting pre-service teachers' knowledge construction and social interaction by employing content analysis (CA), social network analysis (SNA), and a TPACK questionnaire. The practitioners increased pre-service teachers' levels of knowledge construction, high-cognitive discourse as well as network size and the extent of collaboration between those with varying levels of TPACK knowledge in both knowledge sharing and building networks. In both groups, collaboration in the knowledge building network predominantly occurred with peers in the same discipline. The third phase explored both pre-service teachers and practitioners' experience regarding their participation in an online PLC via interviews. The interview findings revealed that practitioners enhanced the quality of the discussion as well as enhancing the depth of the discussion. Another significant finding was that the practitioners enhanced the social interaction among pre-service teachers by strengthening their self-confidence, deepening the ethics of collaborative work within an Islamic cultural perspective, strengthening the sense of community, making interdisciplinary activities, linking pre-service teachers with each other, and encouraging them to use their external support as a resource. The practitioners found that this experience enhanced their professional growth. This research provides suggestions for enhancing pre-service teachers' engagement with practitioners in an online PLC.

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Research Thesis: Declaration of Authorship

Print name:	Enas Alwafi
Title of thesis:	The role of experienced practitioners in promoting Saudi female pre-service teachers' cognitive and social engagement in learning to teach with technology through participation in an online professional learning community

I declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.
I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. Parts of this work is under consideration for publication (Note: The publications listed below were conducted under my own development and writing up. My supervisors was listed as co-authors due to their suggestions and comments on my design):

   Alwafi, E., Kinchin, G. & Downey, C. (in review). The role of experienced practitioners in developing Saudi female preservice teachers' TPACK through participation in an online PLC.
   Alwafi, E., Downey, C. & Kinchin, G. (in review). Promoting Pre-service Teachers' Engagement in an Online Professional Learning Community: Support from Practitioners.

8. Part of this works was presented in the following conferences:

   Alwafi, E., Downey, C., Kinchin, G. (2017). Promoting pre-service teachers' engagement in professional learning through participation in online community. Poster presented at 9th international conference on Education and New technologies, 3-5 July 2017. Barcelona, Spain. (Poster).

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Signature: Date: 2/9/2019

Dedication

This thesis is dedicated to my late father, Mohammad Alwafi, who has been the main source of all success in my life. His words and wisdom remain a source of encouragement and continue to motivate me in seeking to achieve excellence.

To my wonderful mother, Amina Aljehani, who has been the main source of my strength and has always encouraged me. I appreciate all of her sacrifices and support. Her wishes and prayers were a source of encouragement to me in accomplishing this study.

To my darling husband, Ramzi Alrehaili, who sacrificed his time to stay beside me and put his profession on hold during my stay in the UK. Without his support and encouragement, I could not have reached this stage. I will never forget all things that he did for me.

To my lovely son, Anas, whose smile and happiness pushed me to finish this thesis during periods of stress. I really appreciated his patience in the times that he wanted to go out but I was busy working on this thesis

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Abbreviations

CA Content Analysis

CoP Community of Practice

ICT Information and Communication Technology

KSA Kingdom of Saudi Arabia

PLC Professional Learning Community

SNA Social Network Analysis

TPACK Technological Pedagogical Content Knowledge

UQU Umm Alqura University

Chapter 1 Introduction

This chapter sets the stage for this thesis, drawing attention to several issues the study seeks to address. In Section 1.1, background information related to the research problem is provided, followed by a description of the aims and significant contribution to knowledge. Finally, the structure of the thesis is provided.

1.1 Background and Problem Statement

Pre-service teacher preparation programmes represent an important arena for education reform. Indeed, one of the principal objectives of pre-service teacher education is to 'provide teachers with the core ideas and broad understanding of teaching and learning that give them traction on their later development' (Hammerness, Darling-Hammond & Bransford, 2005, p. 3). With the rapid development of Information and Communication Technology (ICT), the integration of technology in teaching and learning has become very important. Effective preparation for pre-service teachers during initial teacher education programmes can play a role in affecting their use of technology in their practice (Balchin & Wild, 2019). However, previous studies have shown that pre-service teachers encounter a number of difficulties in developing an awareness of the complexity inherent in the process of learning to teach with technology (Al-Zahrani, 2015; Saltan, Arslan & Wang, 2017; Bakir 2015). Learning to teach how to integrate technology is considered a complex process due to the knowledge and skills that must be acquired, while the transfer of those skills and knowledge is also recognised as being complicated (Adulyasas, 2018). According to Al-Abdullatif (2019), teachers need to develop their understanding of Technological Pedagogical Content Knowledge (TPACK) in order to integrate technology effectively.

Another difficulty involved in pre-service teacher education is understanding the various ways in which pre-service teachers can learn in different contexts, including university pre-service programmes and practicum sessions. According to Uusimaki (2013), the inconsistency between teacher education in a university setting and practicum sessions can produce conflicting perceptions of teaching with technology. Hus (2012) found that pre-service teachers encounter difficulties in developing awareness of different TPACK knowledge during campus-based study, due to the lack of understanding current issues in the school context. This challenge is related to the existing gap between the theory and knowledge offered by university-based pre-service teacher education programmes, and the practical experience gained during practicum sessions

(Al-Abdullatif, 2019). Hus (2010) stated that a lack of collaboration between university instructors and staff in the university setting leads to a lack of preparation on the part of pre-service teachers regarding learning to teach how to integrate technology in their future practice. Jones, Heffernan and Albion (2015) stated that instructors of the technology integration module in teacher education programmes do not use methods that require students to think and learn deeply, to collaborate and to apply learning to real practice, such as collaboration, problem solving and learning in the community of practice. This was confirmed by the investigations conducted by Al-Zaharani (2015), who examined the quality of pre-service teacher education programmes in Saudi Arabia and found that the technological model adopted by Saudi universities for pre-service teacher education programmes resulted in a gap between theory and practice, which negatively affected pre-service teacher awareness of technology-related knowledge. This technological model considers the process of learning to teach to be a linear process in which the university is responsible for providing the necessary theory and knowledge through coursework, while the school is responsible for providing the field environment and a setting for trial and error attempts (Brindley, 2013). Al-Zaharani (2015) stated that this mode of learning to teach may not represent an effective means of linking theory to practice and enhancing pre-service teachers to understand the complexity of teaching practice about how to integrate technology.

Zeichner (2010) suggested that there is a need to create a hybrid learning space in pre-service teacher education programmes that links the university-based learning experience with the knowledge and experience gained from experienced practitioners working in schools., for example, in-service teachers and learning resource specialists, in order to minimise the disconnection between theory and practice as well as engage pre-service teachers in the process of learning (see section 3.2.4 for further discussion on this hybrid space). Collaboration between pre-service teachers and experienced practitioners, regarding teaching practices, can help pre-service teachers to acquire the teaching skills as well as engage them in the process of learning how to teach (Hammerness et al., 2005). In fact, several researchers have argued that teacher education is rendered more effectively by increasing pre-service teachers' engagement in socially organised practices, for example, by facilitating their involvement in a Community of Practice (CoP) (Fox & Wilson, 2015). Phillips (2017) found that TPACK can be enhanced through negotiation and discussion in a learning community and that networking with others has an influence in developing TPACK. Prior studies concerning pre-service teachers have shown that networking and establishing social relations with other professionals can provide pre-service teachers with access to knowledge regarding the practice of technology integration in teaching (Dorner & Kumar, 2016). Recently, there is increasing focus on how and why pre-service teachers

form networks within a CoP with peers and professionals who can support their professional development (Risser, 2013; Fox & Wilson, 2015).

Nevertheless, creating such a hybrid learning space is difficult due to the lack of availability of practitioners and the time restrictions inherent in the schedules of pre-service teacher education programmes in a university setting (Zeichner, 2010). One way to connect pre-service teachers with practitioners working in schools is through online learning spaces which can facilitate interactions between pre-service teachers and practitioners. The accessibility of online tools assists pre-service teachers in networking with other professionals and developing an online Professional Learning Community (PLC). Online PLC can be used as a means of supporting knowledge-sharing and the development of professional practice within the CoPs (Marklund, 2015). Hou (2015) suggested that online PLCs are superior to face-to-face communities, due to the possibility of connecting people who are geographically remote as well as allowing for interactions at any time and can help to create a repository of community knowledge for members.

Several researchers have argued that learning to teach within a CoP requires members to engage in the learning process (Hou, 2015; Sinclair, 2008). According to Wenger (1998, p. 95), engagement in learning within a CoP is 'both the stage and the object and the destination'. This means that learning to teach is not a static subject, but rather a process of being engaged and participating in ongoing learning and development (Sinclair, 2008). Lemon (2014, 2015) emphasised the importance of examining the engagement process involved in learning to teach within an online PLC in order to evaluate the quality of learning. Bransford, Brown and Cocking (2000) stated that high-quality engagement with learning to teach can help pre-service teachers to address issues of immediate and future concern regarding their teaching practice. Sinclair (2008) observed that success regarding learning to teach is fostered within a professional community, when shared thinking about pedagogical practice is discussed and pre-service teachers are engaged both cognitively and socially. Many researchers have confirmed that learning to teach with technology is not a purely cognitive process that focus on improving the TPACK development and knowledge building, but it also requires social engagement (Lemon, 2014; Dorner & Kumar, 2016). Moreover, learning to teach with technology within an online PLC requires active participation in order to sustain learning within the community. Researchers have suggested that pre-service teachers should cognitively and socially engage with the activities of online learning communities (Hou, 2015; Lemon, 2015). Pre-service teachers can cognitively

engage in the process of learning to teach with technology if they are to develop a high level of TPACK knowledge and high quality of knowledge construction. Furthermore, social engagement in online learning communities can be determined through the level of participation and an individual's position in relation to other members (Risser, 2014). These two elements of engagement are interrelated (Lemon, 2014). For example, active participation in online learning can affect and influence the quality of knowledge sharing, building and TPACK development.

With reference to available literature focusing on the engagement of practitioners with pre-service teachers, only a limited number of prior studies have investigated the role of practitioners in engaging pre-service teachers in learning to teach in general, and learning to teach with technology in particular. A review of relevant literature revealed that there is a lack of empirical evidence concerning the role of practitioners within an online learning community. For example, Wearmouth, Smith and Soler (2004) conducted a case study to investigate the impact of practitioner participation on pre-service teachers' professional growth, in a module designed for special education needs coordinators and found that the presence of practitioners facilitated reflection within the online learning community. Dorner & Kumar (2016) adopted a questionnaire to investigate the impact of expert in-service teachers on pre-service teachers' computer skills and found that expert teachers enhance the level of computer skills among pre-service teachers. In another study, Dorner & Kumar (2017) surveyed pre-service teachers' satisfaction with the participation of expert teachers in an online mentoring environment. They found that they were satisfied with the experts' activity and their role in enhancing their communication with their peers. Liu (2005) conducted an experimental study to examine the impact that expert in-service teachers had on the attitudes of pre-service teachers regarding instructional design. Liu found that expert teachers played a positive role in providing guidance for pre-service teachers, improved performance and attitudes towards instructional design more than those of pre-service teachers who participated in a face-to-face environment. Both Hemphill and Hemphill (2007) and Redmond and Mander (2006) investigated the role that experienced practitioners played in interactions with pre-service teachers in online learning environments through the use of a quasi-experimental approach and content analysis, and found that experienced teachers enhanced their level of knowledge construction. However, Redmond and Mander (2006) found that engaging in-service teachers with pre-service teachers enhanced their problem-solving and thinking skills, but the extent of high-cognitive discourse was restricted due to the lack of practitioners' experience concerning online facilitation techniques. Although these two studies investigated knowledge-building, there are limitations since neither included a control group, making it difficult to justify

the role played by the practitioners, nor prepared the practitioners to facilitate pre-service teachers' knowledge construction.

In terms of studies focused on the Gulf region and the Saudi Arabian context in particular, only one study was identified. Alebaikan (2016) conducted interviews to examine the perception of Saudi graduation students, future computer science teachers, on the idea of inviting a guest expert in educational technology into their class, and focused on the difference between face-to-face and online guest expert. Alebaikan (2016) stated that the involvement of practitioners was not a commonly used teaching approach in the Gulf region, and she recommended that future research should focus on how practitioners can influence students' engagement in the Saudi context, since there are different social and cultural factors that may influence their participation with guest.

The above review shows that only two studies was focused on the use of practitioners to enhance pre-service teachers' understanding about technology integration. However, one of these two study only focused on measuring computer and internet ability (Dorner & Kumar, 2016) and another study focused on pre-service teachers' perceptions (Alebaikan, 2016). No previous study has investigated the impact of practitioners on pre-service teachers' awareness and understanding of TPACK. Moreover, the previous studies did not illustrate how the learner became engaged in the learning process. Li et al. (2014) noted that the research concerning online practitioners does not focus on the role of learners' active involvement within the online learning environment. Costello (2012) found that the studies investigating the presence of online practitioners have not examined the impact of practitioners on the community's group activity, enhancement of the learning experience and social engagement. Li et al. (2014) and Dorner & Kumar (2017) recommended that future studies should focus on the mechanism by which students engage in the learning process with practitioners. Furthermore, the majority of previous studies focused only on cognitive engagement, without social engagemen as did not explore the mechanism of collaboration activities and interaction. Also, most studies relied on a single research method, such as interviews, and did not consider more powerful methods such as SNA and content analysis. Furthermore, the previous study focused only on learners' voice and did not explore how the practitioners affect the learners' engagement from practitioners' voice and perspectives as well as how this experience affects practitioners' professional growth.

Based on the evidence presented, there currently exists a gap in the literature investigating the impact of the presence of practitioners on pre-service teachers' TPACK development and cognitive and social engagement in the process of learning to teach within online learning communities. Moreover, recent research has recommended that future studies should focus on understanding the engagement of pre-service teachers with experienced practitioners and professionals in teaching practice using online tools (Fox & Wilson, 2015). One recommendation made by newly graduated students in Alebaikan's study (2016) concerned the importance of incorporating online practitioners within teacher education programmes in general as well as curriculum and instruction programmes in particular. In this respect, the prospective teachers need to engage with practitioners in order to obtain deeper insight into the teaching process. Therefore, there exists a need to conduct a research study with the aim of examining the feasibility of collaboration between pre-service teachers and experienced practitioners in order to enhance the learning to teach process.

1.2 Purpose of the Study and Research Questions

This study seeks to examine the role of practitioners in enhancing Saudi Arabian pre-service teachers' cognitive and social engagement in learning to teach within an online PLC. To achieve this aim, this study comprises three phases. Phase 1 examines the role of practitioners in affecting pre-service teachers TPACK development. Phase 2 explores the impact of practitioners on pre-service teachers' knowledge construction and social interaction in online PLC. Finally, Phase 3 investigates the pre-service teachers' experiences and perspectives about their participation in online PLC. Therefore, the study seeks to answer the following research questions:

RQ1: To what extent does introducing the practitioners lead to developing the pre-service teachers' TPACK knowledge? (Phase 1)

RQ2: What are the pre-service teachers' experiences and perspectives of engaging with practitioners in developing their TPACK knowledge? (Phase 1)

RQ3: To what extent does the involvement of practitioners increase the level of cognitive discourse in online pre-service teachers' PLC? (Phase 2)

RQ4: To what extent does introducing the practitioners lead to developing pre-service teachers' professional interaction? (Phase 2)

RQ5: To what extent does the involvement of practitioners lead to developing knowledge ties across the boundary between subject disciplines? (Phase 2)

RQ6: To what extent does the involvement of practitioners enhance collaboration between pre-service teachers with different levels of TPACK knowledge? (Phase 2)

RQ7: How does the introduction of practitioners affect the pre-service experience in the online PLC? (Phase 3)

RQ8: What is the practitioners' experience of engaging with pre-service teachers in an online PLC? (Phase 3)

1.3 Significance of the Study

The significance of this study lies in the need to identify a new method that can serve to better engage pre-service teachers in learning to teach with technology. As discussed above, there is currently no empirical evidence concerning pre-service teacher education programmes that specifically aid in understanding the impact of the presence of practitioners on the pre-service teachers' cognitive engagement (TPACK development and knowledge construction) and social engagement (network development), in an online PLC. The results of the current study could therefore contribute to the limited body of research concerning the impact of a community of practitioners on pre-service teachers' engagement in online PLC. The results may also contribute in identifying solutions to better understand pre-service teachers' networking based on their experience, which has been identified as an important area of research by several authors (Risser, 2014; Fox & Wilson, 2015). The current study provides insights for those involved in course design regarding how to design courses in such a way that the presence of practitioners positively enhances learning. It offers some insights for policy makers in terms of creating partnerships between schools and universities. The current study further offers a methodological contribution to the research in relation to understanding social interactions within online environments. As noticed in Section 1.1, the majority of the research that investigates the engagement of pre-service teachers with practitioners in an online learning environment used single method and did not include a combination of more powerful methods, such as Social Network Analysis (SNA) and Content Analysis (CA). Prior computational and social science research has suggested that in order to understand the complexity of the online learning process, mixed methodological techniques should be used to provide a holistic view of the learning process within online environments (Wesler, Smith, Fisher & Gleave, 2008; Eynon, Hjoth, Yasseri & Gillani, 2016). Eynon et al. (2016) suggested that different research methods, for example, SNA, CA and interviews should be incorporated in order to understand interactions within online environments. However, there do exist limitations in terms of using multiple research methods to understand the learning process within online environments. Carpenter and Kurtka (2015) conducted a systematic review

concerning teacher education and Social Network Sites (SNSs). They found that most studies relied on the interview and survey techniques to collect data, although they did identify some limited use of applied content analysis. In terms of SNA, they found that only one study used SNA to understand in-service teachers' interactions. Also, limited studies used experimental design to investigate the impact of practitioners on pre-service teachers' engagement. The review of current literature showed that only two studies used the quasi-experimental approach but both of them did not include a control group, making it difficult to justify the role played by the practitioners. Therefore, the current study will attempt to fill the identified research gap by using experimental design and incorporating mixed methods. It will also explain how specific measures of SNA can be incorporated with other research methods, such as CA and questionnaire data. In so doing, this provides insight into the structural and social relational perspectives on the social interactions that take place within online environments (Eynon et al*.,* 2016). Figure 1-1 provides an overview of the three phases of the research and methods involved into this current study, which will be described in more detail in Chapters 5, 6 and 7.

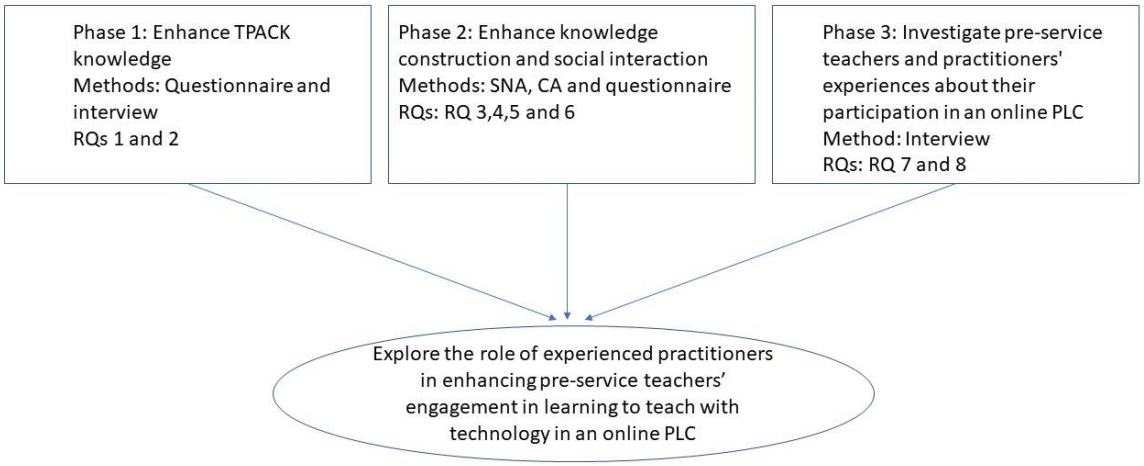


Figure 1-1: An overview of the three phases of the research and methods involved into this current study

1.4 Organisation of the Thesis

This thesis collectively constitutes a three-paper thesis. The thesis comprises nine chapters, including this introductory chapter. Chapter 1 provides information about the background and problem statement of the study, the purpose, aim, research questions of the study and the significance of the study. Chapter 2 provides an overview of the cultural context of this current study by offering some background information on teacher education and the place of ICT in teachers' education in the Kingdom of Saudi Arabia (KSA). Chapter 3 provides general literature and theoretical aspects related to this current study, such as learning to teach with technology,

CoP, social capital theory, engagement in learning to teach and the role of practitioners to enhance the learning process. Chapter 4 describes the methodology adopted in this study, involving the clarification of pragmatic approach, experimental and mixed method design. It also provides a general overview of the relationship between the research questions and methods used in this study. More details concerning the methods adopted in the three research phases are explained in their corresponding chapters (Chapter 5 to 7). Chapter 5 (Phase 1), seeks to examine RQ1 and RQ2 focusing on the role of practitioners in enhancing pre-service teachers' TPACK development. This chapter starts by first reviewing the relevant literature and theoretical aspect used to explore the research questions and gaps. It also reviews the methods and data analysis techniques used to examine RQ1 and RQ2. This chapter also presents the findings, discussions, limitations and future work. Chapter 6 (Phase 2) examines the role of practitioners in affecting knowledge building and social interaction among pre-service teachers, and answers research questions RQ3, RQ4, R5 and RQ6. Specifically, this chapter illustrates the methods used to answer the research questions. It also presents the quantitative findings using SNA, CA and questionnaires. It also illustrates discussion, some limitations and future direction related to cognitive and social engagement. The final research phase (Phase 3), Chapter 7, triangulated and confirmed the Phase 2 findings through in-depth qualitative interviews (RQ7and RQ8). This phase was focused on exploring pre-service teachers and practitioners' experience and perspective about their participation in an online PLC. It outlines the research method and analysis procedure to answer research questions during the interviews. It provides research findings related to both pre-service teachers' and practitioners' experience. At the end of the chapter, discussion, limitations and recommendations were provided. Chapter 8 discusses general conclusions and the original contribution to existing knowledge. Some implications for instructors, course designers and policy makers are presented. The Chapter concludes by outlining some limitations of the study and some potential avenues for future research.

Chapter 2 Context of the Study

2.1 Introduction

This chapter aims to provide a cultural overview of the setting for this study, namely KSA, and it comprises two parts. The first presents an overview of how religion frames the Saudi culture contributing to it distinctiveness. It will also highlight how polices and educational objectives in Saudi Arabia have been guided by Islamic beliefs and practices. This overview can help in a better understanding of the context where the participants live, study and learn to teach. The second part provides an overview of the higher education system in KSA. This is followed by a brief historical account of teacher education in Saudi Arabia, which includes information on programme structure and purposes. Some current issues in Saudi teacher education programmes are then highlighted in addition to a discussion on the role of technology in pre-service teacher education.

2.2 Religious and Cultural Context

Research suggests that many factors shape educational research, such as social, national and international contexts, and researchers should be aware of these factors (Cohen, Manion & Morrison, 2011). Teacher education programmes are necessarily situated within specific settings. Linde (2003) states, 'teacher education has to be analysed and understood in the context where it takes place' (p. 110). Given that this study was carried out in KSA, this section presents an overview of the Saudi cultural and social status in which initial teacher education is situated.

As previously stated, KSA is the place from which Islam emerged. Thus, the influence of Islam on Saudis' social, political and religious practices is significant (Alarfaj, 2015). All Saudis are Muslim, and Arabic is the official language of the country. In the Saudi cultural context, Islam enriches and impacts upon all aspects of citizens' lives. Thus, educational policies and objectives are all based on Islamic beliefs and practices. According to the principles of Islam, people of different genders should be separated if they are unrelated or unmarried, which has resulted in gender segregation policies in all Saudi state and private organisations, including educational institutions. Consequently, at all levels of education, Saudi men and women are educated in separate schools and campuses (Oyaid, 2009).

Despite the formalities of single-sex policies and religion in the Saudi context, there seems to be flexibility in living styles, and the traditional culture coexists with a relatively contemporary one. As Habbash (2011) states, 'Saudi Arabia is a multifaceted combination of tradition and modernity'. Similarly, current educational policies seek to be more effective in keeping with global developments to 'meet the growing economic and social needs of the nation…and shaping them into a workforce of international standards' (Habbash, 2011, p. 34). It is worth mentioning that technological breakthroughs play a significant role in disturbing traditional cultural practices and norms (Al-Zahrani, 2015). This fresh component of cultural heritage provides some opportunities for Saudi men and women to communicate with each other through technology and the Internet. However, culture seems to influence online interaction as well. Al-Saggaf (2004) observed that there were interaction restrictions in the online environment for Saudi people, with females being more apprehensive about interacting with their male counterparts imposed by their cultural belief. A recent study conducted by Abokhodair and Vieweg (2016) has found that Saudi women tend to interact in private groups when using social media and social networking sites due to cultural constraints. Moreover, they found that Saudi women tend to use pseudonyms when they make their accounts public.

Thus, religious affiliation and cultural expectations should be considered when designing educational activities and interpreting pre-service teacher interactions and behaviours (Hamilton and Richardson, 1995). These aspects are expected to affect pre-service teachers' practice and interaction.

2.3 Higher Education in the KSA

In Saudi Arabia, education has seen significant development in the last five decades. The country's higher education sector has evolved over the past 20 years to invest heavily in modernising its education system (Ministry of Higher Education, 2014). The Saudi government allocates 25% of its annual budget towards education to improve the quality of learning and teaching, establish new universities and to reform existing universities. Currently, there are 29 government universities (Ministry of Education, 2018). In fact, local authorities in KSA are aware of the importance of continuously enhancing the country's education system to keep up with global changes and respond to labour market requirements, both domestically and internationally (Ministry of Higher Education, 2014). As such, the government's efforts in education have focused on developing self-assessments and new programmes, and investing in programmes of global relevance (Ministry of Higher Education, 2014). The current government policy, called Vision 2030, focuses on reforming

the country's entire education system, including higher education. Vision 2030 advocates for enhancing the quality of learning and teaching as well as creating suitable labour market outcomes for Saudi higher education programmes (Saudi Vision 2030, 2016).

The higher education system seeks to provide different types of programmes that offer undergraduate and postgraduate degrees. The former includes associate diplomas and bachelor's degrees, and the latter includes associate higher diplomas, master's degrees and doctorates. It is worth mentioning that higher education is responsible for teacher education programmes. More information on teacher education programmes is presented in the next section.

2.4 Teacher Education Programmes in KSA

Teacher education programmes in KSA prepare teachers to take on different educational, psychological and societal roles, including the roles of social and psychological consultants. This enables educational decision-making processes by acting as cultural-religious transferors in and out of school environments (Alarfaj, 2015). According to several authors (e.g. Robertson & Al-Zahrani, 2012; Metwalli, 2008), Saudi teacher education is a multi-disciplinary practice that allows teachers to attain well-rounded general, pedagogical, educational and psychological knowledge. The process of developing teacher education programmes in KSA has gone through several critical stages. While the first stage prepared many Saudi teachers to fill the teacher shortage gap in schools, the second stage developed pre-service teacher education and enhancing current practice of in-service teachers. Table 2-1 summarises the development of teacher education in KSA, as described by Al-Asmari (2008) and Alarfaj (2015).

The first stage was linked to the early phases of establishing adequate education in KSA, when Saudi teachers were called upon to educate the populace. Within this stage, the first institutions for teacher education were created. The institutions phase one to four only prepared primary school teachers, and Saudi universities provided teacher education programmes for intermediate and secondary school teachers (Metwalli, 2008). After the Saudi government met the needs of providing adequate teachers, it shifted its focus to improve pre-service teacher education.

Table 2-1: Phases of Saudi teachers' education programmes (1925 – to date)

Phase	Institute	Features
One	Intermediate Teachers' Institutes (1925 – 1965)	To fill the gap in the shortage of Saudi teachers. A primary school certificate is required to enrol in these institutes. A three-year preparation programme. Graduate teachers only work in primary schools.
Two	Secondary Teachers' Institutes (1965 – 1975)	To fill the gap in the shortage of Saudi teachers and to enhance the practice of current teachers. An intermediate school education level is required. Graduate teachers only teach in primary schools. A three-year preparation programme.
Three	Intermediate Teachers' Colleges (1975 – 1988)	To fill the gap in the shortage of Saudi teachers and to enhance the practice of current teachers. A Secondary school education level is required. A two-year preparation programme. Graduate teachers mainly teach in primary schools.
Four	Teachers' Colleges (1988 – 2004)	To fill the gap in the shortage of Saudi teachers and to enhance the practice of current teachers. A Secondary school education level is required. A four-year preparation programme. Provide a Bachelor certificate of teachers' College Graduate teachers mainly teach in primary schools.
Five	Universities (2004 – 2017)	All teacher colleges moved under the umbrella of higher education institutions.
Six	Universities (2018 – to date)	Suspension of all initial teacher education programmes in order to reform the quality of these programmes.

In the second stage, which focused on improved initial teacher education, teacher colleges moved to higher education institutions, about which there has been significant debate. The proponents of this decision argued that the quality of teacher education programmes should be improved and that the high-quality standards set by universities would improve them (Al-Zahrani, 2015). In 2004, the Saudi government issued a decision to unite the teacher colleges with the closest universities once suitable transfer policies had been developed (Alarfaj, 2015). Consequently, these colleges follow the nearest universities in terms of academic standards and financial support. Furthermore, the association with higher education provides different types of programmes, such as bachelor's degrees in education, higher diplomas in education and some training courses for in-service teachers. It should be noted that there are some aspects can be shared between teacher education programmes in universities, such as admissions policies, study plan and type of teacher education. In phase five, there are two types of teacher education programmes—consecutive and concurrent—which are different in terms of structure, scope and

sequence. Both routes enable students to exit with the qualification to teach in schools. Alarfaj (2015) summarises these types of programmes as follows:

- In the consecutive teacher education system, students finishing their four-year bachelor's degrees in a major area of study ,then join the Faculty of Education and pursue a one-year educational preparation programme;
- In the integrative teacher education system, students study academic courses and educational preparation courses simultaneously. After four years, students can obtain bachelor's degrees in education with a specialisation.

This study is concerned with pre-service teachers who are studying in the consecutive teacher education system (one-year programme) that prepares them to be intermediate or secondary school teachers. This is because these pre-service teachers have less time to learn to teach compared to pre-service teachers who follow the integrative system.

Several researchers examined the quality of the initial teacher education programme in KSA between the period (2004- 2017). Alarfaj (2015) examined the quality of one-year pre-service teacher programmes in different universities in KSA and found that pre-service teachers were not satisfied with the programmes and felt that the level of knowledge was superficial and not linked to current teaching practices. Similarly, Alsaid (2007) evaluated the pre-service teacher education preparation programme at Umm Al-Qura University (UQU) and reported that both faculty and graduates of the programme agreed that the objectives of pre-service teacher education were not completely attained (Alsaid, 2007). In addition, Alsaid revealed that the primary transmission mode of teaching hindered preservice teachers' engagement in the process of learning to teach, and did not enhance their critical thinking.

At the end of 2017 (after the field work of this current study was conducted), the Ministry of Education decided to suspend all initial teacher education programmes in order to enhance the quality of pre-service teachers' educational outcomes and programmes. This was aligned with of the Saudi Vision 2030 objective. One of these objectives is to enhance the quality of teachers, reform and redesign the pre-service teachers' curriculum in order to ensure teachers have suitable skills for the job market. Therefore, this current study can provide insight for policy makers to envisage how they can enhance the quality of teacher education programmes.

2.5 ICT and Higher Education in KSA: The Role of Technology in Pre-service Teacher Education Programme

Over the last decade, higher educational policies in KSA have increasingly recognised the importance of employing ICT in the educational system to keep up with accelerated developments around the world (Bashehab & Buddhapriya, 2013). Utilising ICT in teaching and learning has become one of the main objectives of higher education reform not only because they want to provide the highest quality of teaching and learning, but also because of the increasing number of young citizens in KSA. As a result, the Ministry of Higher Education (MOHE) introduced a national plan for integrating technology in higher education and established the National Centre for e-Learning and distance education (NCEL) in 2006. The main aim of the national plan and NCEL are to integrate technologies and e-learning. The main objectives of the NCEL are:

- Designing and distributing educational software to facilitate the educational process in the public and private sectors;
- Increasing awareness of the culture of technology and e-learning, and contributing to building an information society;
- Organising conferences and workshops that seek to develop e-learning;
- Cooperating with international organisations and institutions related to educational technology;
- Promoting e-learning applications in the educational system in compliance with high-quality standards;
- Providing quality standards for designing, producing and publishing digital educational materials;
- Assessing and evaluating projects and programmes related to e-learning;
- Providing consultations for partners in the area of e-learning (National E-Learning and Distance Learning Centre, 2016).

Saudi vision 2030 places considerable emphasis on technology investment in order to enhance the learning and teaching process (Aldiab, Chowdhury, Kootsookos & Alam, 2017). The current plan for the MOHE has shifted from providing adequate ICT resources and infrastructure to universities, to enhancing the functional quality of resources for teaching and learning (Bashehab & Buddhapriya, 2013). Although efforts have been made to implement digital technology in Saudi higher education, it appears that the use of digital tools is still in its early stages, both in general and in pre-service teacher programmes. Al-Zahrani (2015) has found that two key factors hinder

the implementation of technology in pre-service teachers' programmes: the limited role of technology in the curriculum and the slow introduction of technology by university instructors. Regarding the limited role of technology in the pre-service teachers' curriculum, several researchers acknowledge that Saudi Universities did not pay attention to incorporate the technology as one element in the teacher education curriculum. According to Alshehri (2012), most initial teacher education programmes in KSA were designed using Shulman's (1986) Pedagogical Content Knowledge (PCK) framework focusing on pedagogical and content aspects, but the technology usually featuring in one module. This module typically focuses on the theory and general applications of educational technology (Al-Zahrani, 2015). Alqurashi, Gokbel and Carbonara (2017) examined Saudi teachers' perceptions of knowledge related to technology integration and they found that teachers' knowledge of subject content and pedagogy was greater than their knowledge of technology. Al-Abdullatif (2019) has reported that there were no education programs in KSA that provided adequate preparation for pre-service teachers in how to effectively integrate technology into their teaching practice. She also found pre-service teachers had a low level of perceived competence regarding technology-related knowledge.

As a result, many Saudi academics and teachers advocate that pre-service teacher education programmes should have a comprehensive view of technology in teacher preparation and training programmes (Al-Zahrani, 2015; Al-Asmari, 2008, Al-Abdullatif, 2019). This can be accomplished not only by incorporating technology in teachers' curricula but also by integrating technology into current teaching methods. It is very important to increase pre-service teachers' experiences with technology by helping them to use online systems and to familiarise them with certain technologies (Aljarf, 2016). Several scholars have reported that pre-service teacher programmes are weak in the effective use of digital technologies in learning and teaching (Bingimlas, 2010; Al-Zahrani, 2015). This is confirmed by Colbran and Al-Ghreimil (2013), who surveyed Saudi instructors at seven universities and found that more than half of instructors do not use Learning Management Systems (LMS) in their teaching practices. Moreover, Alqahtan (2015) identified a lack of student and instructor engagement with new technologies, such as Web 2.0 and social networking sites; thus, they are rarely employed in learning and teaching. Al-Abdullatif (2019) found that pre-service teachers had lacked the of use ICT in their professional development and in the opportunity of interacting with their peers to enhance professional growth. Alsaid (2007) evaluated the pre-service teacher education preparation programme at UQU in KSA and found that this programme did not assist pre-service teachers in creating relationships with their colleagues, other in-service teachers and professionals in the field or how to use the technology to enhance these relationships. Al-Zahrani (2015) recommends that pre-service teacher education

programmes need to encourage pre-service teachers to engage with new technologies such as SNS and Web 2.0 by using them as tools for their professional learning activities and interaction with others. He also recommends that online learning activities should be designed to stimulate pre-service teacher engagement. One of the aims of the Saudi vision 2030 initiative, is to improve education outcomes by providing different teaching and learning methods as well as effective professional learning opportunities for teachers.

It appears from the above review that initial teacher education in KSA needs to develop pre-service teachers' understating regarding technology integration, and enhance the learning environment by developing suitable activities that enhance cognitive engagement, and engaging them to use technology in their professional learning. Therefore, this study seeks to help the initial teacher education programme to engage pre-service teachers in the process of learning to teach with technology by engaging pre-service teachers with practitioners and peers in an online PLC. This would help pre-service teachers to create relationships with professionals in the field and increase their technology-related knowledge of current practices in schools. In addition, it would help them to learn how to use technology in their professional development.

Chapter 3 Literature Review

3.1 Introduction

This chapter aims to review the literature relevant to the present study and provide some theoretical aspects of this study. As such, this chapter is grouped into four themes in order to reflect the four elements of the study. The first theme concerns the concept of learning to teach with technology, which can help in understanding the processes involved in learning to teach with technology as well as current issues related to the concept. Also, it explores the key elements of learning spaces required for pre-service teachers with more emphasis on learning in hybrid spaces. This first section is considered the initial step which helps inform this current study about the most effective ways of designing a learning environment for pre-service teachers. In addition, it identifies which weaknesses should be overcome to provide an effective learning experience that not only focuses on enhanced TPACK knowledge (Phase 1), but also to engage pre-service teachers cognitively and socially in the process of learning to teach (Phase 2) and enhance their experience (Phase 3). The second theme considers pre-service teachers' networks with a focus on social capital theory. The theme of social capital can help to expand our understating of pre-service teachers' connections with peers and practitioners (Phase 2), and the importance of these connections in enhancing TPACK development (Phase 1), the knowledge construction and sharing in an online environment (Phase 2) and enhance the experience of pre-service teachers professional learning (Phase 3). The third theme pertains to online CoPs and the associated social aspects which help to explore how learning to teach can work in online PLC. Relatedly, the focus throughout will be on engagement in an online learning environment. It will explore the concept of cognitive and social engagement and how these concepts are related to the three phases of this current study. Finally, studies related to the use of experienced practitioners will be reviewed in order to explore the gap in this current study.

3.2 Overview of Learning to Teach with Technology

This section explores one of the substantive components of the study which is learning to teach with technology. The focus of this section is to discuss the processes which constitute pre-service teacher learning and the contexts in which pre-service teacher learning is enacted. This section is organised into four subsections. First, an understanding of learning to teach will be discussed in order to understand the most effective way that learning to teach can take place. Followed by an insight of learning to teach with technology. This subsection not only focuses on the type of

knowledge that teachers need to integrate technology, but also the context in which this knowledge can be formed. After that, some issues related to learning to teach with technology during the university phase will be explored in order to overcome the weaknesses of current learning to teach with technology approaches used by some universities. Finally, the key elements of learning spaces required for pre-service teachers will be discussed and more emphasis will be on learning in hybrid spaces. This section is considered as the first step that will assist this current study as to the most effective way of designing learning environments for pre-service teachers.

3.2.1 Defining Learning to Teach

In recent decades, many changes have taken place in relation to our understanding of the concept of learning to teach and its process (Feiman-Nemser, 1990). Zeichner (1983) and Feiman-Nemser (1990) provide different orientations towards understanding learning to teach, namely the traditional craft, technological, personal, inquiry, and social orientations. This section considers the concept of learning to teach through the lens of these orientations as well as linking it with the various learning theories.

During the period from the 1960s to the mid-1970s, learning to teach was typically viewed from a behaviourist point of view. During that period, learning to teach was viewed through the lens of the traditional craft and technological orientations. In terms of the traditional craft orientation, teaching was perceived as a group of observable behaviours. Lortie (1975) used the concept of 'the apprenticeship of observation' to perceive a phenomenon most people associate with learning to teach. According to Lortie (1975), this notion is dependent on the premise that being a pupil is similar to serving an apprenticeship in teaching. It is related to the fact that the typical learner has received around 13,000 hours with classroom teachers in a direct way since they graduate from high school (Lortie, 1975). When the prospective teacher was a pupil at school, they encountered different experiences through observing teachers with different teaching styles (Virta, 2002). Therefore, the notion of an 'apprenticeship of observation' has been viewed as equivalent to the assumption that teachers teach in the same manner they were taught. It has also been utilised to explicate the possible preservation of the approaches that teachers acquired in the past while they carry out their work in the present (Heaton & Mickelson, 2002).

Many studies have found that an apprenticeship of observation plays a significant role in influencing pre-service teachers' conceptions about teaching the profession (Goodman, 1988;

Johnson, 1994; Stuart & Thurlow, 2000). There are two important consequences of an apprenticeship of observation for pre-service teachers. The first is related to the teachers' construction of intuitive rather than reasoned responses based on their early learning experiences due to their inability to access the 'backstage' conduct of teachers, including the planning and decision-making practices of their own teachers (Rust, 1994). As such, they have acquired solely ready-made steps for action that relate to the overall setting of teaching rather than systematic interpretations of teaching that they can return to when most needed (Mewborn & Tyminski, 2006). Consequently, it is unlikely that the students can develop the pedagogical principles underlying their teachers' actions and conduct during the 'apprenticeship' stage. In other words, it would not be anticipated that they can analyse the teachers' observed decisions and behaviours in more detail. Another consequence of an apprenticeship is that individuals tend to ignore the complexity of the teaching profession, since many pre-service teachers feel that they can start teaching immediately without undergoing detailed preparation (Feiman-Nemser, 1990; Calderhead & Robson, 1991). Calderhead and Shorrock (1997) argued that an apprenticeship of observation can benefit pre-service teachers if it includes some interaction with experts and professionals in the field, which would allow the pre-service teachers to understand the decision making that informs the teachers' behaviour. This is consistent with the approach of Feiman-Nemser (1990), who stated that the focus should be shifted from the apprenticeship of observation orientation to a cognitive apprenticeship that allows pre-service teachers access to the process of expert thinking by negotiating the associated meaning.

Another orientation of teacher education that appeared during this period is the technological orientation or model. Freeman (2002) described how the characteristic of learning to teach in this orientation features a dichotomy between content and process. He has commented that learning to teach is perceived as the ability of the teacher to master the content and any separate methodologies for the transferral of that particular content to the students (Freeman, 2002). Wideen Mayer-Smith and Moon (1998, p. 133) referred to this method as a 'positivist tradition' and described learning to teach as a linear process in which the university is responsible for offering the relevant theory and knowledge through coursework, while the school is responsible for offering a field environment as a place for trial and error attempts (Brindley, 2013). Calderhead and Shorrock (1997) defined this method as a transmission model of learning to teach, which is viewed as an additional process of acquiring practical skills and knowledge in order to contribute to classroom practice. Although this approach may provide the necessary knowledge for pre-service teachers, the transmission model provides 'neither the interaction between prior and new knowledge nor the conversation that is particularly essential for pre-

service teachers' understanding and internalisation of teaching practice' (Richardson, 1997, p. 3). Therefore, this approach may fail to engage teachers in an exploration of knowledge (Richards, 1998). Hence, the link between theory and practice should be better established in order to help pre-service teachers to engage with the learning to teach process (Freeman & Johnson, 1998).

In the mid-1970s, the focus on observable behaviours in order to capture teaching phenomena started to change and the recognition of learning to teach as an active and personal process witnessed significant growth (Ball & Wells, 2009). As a result, the popular awareness of teachers' thinking and cognition has increased. According to Freeman (2002), learning to teach has so far been focused on teachers' life experiences and the contexts of teaching. In this period, two new orientations towards teacher education appeared, namely the personal and inquiry orientations. Learning to teach during in the mid-1970s was influenced by the constructivism theory that arose from Piaget's (1971) work. This theory assumes that people create their knowledge and meaning of the world through the interaction between their ideas and experiences. In terms of the personal orientation, it views teacher education as the principle of open education as well as the process of becoming a teacher and developing personally (Calderhead & Shorrock, 1997). It views learning to teach as 'a process of learning to understand, develop and use oneself effectively' (Feiman-Nemser, 1990, p. 32). This orientation encourages the discovery of personal strengths by providing safe environments for experimentation (Zeichner, 1983). According to the personal orientation, the concept of learning to teach posits that learning can be seen as a dynamic and practical process, while the teacher learner can be perceived as an information builder who produces their respective personal depictions of reality. The new information provided in association with their previous knowledge, i.e. teacher learners are not seen as blank slates (Russell, McPherson & Martin, 2001). Rather, they are particular people who bring with them previous experiences and cultural determinants to a certain case (Calderhead & Shorrock, 1997). They can thus be involved in a process of knowledge construction instead of knowledge acquirement based on their own individual experiences and knowledge of the setting. The teacher learners' construction and reconstruction of meaning can be conducted on a constant basis, which can be characteristic and personally noteworthy (Williams & Burden, 1997).

The inquiry orientation is another view of learning to teach that developed during this period. The reflective approach is considered one model of learning to teach according to the inquiry orientation. Calderhead & Shorrock (1997) stated that reflection is considered to be one popular approach to the learning to teach process. Dewey (1933, p. 9) defined reflective teaching as the

'active, persistent, and careful consideration of any belief or practice or supposed form of knowledge in the light of the grounds that support it and the conclusion to which it ends.' According to Dewey (1933), by means of reflective teaching, the teacher can critically examine issues related to teaching practices. Despite the value of reflective practices and the value of active engagement in building the knowledge necessary in teacher education, these processes focus on personal initiative (Moore & Chae, 2002). There is an inclination for pre-service teachers to become trapped in a self-defence or excuse-giving process because of their long history of apprenticeship of observation has a significant effect on their attitudes and presumptions regarding what teaching represents for them. Moore and Chae (2002) conducted a study to explore pre-service teachers' reflective practice, and they found that the most effective reflective practice is associated with support from their peers, cooperative teachers and supervisors rather than focusing on individual self-directed inquiry. In fact, the view of learning to teach as residing entirely in teachers' minds was criticised due to failing to focus on the context in which the learning process must occur (Kelly, 2006). Therefore, the focus was shifted towards social interaction and collaboration approach to the learning to teach process.

At the beginning of the 1990s, the significance of social interaction in relation to learning to teach became subject to increased attention within teacher education programmes. The importance of receiving support from other people was emphasised when learning to teach started to be perceived from a sociocultural point of view. As referred to in the sociocultural theory, human learning is seen as a vital process that occurs in social contexts and is disseminated among people and across tools and tasks (Vygotsky, 1978). Johnson (2006, p. 237) drew on the works of Lave and Wenger (1991) and Wenger (1998) to conceive learning to teach as 'the processes of learning are negotiated with people in what they do, through experiences in the social practices associated with particular activities… [and] through the knowledge of the communities of practice within which the individual practice.' From this perspective, one could argue that learning to teach can develop through relying on the particular social activities in which pre-service teachers engage as well as through using the conceptual tools of the community they belong to. Cobb and Bowers (1999) commented that learning to teach can be performed through social negotiation and the interaction of knowledge of self, pupils, subject matter, curriculum, environment and other people. In terms of the process of pre-service teachers, learning is an activity that is primarily facilitated by other parties, including mentors or colleagues (Johnson, 2006).

According to Zeichner (1983), this period was to some extent at least influenced by a social orientation, which asserts that teacher preparation should involve some engagement with the school community in order to develop school conditions and educational opportunities. Feiman-Nemser (1990) stated that this orientation focuses on the social consequences of teachers' actions for the school community by not only providing social support to the students, but also to other teachers working at the school in order to improve education. Calderhead and Shorrock (1997) used the term 'enculturation' or the socialisation model to capture this perspective on the learning to teach process. From the viewpoint of the enculturation or socialisation model, 'learning to teach is viewed largely in terms of induction into the institutional values and practices, the ways of thinking and acting that predominate within the school' (Calderhead & Shorrock, 1997, p. 11). It can be said that learning to teach is a complex task that requires an awareness of the thinking and decision-making processes of experienced practitioners within the school, which develops in a context characterised by a set of common values and norms of the community of teachers. Zeichner and Tabachnick (1981) commented that learning to teach requires an understanding of the customs and opinions that are not only assumed and appreciated within the organisation, but that have become rooted within its many taken-for-granted tasks and, hence, inevitably exert a strong impact on the new teacher.

Lawson (1986) proposed his occupational socialisation theory within the field of physical education. He defined the occupational socialization as all sorts of socialization that impact an individual to join the education field. This theory contains three aspects: acculturation socialisation, professional socialisation and organisational socialisation. The acculturation socialisation focuses on the period prior to pre-service teacher education, as parents and relatives act as a role modelling influence the individual chooses within the teacher education programmes (Romarr & Frisk, 2017). Professional socialisation occurs during pre-service as interaction with teachers and peers influence their conception of teachers' identity (Hushman, 2013). Organisational socialisation takes place during in-service training, teacher being influenced by the interactions with the school community (Hushman, 2013). Lacey (1977) described the steps taken by new teachers within the school environment in order to discuss their way of incorporating themselves into the school community, and being transformed to fit in with a number of school values and practices, so that they can be accepted within the school. In Lacey's (1977) study, the pre-service teachers attempted to influence others in the school as well as going along with other teachers. Based on this perspective, Calderhead and Shorrock (1991) described the pre-service teachers' process of learning to teach as one of weaving their way amongst, and often identifying with, like-minded individuals or groups of teachers from whom they can seek support. It can be

said that this perspective on learning to teach emphasises the role of interaction with others and, more importantly, more knowledgeable people in the field and those who act as practitioners (experienced in-service teachers, mentors or colleagues) in an environment that involves the norms of the teaching profession. Brown, Collins and Duguid (1989) considered practitioners to represent the cultural domain of the community, while the discourse that results from conversation with them is seen as a cultural tool of the community.

However, this does not mean that learning to teach should take place in a work environment, for example, a school. Learning to teach can happen by engaging pre-service teachers in an activity that helps them to engage with the normal practices of the culture (Brown et al., 1989). For example, Kiely & Askham (2012) used the concept of 'furnished imagination' to define learning to teach from a sociocultural and situated perspective. The concept of 'imagination' in their study is derived from Wenger's conceptualisation of learning, which considers identity as a method of perceiving how learning can alter who we actually are and shows how it produces individual stories of being contextualised in the society (Kiely & Askham, 2012, p. 5). Based on the approach of Kiely & Askham (2012), learning to teach is viewed as engaging pre-service teachers in conversational activities that include some sort of imagination and discussion of future practices with enthusiasm and a sense of belonging to the teaching profession. It could be said that learning to teach not only focuses on social interaction as a means of cognitive engagement (i.e. conversational activity), but also emphasises the role of affective engagement through the sense of belonging to the community of the teaching profession.

In fact, the value of socialisation in pre-service teacher education programmes is well appreciated. This is because learning to teach has increasingly been known as a situated social practice (Samaras & Gismondi, 1998; Johnson & Golombek, 2003; Hawkins, 2004) in which pre-service teachers build their knowledge about teaching by means of interacting with their peers and practitioners in the education field, including in-service teachers. Therefore, in the current study, learning to teach is viewed as a social process and it is located within the boundaries of socio-constructivism and situated learning. Thus, learning to teach is referred to in this study as an enculturation process that is embedded through an activity that requires social interaction and conversation about the trends and issues inherent within teaching practice. This is achieved by learning to use the conceptual tools of the teaching profession as practitioners of that cultural domain. In this study, community-based learning form the framework of a learning to teach process that makes use of participation rather than individualism (Lave and Wenger, 1991).

Having established an understanding of learning to teach, the next section will discuss learning to teach using technology.

3.2.2 Learning to Teach with Technology

Initial teacher education programs need to develop pre-service teachers' knowledge and skills concerning how they can effectively integrate technology integration in their future practice. Integrating technologies into teaching and learning remains a challenging task for many teachers (Abbitt, 2011; Mishra, Peruski & Koehler, 2007). Mishra and Koehler (2006) acknowledge that "integrating technology into teaching is not easy" (p. 2). This requires teachers to have adequate knowledge of how they can effectively integrate modern technology into the learning and teaching process. Fisher, Higgins and Loveless (2006) pointed out that teacher knowledge is multifaceted and that it involves much more than simply knowing the subject. Although content knowledge remains a foundation stone, it is not a sufficient component of teacher knowledge (Shulman, 1986). Indeed, teacher knowledge is a far more sophisticated phenomenon that requires a deep understanding of various types of knowledge. As a result the complexities involved in determining the knowledge that teachers need in the digital age, an important theoretical framework has emerged: Technological Pedagogical Content Knowledge (TPACK). This framework considers the role of technology in teacher education. The TPACK framework was developed by Mishra & Koehler (2006) who have built on Shulman's (1986) framework of pedagogical content knowledge (PCK). In the TPACK framework, three domains of teacher knowledge are considered: content, pedagogical and technological knowledge. As illustrated in Figure 3-1, three core forms of teacher knowledge are considered in the TPACK framework: Content Cnowledge (CK)- knowledge related to the subject matter; Pedagogical Knowledge (PK)- knowledge about the teaching and learning methods; and Technological Knowledge (TK)- knowledge about the nature of technologies and the necessary skills to use the various technology tools. From the intersection of the core knowledge, four components of teacher knowledge emerged:

- PCK- knowledge about how teaching practices accommodate the subject matter
- TCK: Knowledge about the kind of association between technology and subject matter.
- TPK: Knowledge about the impact of technology on teaching methods and learning practices.
- TPCK: Understanding the intricate links between the three elements in terms of knowledge content, pedagogy and technology.

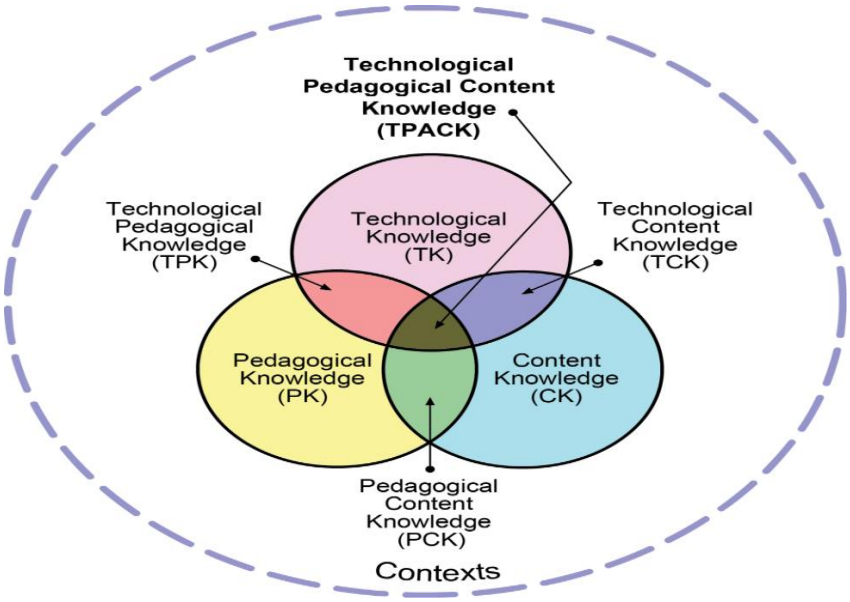


Figure 3-1: TPACK Framework

Mishra and Koehler (2005) have argued that simply introducing technology as part of the learning process does not mean that the teacher is integrating technology in an effective manner. Integrating technology alone cannot lead to effective changes in the process of teaching and learning. Mishra and Koehler (2006) stressed that technology should be regarded as a "knowledge system", arguing that teacher knowledge concerning technology should not be considered in isolation from the teaching process because good teaching practices should link technology with pedagogy and content.

Several scholars acknowledged that context can influence teachers understanding and formation of TPACK knowledge (Mishra & Koehler, 2006; Cox, 2008; Phillips, 2016). For example, Mishra and Koehler (2006) state that

> The core of our argument is that there is no single technological solution that applies for every teacher, every course, or every view of teaching. Quality teaching requires developing a nuanced understanding of the complex relationships between technology, content, and pedagogy, and using this understanding to develop appropriate, context-specific strategies and representations. (Mishra & Koehler, 2006, p. 1029)

Rosenberg and Koehler (2015) have defined context in relation to TPACK as 'the conditions around the knowledge and activities of teachers' (p.2619). Rosenberg & Koehler (2015) have argued that during the developing TPACK knowledge, context cannot be detached from teachers as teachers developed their TPACK knowledge in-context. Vygotsky emphasised the importance of social and cultural factors surrounding the learners' contexts in mediating their psychological

development. A growing body of research has found that social and cultural context of teacher professional learning can provide opportunities for enhancing teachers' TPACK knowledge as well as technology integration (Glazer, Hannafin, Polly & Rich, 2009; Phillips, 2017). Cox (2008) reviews several studies which have employed TPACK and found the majority of these focused on measuring TPACK and tended to ignore the context in which the TPACK is formed or developed. PorrasHernández and Salinas-Amescua (2013) advocate for understanding the different social contexts that influence TPACK development, and they argued that focusing only on the school community as a social factor may narrow our understanding other social contexts that influence teachers TPACK development. Phillips (2017) acknowledges the importance of considering the pre-service teacher programme (university-based context) as the main socio-cultural context factor influencing the development of TPACK knowledge. Phillips (2017) and Albion, Jamieson-Proctor and Finger (2010) emphasise the understanding of socially-mediated factors that influence pre-service teachers during their learning about technology in pre-service teacher education programmes. Several researchers (e.g. Banas & York, 2014; Lim & Chan, 2007; Phillips, 2017) have argued that engaging pre-service teachers in social-cultural contexts during their university-based experience provide opportunities to collaborate with other teachers, discussing and collaboratively reflecting can enrich their understanding of the relationships between and among content, pedagogy, and technology effectively. This means that enhanced pre-service teachers TPACK knowledge and technology integration need to consider the context of teacher education programme and their experience in this university-based programme context and work in enhancing the learning. Therefore, the next section provides comprehensive understanding of current issues related to learning to teach with technology during the university-based context in order to address these issues.

3.2.3 Issues of Learning to Teach with Technology in a University-Based Context

Learning to teach in a teacher education programme involves two main contexts: university-based and school-based (practicum). In this study, the focus will be on learning to teach during the university-based element. This is because the preparation of pre-service teachers is extremely important to their success in their future classroom practices, and helps them to make a good connection between the pre-service university-based phase and field experience in a school (Zeichner, 2010). According to Phillips (2017), there is need to enhance the context of teacher education in order to enhance the TPACK development and forming .As stated by Freeman (2002), a teacher education programme should enrich the process of learning to teach by focusing on activities that consider the essential elements for preparing good teachers. Therefore, this

section will discuss the key issues in learning to teach in university-based learning to best prepare pre-service teachers for real classroom teaching.

Many researchers acknowledge that a lack of practical preparation for real teaching during the university phase can hinder pre-service teachers in providing a good teaching experience, both during the practicum and in their future careers (Allen, 2009; Wilson Floden & Ferrini-Mundy, 2002). There are two reasons for this lack of preparation. The first is associated with the teaching approaches that some universities follow. According to Jones et al. (2015), the transformation approach that some universities use to prepare pre-service teachers to integrate technology does not correspond to good teaching practices, nor does it emphasise deep understanding of the adapting technology in their future practice. This type of approach focuses on activities that require content recall more than deep learning. For example, Aslan and Zhu (2015) have conducted a study on a teacher education programme in Turkey, and found the teaching approach applied by the university, which focused on a lecturer-based classroom, hindered the pre-service teachers' understanding the complexity of technology integration. Saudi Arabia is dominated by the behaviourist approach, which focuses on lecture-based learning (Gashan, 2015). In the transmission approach to teacher education, pre-service teachers are seen as containers to be filled with theoretical knowledge (Freeman & Johnson, 1998; Roberts, 1998). This was confirmed by Gashan (2015), who conducted a study to investigate the perceptions of Saudi pre-service teachers about the relationship between pre-service teacher programmes and deeper thinking, finding that the majority of pre-service teachers felt that the courses in the university did not foster deep thinking around practical teaching issues. Also, this type of method may not help pre-service teachers to engage in the complexity of the teaching context. For example, Allen (2009) has conducted a study to examine the experiences of pre-service teachers in a teacher education programme and found that the pre-service teachers faced difficulties applying the theories they had learned in university within their school placements. They found the classroom environment to be very sophisticated, and they were unsure of how to incorporate theory into that complex context. Tondeur et al. (2012) have reviewed several studies related to preparing pre-service teachers to integrate technology in education, and found that the lack of providing an effective teaching approach by university lecturers hindered pre-service teachers from integrating technology in their future practice as well as not providing opportunity for pre-service teachers to link theory with practice. Hence, it appears that this method may fail to link theory and practice (Ingvarson, Beavis & Kleinhenz, 2004).

The second reason, which is linked to the lack of practical preparation, is related to the duration of the school placement. Some scholars associate the lack of practical preparation to the short duration of a school placement, compared to the university-based learning in pre-service teacher programmes (Russell et al., 2001; Mattsson, Eilertsen & Rorrison, 2011). In the last 30 years, many countries such as the UK and USA have emphasised the shift to school-based experience (Kameniar et al*.,* 2017). However, in Saudi Arabia the duration of school placement is less than that in the university-based context, as pre-service teachers spend only three months in school across a programme of year in length. Proponents of a long duration of school placement have argued that more time spent in the workplace can enhance pre-service teachers' practices. Russell et al. (2001) have emphasised the role of personal experience and active engagement in teaching to develop pre-service teachers' knowledge and experience. However, it is not necessarily true that more time spent learning on the job will lead to more effective teacher education. For example, Hagger and McIntyre (2006) argued that increasing the amount of time in school is not sufficient in itself to improve pre-service teachers' practices, and the focus should be on improving the learning to teach during the school placement as well as in the university-based phase by providing effective methods for partnership between schools and universities. This was confirmed by Ellis (2010), who have found problems in learning to teach from experience for pre-service teachers in the UK during the school placement, arguing that the current methods do not enhance teachers' experience levels. Therefore, he recommended that a conversational approach should be taken with pre-service teachers and practitioners in schools to enhance pre-service teachers' knowledge. In fact, the value of theory that pre-service teachers gain in university-based learning should not be ignored. Kenny et al. (2016) have found that teachers with experience in teaching prior to enrolling in a teacher programme understood the value of theory; indeed, they registered in the programme to enhance their theoretical knowledge since practical experience in teaching alone did do not enhance their practices. Many researchers have emphasised the importance of pre-service teachers in understanding the theoretical aspects of technology integration by engaging them in authentic learning activities that enhance their learning (Tondeur et al., 2012; Ertmer & Ottenbreit-Leftwich, 2010). It can be said that the long duration of school placement may not enhance pre-service teachers learning as the focus should be on how to enhance their learning experience.

Therefore, university-based learning should use methods that help pre-service teachers improve their practical practice and make links between theory and practice. Jones et al. (2015) have stated that instructors of a technology integration module in teacher education programmes do not use methods that require students to think and learn deeply, to collaborate and to apply

learning to real practice, such as collaboration, problem solving and learning in the community of practice. Consequently, many researchers advocate providing an authentic learning activity to make pre-service teachers deeply engage in the process of learning to teach with technology (Tondeur et al., 2012; Ottenbreit-Leftwich, 2010). For example, discussing issues and trends in teaching practice by providing real life examples. Bueno-Alastuey, Villarreal and Esteban (2018) have investigated how the collaboration and discussion among pre-service teachers and instructors in an online learning environment enhanced their TPACK. This study has found that through discussion pre-service teachers develop their awareness of TPACK. Another example is allowing pre-service teachers to discuss in an effective way how to incorporate specific methods with their peers and teachers. For example, Kiely and Askham (2012) examined how pre-service teachers learn to be ready for working in real teaching practice, and this new understanding is based on the sociocultural theory. They use the notion of 'furnished imagination' as an exemplification of how pre-service teachers will perform in their future teaching practice. Learning to teach is seen as a way of deeply understanding the necessary knowledge for designing a lesson plan with enthusiasm and a sense of belonging to the teaching profession. Kiely and Askham (2012) found that this approach increases pre-service teachers' awareness of how they should perform in their future practice. They also found that this approach contributes to increasing pre-service teachers' confidence because imagining their professional future helps make a good connection between knowledge and practice, and makes sense of what they learn. Therefore, the instructors during pre-service teachers' campus-based learning should design activities that can enhance the pre-service teachers' engagement and learning. It appears that learning to teach activities require an environment that supports social interaction and discusses practices and activities that are relevant to their community.

Another issue in university-based learning is detach the campus-based course with field experience. Some studies found that the lack of collaboration between the university instructors and schools, whilst learning to teach with technology in the university phase, leads to a lack of preparation for pre-service teachers to integrate technology in their future practice (Jones et al., 2015). Although there are partnerships among universities and schools in many current teacher programmes, the relationships between these parties have some tensions. Kenny et al. (2016) stated that the main problem is that the policymakers and academics in the university see the school and university communities as separate communities in the context of teacher education partnerships. They also added that this view can decrease the opportunities for the development of mutual understanding and shared practices. Hus (2012) found that the lack of partnership between school and university during university-based context lead to a decrease in pre-service

teachers' awareness of ICT resources which negatively affected pre-service teachers' TPACK development. This lack of interaction may also result in the instructors, teaching the university module, not being fully aware of the current teaching practices or the existing school materials that their pre-service teachers will very likely encounter during school placement (Zeichner, 2010). This problem may influence the pre-service teachers' future practices, hindering their understanding of the ordinary practices of school culture.

Some pre-service teachers feel that the knowledge they acquire in the university is of little value when they enter the in-service phase (Zeichner & Tabachnick, 1981). For example, several scholars (e.g. Tondeur et al., 2012; Goktas, Yildirim & Yildirim, 2008) found that teacher education programmes struggle to prepare pre-service teachers to integrate technology during school placement and future practice. Allen (2009) determined that pre-service teachers found some teaching planning materials provided by instructors do not match their expectations, and the pre-service teachers usually seek to find teaching materials designed by experienced in-service teachers. Thus, indicating that pre-service teachers want to know how practitioners in schools design their activities. Hammerness et al. (2005) and Zeichner (1996) point out that pre-service teachers during campus-based experience lack access to the thinking and decision-making process of experienced practitioners, which is considered extremely important for pre-service teachers to learn. Although there is a current partnership among universities and schools in many teacher programmes, the universities continue to dominate the knowledge dissemination for pre-service teachers, and the schools are the places for trial and error attempts (Kenny et al., 2016; Zeichner, 2010). Even though pre-service teachers can interact with cooperative teachers during their field experiences, pre-service teachers spend more time in universities than in schools. For example, in Saudi Arabia, pre-service teachers spend only three months in school placements and around seven months in universities. Hence, the school staff (practitioners) have little impact on constructing pre-service teachers' TPACK knowledge when compared to the universities' academic staff (Hus, 2012).

Many researchers have argued that the collaboration between university-based learning and practitioners can help bridge the gap between theory and practice (Hammerness et al., 2000; Zeichner, 1996). It can help pre-service teachers to learn in the community of the teaching profession rather than in an isolated environment. Therefore, Alebaikan (2016) has conducted a study on teachers in KSA by connecting them with experts and recommended having opportunities to discuss issues concerning technology integration in teaching practice and

receiving feedback from expert practitioners helped pre-service teachers engage in the process of learning to teach with technology and can assist in linking theory and practice. As a result, many researchers advocate creating opportunities to engage pre-service teachers with practitioners during the university-based experience. By doing this, teachers are better prepared for the real world of teaching. In addition, this would fill the gap of any mismatches between the content of pre-service teachers' courses and the conditions of real classroom practice, as well as enhancing the pre-service teachers' understanding and experience of technology integration in learning and teaching (Dorner & Kumar, 2016; Alebaikan, 2016). Therefore, the pre-service teachers during university-based experience require a learning space link between the theoretical knowledge they receive from the campus course with practitioners' knowledge and experience. In this regard, the next section will discuss the learning space of pre-service teachers and what is the effective space for learning to teach in the pre-service teachers' programme.

3.2.4 Hybrid (Third) Learning Space: Linking University-Based Learning with Practitioner Experience

This study examines learning to teach with technology as a situated social practice, understanding the learning space and environment is very important to help us to understand how the learning to teach takes place. Scholars have divided learning spaces into three spaces: first, second and third (hybrid) spaces (Gutierrez, Baquedano-Lopez & Tejeda, 1999; Moje, Ciechanowski, Kramer, Ellis, Carillo, & Collazo, 2004; Soja, 1996). The first space refers to informal everyday environments, such as an individual's home, community and peer network (Moje et al., 2004). First-space learning usually refers to informal learning that results from the 'natural activity by a self-motivated learner' (Cook & Pachler, 2012, p. 152). An example of informal learning for pre-service teachers would be when pre-service teachers acquire knowledge or information when interacting with their peers. The second space refers to the discourse the individual encounters in 'more formalized institutions', such as learning in a classroom or a work environment that is usually associated with formal learning (Moje et al., 2004, p. 41). An example of a formal space is a classroom activity pre-planned by an instructor to meet pre-determined learning outcomes. For example, pre-service teachers are taught a new TPACK knowledge intentionally through activities designed by teachers.

Several scholars have argued that the integration of knowledge and discourse from different spaces can construct a third space (Bhabha, 1994; Gutierrez et al., 1999; Soja, 1996). This third space, or hybrid space, refers to the space that combines 'a different or alternative space of

knowledge and discourses' (Moje et al*.,* 2004, p. 41). Bhabha (1990) was the first person to use the term third space in post colonialism discourse to describe the hybrid space where different cultures meet. The idea of a third space comes from the hybridity theory and assumes that individuals make sense of the world through building on different funds of knowledge and discourse (Bhabha, 1990). Funds of knowledge refers to the knowledge, information and skills that individuals bring from their culture, community and home to the particular learning environment (Moll, Amanti, Neff & Gonzalez, 2005). Greenberg (1989) acknowledged that multiple funds of knowledge, such as an individual's home, peer network and other networks and systems, can shape individuals' practice as they move from home to their peer group, school or community. The diversity and hybridity in the third space play a role in producing the competing powers and knowledge that help in creating new learning activities, outcomes and roles (Gutierrez et al*.*, 1999).

In education, third space is considered as a conversational space allowing learners to bring different discourses in one dialogue (Moje et al., 2004). Over the past few years, there was increased attention on understanding the intersection between schools and universities activities in the third space (Cuenca, 2010; Cuenca et al., 2011; Martin et al., 2011; Williams, 2013; Zeichner, 2010). Zeichner (2010) envisages the hybrid space of learning in pre-service teacher programmes as linking the knowledge and experience of the university (second space of pre-service teacher) with the knowledge and experience of the school (second space of practitioners) by engaging the practitioner with pre-service teachers in the university. A hybrid space in teacher education minimises the disconnection between school and university, which can create new learning opportunities for prospective teachers. Therefore, the third space rejects the binaries of theory and practice and includes a conjunction of competing knowledge in a new way (Zeichner, 2010). Gutierrez (2008) argues that a third space is 'a transformation space where the potential for an expanded form of learning and the development of new knowledge are heightened' (p. 125). The incorporation of different funds of knowledge and discourse play an essential role in supporting pre-service teachers in learning how to effectively link theory and practice, and engage in the process of learning. Hybridity theory proposes that people in any community build on several funds and resources to make sense of the world, and in my context, to make sense of teaching practice with technology. Multiple funds of knowledge and discourse can predicatively enhance pre-service teacher teaching, social and cultural practices and pre-service identity development (Moll et al*.,* 2004). For many years, universities tried to create hybrid spaces for pre-service teachers during the university-based experience. This can be done through hiring some in-service teachers to teach some parts of a course in the pre-service teacher programme. In some

USA institutions, this approach is called clinical experience. For example, Zeichner (2010) describes the experience of the University of Wisconsin-Madison in the USA in creating a hybrid space for pre-service teachers to combine the academic knowledge they receive from the university with practitioner experience during the campus-based experience. The Literacy Methods course at the University of Wisconsin-Madison was taught with cooperation between the methods' instructor and in-service teachers. The course sought to connect the concepts and practices taught in the course to the expertise that existed within the school staff. For example, the in-service teacher was invited to the class and presented some aspects of her work or the pupils' work and the pre-service teachers could discuss and interact with in-service teachers. At other times, the pre-service teachers were studying particular subjects and had the chance to go to the school and observe the teachers and discuss issues with them. Another example of the hybrid space in pre-service teacher education is creating campus-based laboratory schools on the university campus that help pre-service teachers observe a particular teaching approach (Ball and Forzani, 2009). McIntyre and Hobson (2016) created a face-to-face professional learning community as a third space which included pre-service teachers with in-service teachers. They found that this space played a role in developing pre-service teachers' identity and engaged them in the process of learning to teach, and finding the space was very effective in terms of enhancing the networking and social interaction among pre-service teachers and in-service teachers.

Although these approaches attempt to strengthen the connection between campus and practitioner knowledge, there are still difficulties in changing the structure of teacher education institutions in terms of managing this partnership (Zeichner, 2010). The main difficulty is arranging the course's schedule with the practitioners' availability. Therefore, many researchers use the online environment as a third space to merge different fund knowledge and discourse. For example, Moje et al. (2004) used the term third space with secondary school students by making a connection between the out-of-school space with an in-school second space mediated by technology. They focused on secondary school students' literacy learning and observed how the different instructional, home and community knowledge and discourses, that teachers and students bring, can impact classroom discourse. In their study, the funds of knowledge in the first and second space enhanced students' learning. Similarly, Dredger, Woods, Beach, and Sagstetter (2010) have applied the hybrid space by integration of virtual literacy practices, such as blogging and e-mailing, with classroom activities. This space motivates students to engage in activities because they receive feedback from virtual audiences.

In this study, I propose a virtual space (online PLC) as a third space that attempts to create a productive 'hybrid cultural space' by merging the two different discourses: TPACK theory and knowledge of pre-service teacher curriculum with the practice and experience of practitioners. Thus, the third space (online PLC) can provides pre-service teachers an additional venue for interacting with practitioners and for combining academic knowledge with practitioners' experiences, as such exposure to practitioners in a normal situation is limited.

3.3 Pre-service Teacher Networks as a Way of Learning to Teach in an Online Environment: A Social Capital Perspective

In recent years, increased attention has been placed on understanding how pre-service teachers' social networks can support them in face-to-face learning or online learning. Scholars have argued that pre-service teachers' social interaction, that is embedded in social networks, can play a role in benefitting pre-service teachers to engage in learning to teach with technology. Social capital is considered as one important aspect that can explain the benefits that pre-service teachers gain from their networks, and has been used to explore the development of pre-service teachers as professionals (Fox & Willison, 2015). Social capital is an important concept in this current study, as it informs our understanding of pre-service teachers' connections with peers and practitioners (Phase 2), and how these connections are important in enhancing TPACK development (Phase 1), knowledge construction and sharing in an online environment (Phase 2), and enhancing the experience of pre-service teachers professional learning (Phase 3). Therefore, this section will provide an explanation regarding the social capital theory and their form in order to design effective learning experiences for pre-service teachers.

3.3.1 The Definition of Social Capital Theory

Social capital refers to the social interaction and personal associations through which individuals can build communities and commit to their role within the network. It refers to the collective knowledge, awareness, abilities and support efforts required to attain common objectives, or used to help other members deal with an issue (Putnam, 2000). It has been used to advance a wide range of social phenomena, such as community development and a collaborative culture. It is considered to be a key component that links members of a community (Preece, 2004).

Members of the community expect to offer and receive help from one another. These benefits both the individual and the community as a whole. Therefore, in the context of the current study,

social capital is defined as “the resources embedded in social relations and social structure which can be mobilised when an actor wishes to increase the likelihood of success in purposive action” (Lin, 2001, p. 24). As such, social capital in this current study views the social relations of a system is as an investment where accessing the resources of peers or practitioners is enabled in order to enhance TPACK knowledge development, knowledge sharing and construction in an online PLC. Therefore, the resources and knowledge that can be gained by pre-service teachers, through their shared ties with others, can assist in an understanding of the engagement of pre-service teachers in an online learning community. As the relational ties that pre-service teachers establish with others can play a role in the development their social network.

Fukuyama (2001) emphasises the role of collaboration in supporting the development of social capital, and defines social capital as the sum of capital present in people relationships. Therefore, social capital can be used as a theoretical tool to study social relationships. It also contributes significantly to an understanding of how social structures can affect the professional development in an online PLC.

3.3.2 The Forms of Social Capitals

There is a multidimensional notion to social capital which can be understood using different perspectives. There are two forms of social capital: structure and cognitive forms (Wilson, 2012). The structure form focuses on the social relationships and the cognitive form focuses on the content and resources (Edwards, 2010). Applying to this study's context, social capital can help pre-service teachers to reach professional support as well as support knowledge sharing and building in an online PLC and enhance TPACK.

Cognitive social capital is regarded as a shared meaning that is developed through shared language, code and narratives, within a particular social community. Shared language and code involve common linguistic items which have a specific contextual connotation in practice. Through language, pre-service teachers can interact with one another, exchange knowledge and develop collegial relationships. Lave and Wenger (1991) and Brown and Duguid (2000) have argued that shared language and codes help people to reach others and access information. Developing and creating shared meaning can be done through an ongoing process of interaction with members of the community. In other words, the system of meaning amongst groups of people can be developed through ongoing dialogue, and the collective actions of meaning making amongst a

member of the community (Weick 1995).It means that the cognitive social capital is very important to substance the online PLC and create rich amounts of meaning and understanding. However, Wenger (1998) states that well-defined community boundaries may act as an obstacle by allowing members to understand the new knowledge and language of other communities. According to Daniel, Schwier and McCalla (2003), communities that have rich meaning and share language can enhance their understanding of knowledge. Therefore, this study hypothesises that practitioners engaging with pre-service teachers can enhance their shared language, code and narrative. Consequently, this can expand their understanding of different TPACK concepts and experience of issues related to technology integration, as well as enhance the process of knowledge (resources) sharing and construction.

In terms of structure forms, it focuses on patterns of interaction and the properties of these patterns in the network (Nahapiet & Ghoshal, 1998). Structure social capital focuses on social network including nodes (i.e., people/groups), and the ties (relationships) between them. Investigation of structure can provide insight related to the process of collaboration in how individuals reach and create the resources (Fox & Wilson, 2015). The processes can help understand how pre-service teachers access these resources and how they share and construct knowledge. Access to social capital can be affected by density of individual ties in the network, the individual attributes distribution and tie distribution on the whole-group level (Baker-Doyle and Yoon, 2011).

Regarding the density of individual ties, teachers with many social ties can access useful resources through these social relations (Moolenaar & Daly, 2012). Networks that have dense and cohesive relationships among members can play a role in transferring and developing knowledge within the network. However, a limited amount of relationships can hinder the members within the network in collaborating and reaching the required objective (Daly and Finnigan, 2010). If the teachers do not interact with each other, they become isolated from the community, will not be able to access other social capital, and share their knowledge with others (Mehra et al. 2001).

Another feature of structural form is related to the distribution of individual attributes in the network. This related to the concept of the diversity of the ties. Burt (1992) states that the diversity of the network is important. Interaction with teachers with similar interests may not result in the acquisition of new teaching practice ideas. This is because diversity in the network

can enhance teachers' outcomes as a result of receiving different perspectives from people with dissimilar experiences (Fox & Alison, 2015). Several studies have found that the pre-service teachers, during university-based campus, usually interact with tight-knit groups (peers from similar coherent disciplines) (Smith, 2007). Zeichnier (2010) found that the pre-service teachers' community, during the university-based context, is usually isolated from the in-service teachers and school community. According to Smith (2007), this isolation can negatively affect the pre-service teachers' professional development in which they lack access to the knowledge and resources that practitioners (in-service teachers) have in schools. Hezlett and Cibson (2007) argue that interaction between pre-service teachers with people outside their inner group and social system can expand the opportunities to enhance their knowledge. This is similar to concept of the weak ties proposed by Granovetter (1973). Granovetter (1973) has stated that weak ties can provide opportunities for accessing new information which can be increased through different contacts. The idea of Granovetter is similar to the notion of boundary crossing which refer to individual's interaction and moving in different places (Suchman, 1994). Creating a bridge between a pre-service teachers' community and the practitioners' community can provide the opportunity to access new knowledge. Diversity in knowledge is required by pre-service teachers, so contacting people with similar interests may not result in the acquisition of new teaching practice ideas. Thus, the assumption is that creating online PLC, combining different individuals from different social systems (practitioners and pre-service teachers from different disciplines) can enhance pre-service teachers' professional learning and growth.

The tie distribution on the whole-group level is considered another factor which can affect access to the social capital. This is related to the balance in distribution of individuals with different attributes in the network. Daly et al. (2010) state that network with too many cliques can hinder the changes relating to teachers' development. For example, cliques which include pre-service teachers of high teaching performance can act as obstacles for the pre-service teachers in accessing the knowledge of high performing teachers, thus preventing enhancement of their knowledge development. So, the online PLC needs to encourage the sharing norm among pre-service teachers from different disciplines and knowledge levels. Therefore, this current study seeks to enhance the interaction among pre-service teachers by facilitating techniques used by practitioners.

3.4 Learning to Teach in an Online Professional Learning Community

In recent years, the Online Professional Learning Community (PLC) has been recognised as a useful collaborative learning environment that can enhance pre-service teachers' professional growth (Kirschner and Lai, 2007). Stoll, McMahon, Wallace and Thomas (2006) defined the PLC as a group of teachers who shared similar learning interests as well as discuss, analyse and solve the problem related to teaching and learning in order to develop their professional learning. Phillips (2017) and Balchin and Wild (2016) emphasise the importance of CoPs in influencing TPACK development and enactment. Saudelli and Ciampa (2016) and Balchin and Wild (2019) found that using CoPs to enhance the TPACK is missing from studies that focus on technology integration. More details of TPACK studies in Chapter 5 (Section 5.2.4). Le Cornu and Ewing (2008) contend that it is highly important for pre-service teachers to engage with communities of practitioners and to learn how to participate in a PLC. Such participation can transform the process of learning to teach, enabling pre-service teachers to expand their outlooks. Here, a personal and private perspective of learning to teach is improved through open public discussion and collective reflection, which facilitates the achievement of a professional standard. PLC is considered as one form of Community of Practice (CoP) (Parker, Patton & Tannehill, 2012). CoPs themselves tend to be used to guide the design of online learning communities (Hou, 2015). At this point, it is helpful to provide an explanation of the framework behind online CoP. The theory behind the CoP indicates that learning opportunities should be created for learners in which knowledge is established in both social relations and learning practices. The focus of this section is to understand the processes of pre-service teacher learning through CoP. This section is organised into three subsections. First, the definition of CoP will be discussed. The second section focuses on the social aspects of CoP. The third section will discuss Legitimate Peripheral Participation (LPP) which is considered one of the key components of CoP.

3.4.1 Definition of Community of Practice (CoP)

Much of the literature concerning teacher education is grounded in the social nature of teachers' learning. Teachers' socialisation is the field of investigation that focuses on the social aspects of teachers' education. The notion of 'socialisation' has been linked with the teaching profession for decades, as Danziger (1971) used this term when drawing from Waller's (1932) work. Danziger (1971) viewed teachers' learning as a process that focuses on how an individual can become a member of the teachers' community by learning the norms, knowledge and practice of the teaching profession or the specific school community. This view was also captured in the conceptual framework of Pollard (1982), who focused on understanding the influence of the workplace (school) on teachers' learning. In his view, teachers respond by means of their actions

to the context that shapes their perception of the community and who belongs to it. It can be said that this view of teachers' socialisation focuses on the community's ability to shape teachers' practice. In recent years, the literature surrounding teachers' socialisation has used the community of practice as a framework for enhancing pre-service teachers' professional growth (Kirschner & Lai, 2007).

In 1991, Jean Lave and Etienne Wenger established a new model for social learning. They studied people's relationships in different contexts, including the workplace, school, home and public places, examining conscious and unconscious behaviour through the lens of socio-constructive theory. They use the lens of the social relationship to suggest that learning is a way of becoming involved in a CoP. The focus of their work was to understand how newcomers become involved with old-timers. Lave and Wenger (1991, p.34) define CoP as 'a group of people who interact, learn together, build relationships, and in the process, develop a sense of belonging and mutual commitment'.

Drawing upon Lave and Wenger's (1991) work, Lieberman and Pointer-Mace (2008) examine teacher training from a CoP perspective, suggesting that learning to teach is 'rooted in the human need to feel a sense of belonging and of making a contribution to a community where experience and knowledge function as part of community property' (p, 227). A sense of belonging and a feeling of contributing to a community seem to be very important for pre-service teachers – these two features help trainees to discuss the success and problems that they encounter and to seek support from each other. Thus, pre-service teachers become engaged in their own professional development. According to Fox and Wilson (2015), the sense of belonging to a community of professionals is very important for pre-service teachers as it plays a continuing role in teaching professions.

Wenger (1998) also support the opinion that learning is 'a social participation' and knowledge is 'a matter of competence with respect to valued enterprises [and] a matter of participating in the pursuit of such enterprises' (p. 4). The view of communities from Wenger's (1998) perspective is that 'the social configuration in which our enterprises are defined as worth pursuing and our participation is recognisable as competence' (p. 5). It appears that such communities can foster professional learning among pre-service teachers, promoting a collective sense of knowledge

between pre-service teachers by assisting the exchange of ideas, promoting joint problem-solving and developing their teaching practice.

Members of communities of practice, as Wenger (1998, p. 47) has suggested, 'act as resources for each other, exchanging information, making sense of situations, sharing new tricks and ideas, making the job possible and the atmosphere pleasant as well as keeping each other company and spicing up each other's working days'. Thus, CoP highlight how learning is a social practice, while knowledge is an essential component of social relationships. As soon as pre-service teachers start to be involved in CoP where 'learning is their practice, they are engaged in practice which is the stage and the object, the road and the destination' (Wenger, 1998, p. 95).

Wenger, McDermott and Snyder (2002) point out that there are six elements which differentiate one community from another: size, lifespan, membership, location, formality and boundaries. From their perspective, a CoP may have a heterogeneous or a homogeneous membership. The number of members can be small or large. The group may last for the members' lifespan or it may disband after a short period of time. Moreover, CoP exist in different forms. Some are face-to-face communities, whereas others function online. Indeed, some groups combine the two approaches, using both physical and virtual methods of communication. Hou (2015) noted that online CoP may have some advantages over face-to-face CoP, since ICT tools can save all the interaction and knowledge exchanges and thus act as a repository. Goodyear, Parker & Ashley Casey (2019) have found that engaging teachers in online PLC through social media help to create deep discussions and increase professional relations among teachers.

In the present study, the members of the online CoP in question can be considered to some degree heterogeneous and to another degree homogeneous. In terms of the homogeneous aspects, all the participants in this study are female. Members of this CoP mainly fall into two categories: (1) the pre-service teachers' community and (2) the community of practitioners. The main difference between these two communities is that the pre-service teachers' community has not yet been exposed to teaching practice, while the community of practitioners is made up of people who have experienced teaching practice. For example, in-service teachers and those who work as learning resource specialists within schools. Hence, this CoP has some heterogeneous features in terms of the community they belong to. These communities tend to function via the online mode of communication because face-to face interaction is limited by geography, while the

online community offers certain advantages over the face-to-face community as mentioned above.

3.4.2 The Social Aspects of CoPs

Wenger (1998) outlines three main characteristics defining CoPs: mutual engagement, joint enterprise and the shared repertoire.

Mutual engagement refers to patterns of interaction between members of the community, as well as their commitment to the community (Wenger, 1998). Wenger (1999) argue that there is need to have shared task among people in community to decrease the unbalance 'power relations'. Mutual engagement is achieved when members become conscious of the importance of the contributions of others to the community (Gutwin & Greenberg, 2002). It is recognised that interactions within the community enable members to create a community culture and a set of established community practices. Wenger (1998) states that the mutual relationships embedded in members' interactions and relationships are complex, adding that CoP participation may include disagreements, challenges and competition.

Joint enterprise is the glue that creates community coherence. It refers to the common goals and shared interests that connect members of the community with one another (Wenger, 1998). Moreover, joint enterprise includes the negotiation of a set of community statements and expectations that are agreed by the membership. The members have a joint responsibility in terms of providing support and sharing information that their community needs. The members' responsibility involves 'what matters and what does not, what is important and why it is important, what to do and not to do, what to pay attention to and what to ignore, what to talk about and what to leave unsaid, what to justify and what to take for granted, what to display and what to withhold, when actions and artefacts are good enough and why they need improvement or refinement' (Wenger, 1998, p. 81).

Shared repertoire: Over time and through the negotiation of meaning, the members of a CoP develop a shared repertoire, including common ways of speaking, stories, artefacts, tools, discourses, concepts and histories (Wenger, 1998). This shared repertoire provides the members of the community with possible methods through which to improve their practice and handle problems. Wenger (1998) also points out that the larger and more diverse the repertoire is, the easier it is for the participants to create meaning. In the current study, it is expected that practitioners' engagement with pre-service teachers will enhance the shared repertoire as

practitioners will bring discourses, tools and practice methods from their working lives to the pre-service teachers' community.

3.4.3 Legitimate Peripheral Participation as a Means of Understanding Pre-service Teacher Engagement in the Community

Lave and Wenger (1991) argue that successful learning occurs in a CoP through the process of Legitimate Peripheral Participation (LPP). CoPs change the learning environment from a one-to-one relationship between an expert and a novice, to a community experience that takes the social aspects of learning into account. Lave and Wenger (1991) suggest that LLP is the first form of participation in a culture of practice – it permits the integration of novices or newcomers into a CoP. Lave and Wenger (1991) describe LPP as:

> a way to speak about the relations between newcomers and old-timers, and about activities, identities, artefacts, and communities of knowledge and practice. A person's intentions to learn are engaged and the meaning of learning is configured through the process of becoming a full participant in a socio-cultural practice. This social process includes, indeed it subsumes, the learning of knowledgeable skills (p. 29).

Crook (2001) argues that it is necessary to fully understand the social dynamics of members' participation in CoPs, in order to determine the influence of each member upon the community. In the context of teacher education, LPP was used to describe the pre-service teacher engagement in school community and community of teaching practice. Pre-service teachers as newcomers learn and work collaboratively with practitioners or more experienced members in the school (in-service teachers) as old-comers, and this leads them to adapt the community's practices (Akkoç, Balkanlioglu & Yesildere-Imrie, 2016). As Lave and Wenger (1991, p. 49) contend, LPP connects 'issues of socio-cultural transformation with the changing relations between newcomers and old-timers in the context of a changing shared practice'. This feature is of interest in the context of the current study as it can help us to understand how the relationship between pre-service teachers and the community of practitioners facilitates improved knowledge about teaching practice. A peripheral experience to pre-service teachers can be provided by being involved in the community of practitioners through a legitimate access. Such a community can also help pre-service teachers to engage in the process of enculturation, enabling them to adopt the norms, behaviours, skills, beliefs, language and attitudes of the community of practitioners (Rogoff, 1990). Where the current study is concerned, the notion of LLP can assist with determining the position and level of power of each member in the learning network. Wenger

(1998) argues that members of a CoP have different positions and levels of authority, which are dependent upon the relationships within the group. He identifies different trajectories of CoP membership:

- Peripheral ('lurker'): A member who may not become a community insider, but who communicates sufficiently to be known as a member.
- Inbound ('novice'): A newcomer who seeks to become a member who fully engaging in a community.
- Insider ('regular'): A member who is fully committed to participating in the community.
- Boundary ('leader'): An experienced, committed member who provides various services and types of knowledge to the community.
- Outbound ('elder'): A member who intends to abandon the community for a particular reason.

Wenger (1998) argue that, 'by choice or by necessity, some trajectories never lead to full participation, yet they may well provide a kind of access to a community and its practice that becomes significant enough to contribute to one's identity' (p. 154). We can interpret this to mean that such memberships provide pre-service teachers with an opportunity to decide what is important to them and what is not. They have the full freedom to stay in or leave the CoP, this being a decision that depends on the reasons for membership.

The importance of scaffolding should also be noted here for its role in transforming a pre-service teacher from a legitimate peripheral participant into a full participant. The participation of a pre-service teacher in learning can be viewed here as a means through which to develop one's level of membership. Goodyear et al. (2019) recommended that in order to make the teachers active participants in an online PLC, it is very important to provide some sort of scaffolding by engaging some experts in the field to act as facilitators for their professional growth. Therefore, in the current study, it is hypothesised that practitioners could play a role in facilitating the full participation of pre-service teachers in a CoP.

3.5 Engagement in Learning to Tech in an Online Learning Communities

This section explores the concept of 'engagement' which is considered as an important theme of this current study. It begins by defining learner engagement and followed by describing how learner engagement can be understood and measured in an online learning environment. It helps to conceptualise our understanding of the two main engagement elements that pre-service

teachers need, which are cognitive and social engagement. It focuses on conceptualising the elements of social interaction in Phase 2 of this current study, and cognitive engagement in Phase 1 and 2. Community learning is particularly thought of as supporting the need for members' engagement in their district. Several scholars have argued that learning to teach in CoP requires engagement in this learning process. As Timperley (2008) demonstrated, learning in professional communities requires engagement on a larger scale. According to Wenger (1998, p. 95), engagement in learning within CoP is 'both stage and object and the destination'. This means that learning to teach is a process of participating and engaging in developing ongoing learning (Sinclair, 2008). Lemon (2014, 2015) emphasised understanding the quality of the engagement process in relation to learning to teach within a learning community to evaluate the quality of members' process of learning. Sinclair (2008) stated that learning to teach in communities helps to sustain interaction and participation among teachers. In a similar vein, Job-Sluder and Barab (2004) stated that engagement is considered to be the main factor in sustaining teachers' learning communities. Engagement is also understood as a valuable lens through which to examine the quality of the process of learning to teach. According to Lemon (2014), it is very important that pre-service teachers engage in the process of learning to teach, since this commitment can support their future professional development.

3.5.1 Defining Engagement

Researchers have placed great attention in defining the concept of learner engagement. As an abstract concept, engagement has been defined in various ways. Chen, Gonyea and Kuh (2008) describe engagement as the degree to which learners are engaged with their educational activities which lead to achieving desired outcomes, including gaining high levels of knowledge. In Chen et al.'s definition the focus was on cognitive engagement such as an increased level of knowledge. On the other hand, Coates (2007) the emphasis of his engagement theory was on the social aspect of learning. He defined engagement as the process of active participation in a collaborative and learning community environment. Coates did not attach attention to the cognitive aspect. Kearsley and Shneiderman (1998) place a great deal of emphasis on both the cognitive and social aspects of learning in their engagement theory. They define the engagement as learners should be "meaningfully engaged in learning activities through interaction with others and worthwhile tasks" (p. 20). Although the Kearsley and Shneiderman definition considered both social and cognitive aspects, they did not take into account the gain of desired outcomes, such as increased level of knowledge. This is considered very important for their academic engagement and development. Therefore, in this study, engagement is defined as a combination of previous

definitions that focus on a socio-cognitive view. Engagement is seen as participation of pre-service teachers in an online PLC, wherein pre-service teachers are meaningfully participated (i.e. higher level of knowledge construction) in learning activities through interactions with others in an online PLC (i.e. social engagement) to gain deeper understanding of TPACK knowledge (i.e. increase cognitive development). Phillips (2017) observed that successful learning to teach with technology is fostered in a professional community when mutual thinking, regarding pedagogical practice and TPACK is shared, and teachers are supported socially by other peers. Many researchers have confirmed that learning to teach is not a purely cognitive process, but instead requires social engagement as well (Fox & Wilson, 2015; Lemon, 2015).

Cognitive engagement denotes the task-specific thinking that learners employ while undertaking their studies and knowledge development (Lemon, 2015). The social engagement denotes learners' social interaction in academic and social activities, and feelings of interpersonal connection (Wang & Kang, 2006). It is important to note that these two elements are dynamically interrelated within an individual, and hence cannot be viewed in isolation. Indeed, Fredricks et al. (2004) argued that learners' engagement is a multifaceted phenomenon, the study of which can help educators to understand the complexity of their learning experiences. These two elements of engagement play important roles in pre-service teachers' professional development. For instance, cognitive engagement can help teachers to engage in deeper processes of learning (Kim, Kim, Yuan, Hill, Doshi and Thai, 2015). Lemon (2014) proposed that cognitive engagement can promote high-quality discussion and problem-solving, concerning various issues in teaching practice. Further, Kim et al. (2015) found that cognitive engagement with pre-service teachers encourages them to challenge themselves, making their discussions deeper and wider. They also consider different issues when collaborating in lesson design. Social engagement is also important. According to Santagata, Jovel and Yeh (2017), the social interaction among pre-service teachers is very important in terms of developing a sense of belonging to the teaching profession and increases interaction during the process of learning to teach. This enables pre-service teachers to engage more fully in learning activities. Lemon (2014) stated that learning in the context of learning communities requires all two elements of engagement, because a feeling of connection and active interaction with each other (social engagement) among pre-service teachers encourages them to share their thinking (cognitive engagement). More details of benefits and challenges of the engagement in an online PLC in Section 7.2.1

3.5.2 Cognitive and Social Engagement in an Online Learning Community

In order to identify the indicators of engagement in online learning communities, several researchers have developed indicators to understand learners' engagement in technology-supported learning environments in general, and online communities in particular. Social engagement was defined as social involvements and interactions with others, providing support, encouragement and developing relationships with others. Social engagement is crucial in sustaining learning in online communities. Lobel et al. (2002a; 2002b) defined this engagement in an online environment as attentive and active participation in collaborative discourse and information exchange. Risser (2014) has replied that the quantified number of messages may not be useful for measuring the level of social engagement, calling for a more sophisticated process such as SNA. This technique has been adopted by many researchers to investigate patterns of interaction and the social engagement in online learning communities, as well as professional learning and classroom interaction. It seems that this technique is very useful in understanding behavioural engagement in online CoP. This is because it can provide insight on the roles experienced by pre-service teachers in online CoP and can also explain the interdependencies involved in social interaction.

The cognitive engagement was viewed as the level of cognitive effort exerted by students during the process of knowledge construction (Wang & Kang, 2006). Knowledge construction is "a social process of information sharing, negotiating, revising and agreement achieving" (Wang et al., 2009, p. 97). In other words, it is a process that occurs through social interaction or collaboration with others to construct, build ideas and knowledge. Understanding the quality of knowledge construction in an online PLC can provide a view about the quality of professional growth among teachers and the quality of cognitive engagement.

Sinclair (2008) emphasises the importance of these two elements in learning to teach, as he stated that learning to teach relies on shared thinking and knowledge construction, active participation in the task of supporting teachers' development, and a sense of connecting to the community of learning to teach, all of which promote professional growth and development. Therefore, the current study subscribes to the view that engagement in learning to teach in an online learning environment is a multidimensional phenomenon that incorporates cognitive, and social elements in a meaningful way. The cognitive engagement in this study focuses on both understanding the TPACK knowledge development (Phase 1, Chapter 5), and the knowledge

construction in an online PLC (Phase 2, Chapter 6). On the other hand, social engagement focuses on the network structure and development (Phase 2, Chapter 6) and investigates both pre-service teachers and practitioner experience of the engagement in this environment (Phase 3, Chapter 7).

3.5.3 Theoretical Framework of the Engagement in an Online Learning Community

In an online learning community, it is essential to create a learning environment that supports learners' collaboration, interaction and engagement (Lemon, 2014; Salmon, 2013). Salmon (2002) developed an e-tivities model that can support collaboration best practice, interaction and engagement for computer-supported learning. This model can provide fundamentals steps regarding how to promote learning and engagement in an online environment (Yeh, 2010). This model includes five-steps which provides guidelines for designing online PLC that can support effective engagement for learners (See Figure 3-2 below). This five-step model includes access and motivation, online socialisation, information exchange, knowledge building, and knowledge development. Salmon (2002) suggested that designing online learning activities that consider these five steps can foster learning, engage learners, and build knowledge by encouraging social interaction and assisting in achieving desired learning outcomes. Therefore, adapting Salmon's model in this study can play a role in fostering knowledge construction (cognitive engagement) through socialisation with other members in the group (social engagement), which can enhance knowledge development (TPACK development). Salmon's model can also provide insights on how to provide an effective learning environment and scaffolding for pre-service teachers. In this study, Salmon's model is adopted as a theoretical foundation and a guide for designing and developing online learning activities (for further details on Salmon's model and designing online activities, see Section 4.4.1).

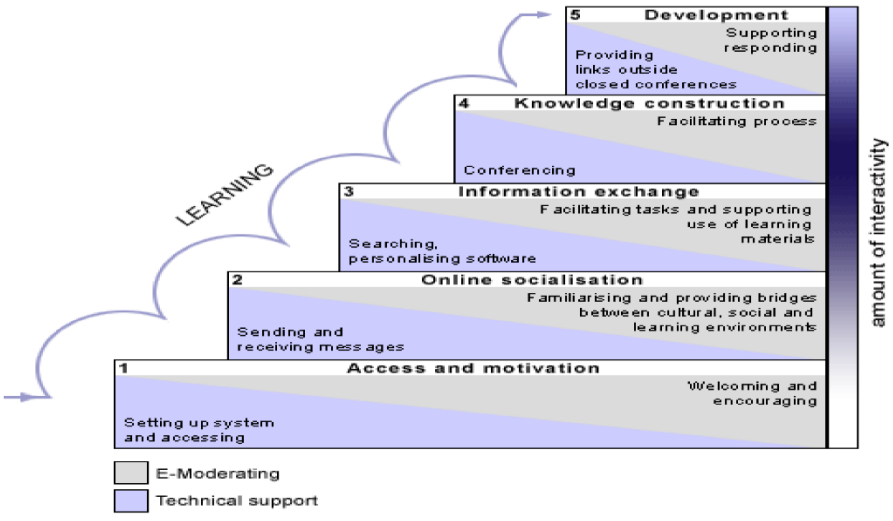


Figure 3-2: The E-tivities model

Another model that was developed to support engagement is the Community of Inquiry (CoI). CoI describes how groups of learners can collaboratively engage in the process of knowledge building and critical reflection to confirm mutual understanding (Garrison & Anderson, 2003). CoI focuses on the process of developing a deep and meaningful learning experience of an online learning community with an emphasis on the role of learners' social interaction and engagement in knowledge construction through different presence forms: teaching, social, and cognitive (Garrison & Anderson, 2003). Cognitive presence focuses on the process of knowledge building and fostering, social presence focuses on members' social interactions with others, and teaching presence focuses on the facilitation and scaffolding techniques (Garrison, Anderson & Archer, 2001). The community of inquiry model uses a framework to analyse and understand interaction and engagement in an online PLC. CoI highlights that knowledge is embedded within a social context. This means that knowledge construction (cognitive engagement) can be done through social interaction (social engagement) (Garrison et al., 2001). So, this inquiry can support the development of online PLC through collaboration and interaction. Adapting CoI in this study can provide insight into how pre-service teachers construct their knowledge collaboratively through social interaction.

One of the key components of CoI is cognitive presence. Garrison et al. (2001) define cognitive presence as "the extent to which the participants in any particular configuration of a community of inquiry are able to construct meaning through sustained communication" (p. 89). This study recognises the importance of fostering cognitive presence to enhance the quality of the discussion and cognitive engagement. Garrison et al. (1999) developed the cognitive presence coding schema to evaluate the level of knowledge construction in a learning process, comprising four phases:

- Triggering: Focuses on the posts involving some identification of the problem, such as asking a question
- Explanation: Focuses on sharing information and knowledge
- Exploration: Focuses on connecting ideas and creating solutions
- Resolution: Involves testing and critically assessing the solution

The first two phases represent a lower level of cognitive demand, while the latter two represent higher-level cognitive discourse (Hemphill & Hemphill, 2007). In this study, the cognitive phases can help determine the level of knowledge construction among pre-service teachers, which can assist the quality of knowledge building (more details regarding cognitive presence can be found in Section 6.2.1).

Having discussed the critical concepts of online PLC engagement, the following subsection examines the literature concerning the use of practitioners as pedagogical tools to engage pre-service teachers in the learning process. This enables the enhancement of pre-service teachers' engagement in an online PLC.

3.6 The Presence of Practitioners as Pedagogical Tools to Engage Pre-Service Teachers in Learning to Teach in an Online Learning Environment

The involvement of practitioners may bring about many benefits for students, and it has various uses in teaching and learning that will be discussed below. In brief, practitioners can provide an authentic learning experience, which enhances learners' engagement, participation, learning and motivation, and which can offer an alternate perspective on the course topic. In face-to-face environments, practitioners have been used in various ways to enhance students' engagement in courses or to establish links between theory and practice (Agha-Jaffar, 2000; Metrejean, Pittman & Zarzeski, 2002). For example, Mooney (1998) investigated the influence of the presence of practitioners on students' registration for future courses and found that students who actively engaged with a practitioner were more likely to register for a future course related to the topic discussed by that practitioner. Lang (2008, p. 1) observed another advantage of the presence of practitioners, noting that they 'can offer glimpses of the various realms that students are studying and may one day enter'. The presence of practitioners is therefore considered to be a teaching approach that can enrich students' experience and link theory with practice. Butler and Wielligh (2012) mentioned two important contributions made by practitioners. They observed that practitioners helped students to link theory to practice as well as providing networking opportunities for professional communities. Alebaikan (2016) also indicated that practitioners play a role in providing up-to-date, realistic information along with their own distinctive experiences. Kamoun and Selim (2007) has reported that inviting practitioners to participate in a course gave students the opportunity to understand concepts in a real-world practical context. Meanwhile, Li et al. (2014) indicated that the presence of practitioners not only helped students to learn better, but also to become more engaged in the process of learning. These benefits are of great potential importance to the participants in the current study. In terms of engaging pre-service teachers in the process of learning to teach, the presence of practitioners could potentially stimulate their thinking about classroom issues and deepen their cognitive engagement. Moreover, the presence of practitioners is a way of enculturating pre-service teachers into

professional communities, which can play a role in engaging them both cognitively and socially. Although it is possible to argue that online learning facilitators can play a similar role, experienced practitioners can stimulate learners' thinking and make their interaction more interesting, since it helps them to feel that they belong to a community of professionals (Dorner and Kumar, 2017).

Importantly, the integration of ICT and networked learning can provide more opportunities to interact with practitioners beyond face-to-face meetings. For example, online opportunities can enhance interaction and engagement with a wide range of practitioners (Costello, 2012). According to Hemphill and Hemphill (2007), the virtual guest expert experience is more interactive than meeting face-to-face with guest expert, since students can interact and discuss with them anytime and anywhere. In addition, Eveleth and Baker-Eveleth (2009) experimented with online discussion with practitioners, and they found that students' interaction and participation were high, and students enjoyed the learning process. Alebaikan (2016) has examined female Saudi students' perceptions of online and face-to-face guest, and she found that students preferred online experts due to their flexibility and accessibility.

Although the presence of the practitioners offers various benefits for learners, certain considerations should be taken into account when selecting practitioners. Lang (2008) stressed that the choice should be closely related to the course topic and it should be thought out in advance. Nathan and Petrosino (2003, p. 909) encountered obstacles when using experts, suggesting that they may exhibit an 'expert blind spot' when interacting with students. They added that when the experts have worked for a long period in their fields, it is more difficult for them to understand the challenges faced by newcomers (Nathan & Petrosino, 2003). Therefore, it is essential to carefully select practitioners and provide them with guidance on how they can best help students.

Certain considerations should also be examined in order to facilitate the involvement of practitioners. Nathan and Petrosino (2003) emphasised that the practitioner must ensure that they bring insights related to the course topic, while Alebaikan (2016) observed that students' learning experience is affected by the knowledge and experience that practitioners bring. She conducted a study on Saudi graduates from an education programme and found that practitioners were able to provide the students with new research topics for an assignment. Another consideration is the need to familiarise the practitioners with the learning environment and the

course content as well as to allow both practitioners and students to prepare in advance (Nathan & Petrosino, 2003). Barrett and Wuetherick (2012) recommended that preparation and familiarity with the students' context allowed practitioners to provide suitable information that meets the relevant learning objectives. Wearmouth, Smith and Soler (2004) recommended that practitioners should attend some training sessions prior to their involvement with students. Although the important of training and preparing the online experts was mentioned in several studies, there is no research conducted training program to the practitioners which this current study attempted to do.

Although the benefits of practitioners' involvement for students' learning have been noted, empirical research evaluating their effect on networked learning in general, and learning to teach in particular, has so far been limited. Table 3-1 summaries studies that investigate the role of the practitioner in affecting online learning.

Table 3-1: An overview of the studies related to the presence of practitioners

Authors	Aim of Research	Context	Participants (Sample size)	Methods	Key Findings
Wearmouth, Smith and Soler (2004)	To investigate the impact of practitioners' participation on students' (potential teachers) professional growth in a module for special educational needs coordinators.	One higher education institute in the United Kingdom	The online activity conducted with 228 students and two experts Interviews were held with 16 students	Quantitative data (number of contributions to discussion). Qualitative data (interviews).	The study found that the level of participation had significantly increased. The presence of practitioners facilitated reflection in the online learning community.
Hemphill and Hemphill (2007)	To examine the impact of the presence of practitioners on the level of Knowledge construction engagement among students.	One university in the USA.	16 students and two experts	Content analysis.	A high level of knowledge construction was seen to result, as practitioners increased students' level of interest
Costello (2012)	To examine students' perceptions of guest lecturers' impact on online learning communities.	One higher education institute in Canada	20 students and two experts The interview conducted with only	Qualitative data (interviews).	The initial finding of the research is that the guest speakers play a role in linking theory with practice.

			eight of the 20 students		
Alebaikan (2016)	To examine students' perceptions of online and face-to-face guest speakers.	One higher education institute in Saudi Arabia	Ten students and two experts The interview conducted with only four of the ten students	Qualitative data (interviews).	Students' have a positive experience with guest speakers in both contexts (online and face-to-face). Students' prefer online interaction to face-to-face, since the students can prepare themselves. Students' engage in the discussion with practitioners.
Liu (2005)	To investigate the effect of connecting expert teachers with pre-service teachers in an online environment on pre-service teacher's performance and their attitudes towards instructional planning.	Elementary teacher education program in Taiwan	24 preservice teachers and four experts. Both control and experiment group include 12 preservice teachers	Experimental study Questionnaire	Expert teachers played a role in providing guidance for pre-service teachers' performance and attitudes towards instructional design, more than those of pre-service teachers who participated in a face-to-face environment.
Dorner and Kumar (2016)	To investigate collaborative mentoring by participation in an online learning community, to help pre-service teachers integrate technology into their teaching practices.	One teacher education program in Hungary	116 Hungarian pre-service teachers Three experts	Questionnaire	This study found that interaction with experts enhanced pre-service teachers' computer use and internet ability, and their satisfaction with the online learning community.
Dorner and Kumar (2017)	Pre-service teachers stratification in engaging with expert in-service teachers.	One teacher education	154 Hungarian pre-service teachers Three experts	Questionnaire	The involvement of expert teachers with pre-service teachers in an online PLC to discuss issues around technology integration,

		program in Hungary			enhanced collaboration and communication among pre-service teachers as practitioners established share norms among pre-service teachers.
Redmond and Mander (2006)	To explore the role of in-service teachers in enhancing cognitive presence among pre-service teachers in an online PLC.	One secondary teacher education program in Australia	33 Pre-service teachers and three expert in-service teachers	Content analysis	Engaging in-service teachers with pre-service teachers enhanced their problem-solving and thinking skills, but the extent of high-cognitive discourse was restricted due to their limited experience of online collaboration

Although the above table shows that the majority of the studies were conducted with a small sample size, these studies have been conducted across a range of geographic research contexts including the UK, the USA, Australia, Hungary, Canada, Taiwan, and Saudi Arabia, which builds an evidence on the presence of practitioners in the learning process. For example, the research provides insights into the role of practitioners in enhancing the discussion (Alebaikan, 2016; Costello, 2010; Hemphill & Hemphill, 2007; Redmond & Mander, 2006) the amount of online posts (Wearmouth et al., 2004), computer use capabilities (Dorner & Kumar, 2016), the design of lesson plans (Liu, 2005), and pre-service teachers' satisfaction with the learning environment (Dorner & Kumar, 2017). It also provides some evidence on pre-service teachers' preferences for online interaction with experts rather than face-to-face, as the online environment provides some flexibility for communication at any time (Alebaikan, 2016; Liu, 2005). Although the key findings from the above table provide insights into the role of practitioners in supporting learners, the quality of these findings needs further investigation. The previous studies relied on a single research method using a self-report instrument such as an interview or a questionnaire. Only two studies (Hemphill & Hemphill, 2007; Redmond & Mander, 2006) analysed the actual interaction through the use of content analysis methods. According to Chappel et al. (2002), analysing actual online discussions can provide insights into the features and characteristics of online learning. Previous research provides insights on the cognitive aspects of learning such as the level of knowledge construction (Hemphill & Hemphill, 2007; Redmond & Mander, 2006), quality of the discussion and reflection (Costello, 2010; Alebaikan, 2016), computer skills (Dorner & Kumar, 2016), and learners' performance towards instructional planning (Liu, 2005). However, previous research did not investigate the multidimensional perspectives of learners' engagement, for example, both cognitive and social aspects of learning and the impact of practitioners on community activities. According to Lemon (2014), both cognitive and social aspects of learning are needed to enhance the learners' experiences.

From the above review, it appears that most of the studies focused on the students' and pre-service teachers' perceptions and views concerning the involvement of practitioners. Only two studies were focused on the use of practitioners to enhance pre-service teachers' understanding about technology integration. However, one of these two study only focused on measuring computer and internet ability (Dorner & Kumar, 2016) and another study focused on pre-service teachers' perceptions (Alebaikan, 2016). No previous study has investigated the impact of practitioners on pre-service teachers' awareness and understanding of TPACK. Another limitation is that the previous studies did not explain how the learner became engaged in the learning

process. Li et al. (2014) noted that the research concerning online practitioners does not focus on the role of learners' active involvement within the online learning environment. Costello (2012) found that the studies investigating the presence of online practitioners have not examined the impact of practitioners on the community's group activity, enhancement of the learning experience and social engagement. Li et al. (2014) and Dorner & Kumar (2017) recommended that future studies should focus on the mechanism by which students engage in the learning process with practitioners. Furthermore, the majority of previous studies focused only on cognitive engagement, without social engagement. These previous studies did not focus on the mechanism of collaboration activities and interaction. They did not explore the development of professional collaboration relations and interaction with members with different department. Also, the previous study focused only on learners' voice and did not explore how the practitioners affect the learners' engagement from practitioners' voice and perspectives. Moreover, the practitioners' experiences of their participation with pre-service teachers was not explored.

They were also found to have methodological limitations. For example, most studies relied on a single research method, such as interviews, and did not consider more powerful methods such as SNA and content analysis. The combination of these methods could provide significant insight into the overall engagement of networked learning (Wesler et al., 2008). Only one study considered the impact of practitioners on the learning to teach with technology process. One of the recommendations made by newly graduated students in Alebaikan's (2016) study considered the possibility of incorporating guest speakers into teacher education programmes in general, curriculum and instruction with technology programmes in particular, since prospective teachers need to engage with practitioners in order to obtain deeper insights into the teaching process. Another significant limitation is that most of these studies were conducted in Western countries, while only one took place in the Gulf and Saudi Arabia region. Alebaikan (2016) has stated that involving practitioners was not a commonly used teaching approach in the Gulf region, and she recommended that future studies should focus on how practitioners can influence students' engagement in the Saudi context, since there exist different social and culture factors that may influence their participation with guest speakers.

Therefore, the current study seeks to fill the identified gap in the literature concerning the different aspects of the impact of practitioners' presence on pre-service teachers' engagement in learning to teach with technology within online PLC. First, it attempts to understand the impact of practitioners' presence on the process of cognitive and social engagement within online PLC.

Second, it seeks to fill the methodological gap by combining different types of research methods, including interview, questionnaire, content analysis and SNA. Finally, it will fill the local context gap by focusing on the Gulf region and, more specifically, female Saudi pre-service teachers.

Chapter 4 Methodology

4.1 Introduction

This chapter is considered to be an introduction to the methods employed within the three phases of this research. As mentioned in Section 1.2, this thesis includes three phases, which are described in Chapters 5 to 7. More in-depth discussion of the particular method of each phase is illustrated within the corresponding chapter. Therefore, this chapter provides an overview of the methodological approach and methods selected in this thesis. Section 4.2 tackles the philosophical assumptions underlying this thesis. Section 4.3 presents the overarching research methodology and research design. It describes the experimental design that was applied in this study followed by an introduction to the features of mixed-methods design and a rationale for its selection. Sections 4.4 and 4.5 tackle the research sample and setting. Section 4.6 discusses the criteria of selecting the practitioners and the training programme provided for these practitioners. Section 4.7 discusses an overview of the methods employed in this study and their relevance to each phase. The discussion of language translation issues and techniques is then explained in Section 4.8. Before ending the chapter with a reflection on research positionality in Section 4.11, Section 4.9 presents the outcomes of piloting study and Section 4.10 gives a brief note on ethical considerations.

4.2 Philosophical Assumptions

Ontology, epistemology, methodology and methods are the four elements that construct the researcher's philosophical stance. Guba and Lincoln (1994, p. 105) described the research paradigm as 'the basic belief system or worldview that guides the investigator, not only in choices of method, but in ontologically and epistemologically fundamental ways'. They also argued that these four elements are interrelated. This is because the nature of truth (ontology) influences the nature of knowledge (epistemology), which impacts on the researchers' choice of methods and techniques. In academic research, there are two major paradigms: interpretivism and post-positivism (Johnson & Onwuegbuzie, 2004). The post-positivism paradigm is associated with quantitative strategies and techniques, such as experiments, surveys and numerical data. This paradigm holds that research problems can be addressed by understanding cause-and-effect relationships, including what factors or variables influence the outcomes (Merriam, 1998). The interpretive paradigm is usually linked with qualitative strategies and methods, such as observation and interviews, which seek a deeper understanding of people's experiences of social

phenomena (Guba & Lincoln, 1994). Johnson and Onwuegbuzi (2004) stated that strengths and weaknesses are existed in each paradigm and when combining both worldviews in a study, research outcomes can be enhanced.

This research focuses on understanding how learning takes place in online PLC and the effect that this learning places on pre-service teachers' engagement. Learning in this environment is a complex process that involves cognitive and social dimensions (Illeris, 2003). Computational and social science research suggests that, to understand the complexity of the online learning process, researchers should combine various worldviews and mixed methods to provide a holistic answer to the research question (Wesler et al., 2008; Eynon et al., 2016). This is because online researchers not only need to understand the cause-and-effect mechanism of online learning, and its effect on learners' outcomes, but also learners' experiences and interpretations (Eynon et al., 2016). As the present study seeks to understand the cause-and-effect mechanism of practitioner participation in online learning communities and its effect on pre-service teacher cognitive and social engagement in learning to teach about technology, as well as pre-service teachers' experiences and reasons behind their engagement, a pragmatic research paradigm was selected for this study (Tashakkori & Teddlie, 1998). Pragmatism allows me as researcher the use of various methods, different worldviews and techniques for collecting and analysing data, enabling me to be free of restrictions forced by the 'choice dichotomy between post-positivism and constructivism' (Creswell & Clark, 2007, p. 27). Following a pragmatic approach allows applying 'what works' and employ both quantitative and qualitative methods, giving my research questions and problems the needed priority. Through the pragmatic approach, I can consider both the objective consequences and subjective processes of communication practices and the meaning of knowledge construction among pre-service teachers and practitioners.

In terms of ontology, it is concerned with the nature of existence and reality (Guba & Lincoln, 1994). Post-positivism assumes that there is an objective reality that exists outside of our thinking, while interpretivism assumes that there are multiple realities that rely on shared meaning constructed by a community (Guba & Lincoln, 1994). In this present study, I aligned myself with Walker and Creanor's (2012) views on the reality of the networked learning environment. Walker and Creanor believed truth is distributed in actors and entities in networked learning that exist independently of our knowledge, but interactions with these actors and entities can provide multiple and different views of reality. Accordingly, the truth exists 'out there' and can be interpreted and explained through an understanding of the interactions that take

place in networked learning (online PLC). In the present study, I explore the objective reality of causal links between practitioner participation and pre-service teacher engagement by examining multiple perspectives on the subjective processes of interaction practices and knowledge-constructing meanings of practitioners and pre-service teacher participants.

In terms of epistemology, or assumptions about the way in which the world works, I believe in subjectivism and objectivism. In other words, objectivism can provide insight into the cause-and-effect relationship between practitioner participation and pre-service teachers' engagement in the process of learning to teach. This can be achieved by gathering quantitative data, such as the TPACK development, by means of a questionnaire, as well as the level of knowledge construction through CA and measurements of individual positions through an SNA. Subjectivism can provide valuable insights into the process of causal mechanism of the interaction and knowledge-constructing among practitioners and pre-service teachers, as well as offering explanations of how pre-service teachers perceive their roles in an online PLC. This can be achieved by gathering qualitative data from online conversations and conducting interviews to understand individual views of the phenomena.

This position helps me as a researcher to mix different components of a single design that is expected to provide the most appropriate way to address each research question. Advocates of pragmatism recognise that the key advantage of the mixed-methods approach is that the strengths of each method are emphasised, while the weaknesses are reduced (Creswell, 2003; Tashakkori & Teddlie, 2003). Wesler et al. (2008) suggested that research of an online learning community should explore three levels of data: 1) the structural level by measuring patterns of interaction, which can be achieved by an SNA; 2) the thin level, which focuses on the content of the interactions using content analysis techniques; and 3) the thick level, which builds an understanding of the contexts, meanings and participant experiences using qualitative data, such as interviews. In this thesis, these three levels can help to explore the engagement in an online PLC.

4.3 Research Design

Burns and Bush (2004, p. 120) defined research design as ‘a set of advanced decisions that make up the master plan specifying the methods and procedures for collecting and analysing the needed information’. The main aim of research design is to obtain the most valid and accurate

answer to the research question (Macmillan & Schumacher, 1993). As I applied a pragmatic approach to understanding and answering the research questions, a sequential explanatory mixed-methods design, embedded within an experimental approach, was applied. This will provide a comprehensive understanding of the impact of practitioner participation on pre-service teacher engagement in learning. The following subsections provide further details on the applications of these two approaches.

4.3.1 Experimental design

To examine the influence of practitioners' participation on pre-service teachers' engagement in learning to teach about technology in an online PLC, an experimental design was selected. Based on a pragmatic view that seeks to identify a solution for a real-world problem, the experimental design assisted in identifying a solution for the lack of pre-service teacher engagement in the process of learning to teach. Therefore, it was expected that connecting pre-service teachers with practitioners would support engagement in the learning to teach process. The experimental design allowed the influence of the presence of practitioners to be determined. Cohen, Manion and Morrison (2011) stated that when a researcher seeks to determine cause and effect, an experimental approach is an ideal methodology for the investigation. Randolph (2008) also stated that experimental approaches can be used as a comparison method through which researchers attempt to alter a phenomenon and monitor its impacts, then conduct a comparative analysis of the findings. In an experimental approach, the researcher deliberately manipulates one or more independent variables to determine the effect of these changes on the dependent variables. In the present study, the independent variables are the practitioners' participation, while the dependent variables are the pre-service teachers' cognitive (level of TPACK development, knowledge construction) and social engagement (network development).

The nature of the problem investigated in this study required identifying ways to engage pre-service teachers in the process of learning to teach about technology in an online PLC, and one way is to connect pre-service teachers with experienced practitioners. To determine the impact of the influence, I compared the presence and absence of the experienced practitioners in pre-service teachers' online PLC. Therefore, the experimental approach was the most appropriate methodology to investigate and answer the research question, as it could provide explanations regarding whether the presence of practitioners could impact on pre-service teachers' engagement in the process of learning to teach. In other words, it could provide a form of comparison that other methodologies were not able to provide and allowed the researcher to

identify the effect of one variable (practitioners' presence) on another (pre-service teacher engagement).

The pre-test-post-test control and experimental group design with repeated measurement was used (Cohen et al., 2011). In this design, pre-service teachers were randomly assigned to either the control or the experimental group. The main reason for the use of the random assignment technique was to decrease researcher bias and to reduce the effect of exogenous and endogenous variables (Cohen et al., 2011). Regarding the random allocation process, all pre-service teachers who agreed to participate in the research were assigned a number on an Excel spreadsheet. The RAND function in Excel was used to generate random numbers for cells. Next, the pre-service teachers assigned to the experimental group received the intervention, while the pre-service teachers in the control group did not. The following formula explains the pre-test-post-test control group design, adapted from Cohen, Manion and Morrison (2011):

Experimental group: R O1 X O2 O3

Control group: R O4 O5 O6

The interpretations of the symbols, as indicated by Campbell and Stanley (1963, p. 13), are:

- X indicates the group exposed to an experimental variable
- O refers to the process of observation or measurement
- Xs and Os vertical to one another are simultaneous
- R indicates random assignments to separate treatment groups

The selection of this approach is supported by two factors. The first is that this design allows for comparisons between two situations (i.e. the presence and absence of practitioners) in determining the influence of practitioner participation on pre-service teacher engagement in an online PLC (Chandra & Sharma, 2007). Therefore, two groups are required to identify the influence. The second factor is related to the strength of the design, which takes prior performance of both the control and experimental groups into account and helps to determine whether there are any differences before and after the intervention is introduced (Chandra & Sharma, 2007). This is useful in determining the level of pre-service teachers' engagement for both groups before introducing practitioners. Identifying prior performances can help to reduce the impacts of other variables, which increases confidence in the findings and ensures that any differences found between the two groups are due to the intervention (Chandra & Sharma, 2007).

However, there is one challenge related to include the control group. One of the characteristics of experimental designs is the possibility that the control group will be denied any potential benefits as a function of the planned intervention. In fact, the researcher was intended to use crossover design to overcome this problem. However, because the crossover design is more appropriate for longitudinal approach and the researcher only had limited access to the research context. Therefore, classic design was selected, and the researcher used random allocation to provide opportunities to each individual to have a chance to participate.

In this study, pre-service teachers were to be randomly assigned to experimental and control groups. The module of education involves three activities related to one of the main themes of the module. Before the pre-service teachers began engaging in the online module activities, a socialisation session (ice-breaking session) was performed for both groups in order for the pre-service teachers to get to know each other. The activity was to encourage each pre-service teacher to introduce herself, explain what her subject discipline was and what her favourite hobbies were. A training programme was also provided for practitioners prior to their participation in an online PLC (details of this training programme are to be found in Section 4.6.2). Prior to introducing the intervention (i.e. practitioners) to the experimental group, both groups were asked to perform the same activity (one) on the online PLC in order to measure their levels of engagement. For the remainder activities (two and three), practitioners participated in the experimental group, while the control group conducted the activities without the stimulus provided by practitioners. The levels of engagement of pre-service teachers were then measured.

I was aware that it would be difficult to control all variables involved in the research. Chandra and Sharma (2007) pointed out that the nature of social science research makes it difficult to control all variables. There were several uncontrollable variables in the present study, such as internet access and pre-service teachers' experiences using ICT. Therefore, some tutorials on the selected SNS (Facebook) were provided to all participating pre-service teachers by sending some videos and guidelines, ensuring that they knew how to use the selected Facebook approach for learning.

4.3.2 Mixed-methods design

A mixed-methods approach is most commonly used by social science researchers when the research includes a combination of quantitative and qualitative methods (Creswell & Plano Clark, 2011). Mixed-methods design is considered to be the involvement of different methods of data

collection to answer one or multiple research questions (Creswell & Plano Clark, 2011). The research questions in this study required analysis of both quantitative data about pre-service teachers' level of TPACK, knowledge construction and online network behaviours (RQs 1, 3, 4, 5 and 6) and qualitative data of pre-service teachers and practitioners' experience and perspective of engaging in an online PLC (RQs 2, 7 and 8).

Another strength of mixed methods is in reducing the weaknesses of using a single method. According to Creswell (2009, p. 15), 'recognising that all methods have limitations, researchers felt that biases inherent in any single method could neutralise or cancel the biases of other methods'. Punch (2009, p. 290) recognised the importance of using mixed methods, stating that 'we can learn more about our research topic if we can combine the strengths of qualitative research with the strengths of quantitative research while compensating at the same time for the weaknesses of each method'. Therefore, the combined approach used for this research study provided a comprehensive understanding of the research problem as well as a corroboration of the findings (Johnson & Onwuegbuzi, 2004). For these reasons, different data collection methods and mixed quantitative and qualitative methods were used. Another strength of a mixed-methods approach is that it allows the researcher to triangulate the data sources, seeking convergence throughout qualitative and quantitative methods, as well as to obtain a comprehensive explanation for the research problem (Bryman, 2008). According to Cohen et al. (2011, p. 195), 'triangular techniques in the social sciences attempt to map out, or explain more fully, the richness and complexity of human behaviour by studying it from more than one standpoint.' It also allows one method to inform the process of the next method and expands our understanding of the research problem (Creswell, 2007). For these reasons, adapting mixed methods design in this study was helpful due to the complexity of understanding pre-service teachers' engagement in the process of learning to teach in an online PLC.

Although the mixed-methods approach has several benefits, there are several weaknesses in the use of the mixed-methods and pragmatic approach. One of these weaknesses is that researchers should have a deep understanding of different data collection methods, which may affect the validity and reliability of the research (Creswell & Plano Clark, 2011). To overcome this weakness, the researcher was registered in different modules inside and outside the university to increase her understanding of different methods. These modules included the use of SNA, questionnaire, the use of qualitative and quantitative methods and their analysis, and the research design. The researcher also piloted the instruments and conducted several reliability and validity steps in the

research (explained further in Sections 4.9, 5.3.5, 6.3.4 and 7.3.4). A further weakness is that mixed methods need a considerable amount of time and effort from the researcher to focus on the research. The nature and duration of full-time PhD study allowed the researcher to focus on the research study.

There are two ways to conduct research using a mixed-methods approach: parallel or sequential (Creswell, 2003). For a parallel design, the quantitative and qualitative data are collected at the same time, and the findings from the quantitative data are reported separately and may not necessarily relate to nor confirm the results from the qualitative phase (Tashakkori & Teddlie, 1998). For sequential studies, the researcher begins by conducting the quantitative phase and then conducts the qualitative phase, or vice versa (Tashakkori & Teddlie, 1998). The results of the first phase inform and help to plan data collection in the second phase (Creswell, 2007). A sequential design seemed more appropriate for the purpose and nature of the present study, as supported by many researchers in the area of networked learning. According to Eynon et al. (2016), to understand the learning process that takes place in online learning communities, researchers should first observe the interactions, outcomes and actions that take place in an online environment and then determine the reasons behind these actions. This is consistent with Wesler et al.'s (2008) findings, who stated that observations of interactions may not provide explanations for specific behaviours of pre-service teachers. Therefore, a sequential design seemed more appropriate for the purpose and nature of the present study, particularly in understanding the complexity of the interactions between practitioners and pre-service teachers.

Tashakkori and Teddlie (1998) stated that there are two commonly used sequential designs used for mixed-methods: explanatory and exploratory. According to Tashakkori and Teddlie (1998), explanatory design is typically used when quantitative data are collected in the first stage and qualitative data in the second stage, which are used to explain the relationships and examine the findings of the first phase in more detail. The exploratory design begins with qualitative data collection, followed by quantitative data collection, and is typically used when the researcher seeks to explore the phenomena and build on the findings by creating and testing new instruments (Tashakkori & Teddlie, 1998). The explanatory sequential mixed-methods design is appropriate for the present study for many reasons. One of the main reasons is that the purpose of this study was to describe the interaction practices of female Saudi pre-service teachers in online learning environments without developing intentions to test new instruments. Another

reason is that the context of the interactions in this study, an online learning community, was complex because it involved cognitive and social dimensions.

According to Eynon et al. (2016), understanding online learning communities requires examining different steps of the learning process. First, it requires an understanding of the structure, content and outcomes of interactions, which informs the following step of focusing on exploring the reasons and experiences behind these interactions through in-depth interviews. In the present study, the quantitative data obtained in the first step (i.e. TPACK questionnaire, level of knowledge construction and network development) assisted in selecting the interview sample and questions (i.e. the qualitative data), as the intention was to select participants with different levels of engagement in online learning communities to build a deeper understanding of the numerous factors involved in the engagement. The first step of this study focused on collecting quantitative data, where the pre-service teachers' levels of engagement were measured using SNA and a TPACK questionnaire, while the levels of knowledge construction were determined through a CA. In the second step, a qualitative exploration of the problem was conducted through individual face-to-face interviews with the pre-service teachers, building on the findings of the first step. Figure 4-1 describes the process of collecting data and how these related to each phase of data analysis and interpretation (Chapters 5, 6 and 7) in this current study. In Chapter 5 (Phase 1), the phase starts by analysing TPACK data followed by conducting the interviews. The interviewees were selected based upon their levels of TPACK. In Chapter 6 (Phase 2), it focused on analysing knowledge construction and network development and structure. The TPACK questionnaire analysed in phase 1 was triangulated in Phase 2. It helped to explore how the pre-service teachers TPACK levels could affect the group forming. The results of phase 2 helped to inform the selection of the interviewees in Phase 3 (Chapter 7).

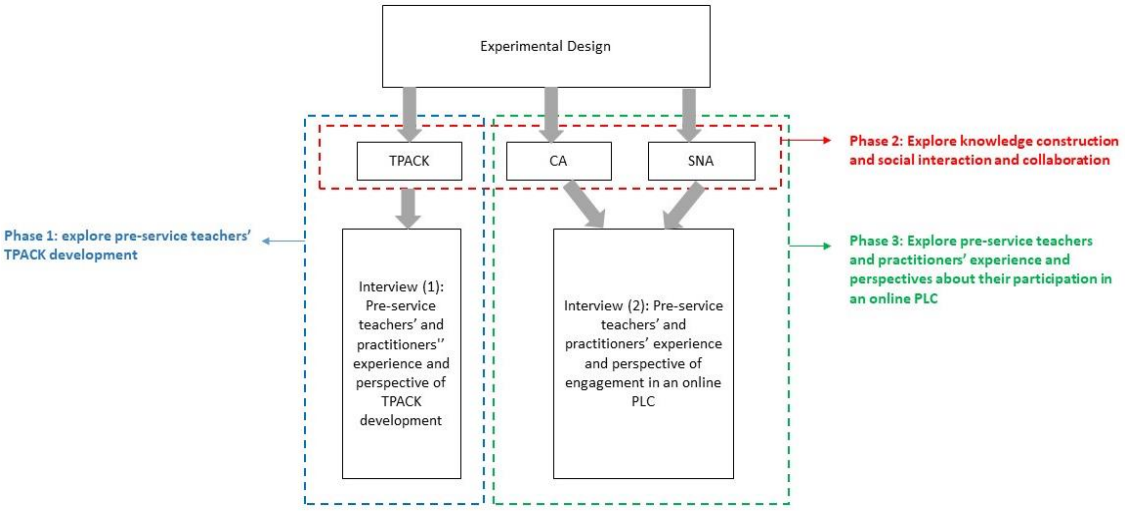


Figure 4-1: The process of collecting data and how these related to each phase of data analysis and interpretations

Although the results from the quantitative analysis can answer some of the research questions regarding the level of engagement in online PLC, it cannot provide a full description of online learning environments, nor can it answer the remainder of the research questions. Employing both quantitative and qualitative research methods allows for holistic answers to be reached. The quantitative method offers objective observations of the quality of interactions in online learning communities, while qualitative methods lead to a more thorough understanding of the pre-service teachers' perceptions of their social world (Gergen & Gergen, 2000). Having provided a detailed description of the research design, the next section discusses the research setting and sample.

4.4 Research Setting

The study was being conducted at Umm Al-Qura University (UQU), Saudi Arabia. UQU is one of the oldest universities in the KSA, and it was established in Makkah in 1949. It has an academic reputation in different fields such as Islamic, Arabic studies and Education. Since its inception, the Faculty of Education at UQU has been committed to both preparing pre-service teachers and providing training courses for in-service teachers. The Faculty of Education at UQU consists of seven departments: Curriculum and teaching methods, Educational leadership and planning, Psychology, Islamic education, Special needs education, Sports education and Childhood education (UQU, 2016). In addition, it hosts a Centre for Training Courses that trains in-service teachers. This study was conducted on pre-service teachers enrolled on a one-year education programme during Fall Semester 2017. The 'Educational Means and Technology' module was selected for this study, which is mandatory for all pre-service teachers in teacher education

programmes at the university and must be taken before school placement. This module focuses on the use of educational tools in education, more specifically ICT tools. The module includes several topics concerning the use of technology: an overview of educational means and technology, the rules and criteria for choosing educational means and technologies, the use of white and smart boards, multimedia in education and online learning. This module was chosen because it offers accessibility and benefits to a wide range of pre-service teachers across study subjects Another reason, as indicated in Section 2.5, is that Saudi pre-service teachers have little experience with using technology in their practice, as well as in their professional development, and this module requires technology use. In addition, pre-service teacher participants were in the university phase prior to school placement, and the results of this study may benefit them during school placement and throughout the remainder of their teacher education. The module typically consists of two-hour lectures every week for a period of 15 weeks.

4.4.1 Designing online PLC: online platform and activity

In the present study, Facebook served as a platform for the online learning community. Facebook is an SNS designed for socialisation, and its key features include providing a secure, closed environment for collaboration, offering ways to share and store materials on a cloud-based system and allowing teachers to create professional groups and communicate with the broader community (Saunders, 2008). Facebook was chosen because it is currently used by UQU instructors, so the students were also familiar with this platform. In terms of the structure of the Facebook discussion, any members of the group can post to the group's wall, and other members can comment on the post. Members can continue commenting on the original post or comment on comments made by other members. Figure 4-2 shows that participant A started the discussion by posting a question. Participants B and C commented on the original question proposed by Participant A. Participants D and E commented on the comment provided by Participant C.

Figure 4-2: Snapshot of Facebook discussion

The design of the online PLC was informed by theoretical understandings of situated learning and CoP framework that underpinned this study. Several scholars emphasise the careful design of social learning environment in general and PLC in particular that integrate the situated nature of learning as well as support learners' active interaction and engagement (Vygotsky, 1978; Lave & Wenger, 1991; Hou, 2015, Salmon, 2002). Meanwhile, the E-tivities model that was developed by Salmon (2002) was applied as a practical guideline for building and designing the online PLC. This framework was designed to enhance learning in computer-mediated education. Salmon's (2002) E-tivities model was used as a framework that guided the researcher to design online PLC (Cuthell, 2008; Yeh, 2010). The E-tivities model includes five stages (See Figure 4-3).

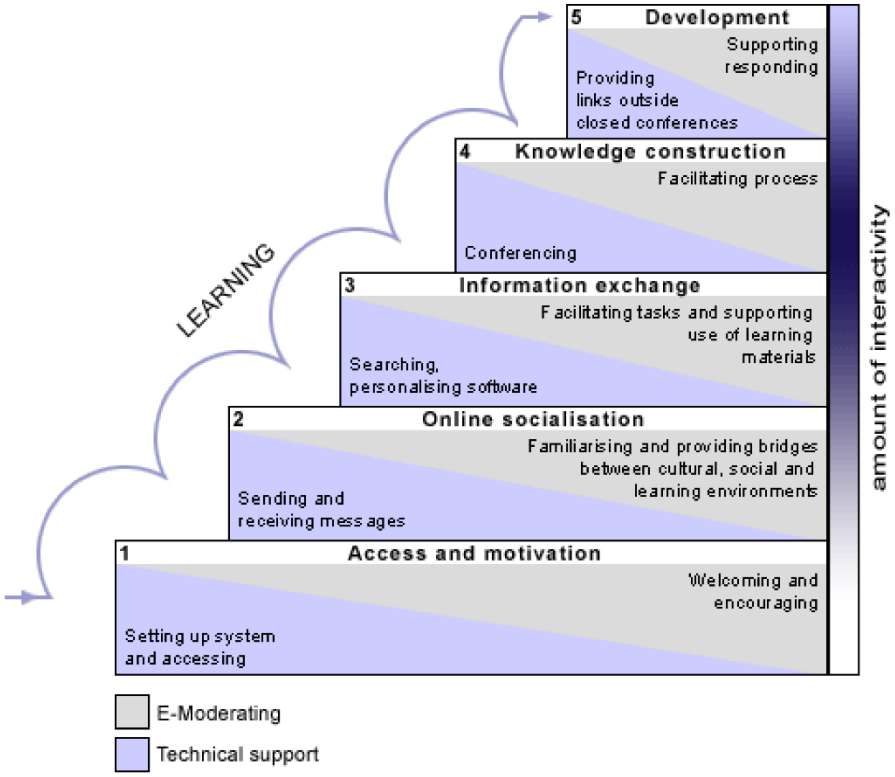


Figure 4-3: The E-tivities model

The descriptions of each stage are as follows:

- Stage 1. Access and motivation: this stage focuses on encouraging students to become familiar with the online environment for learning, and how they use the online tools
- Stage 2. Socialisation: this stage focuses on building an online learning community and establishing relationships with other members of the learning community. The idea is to familiarise students with the online culture
- Stage 3. Information exchange: this stage focuses on exchanging information and doing tasks, and at this stage members of online PLC share information related to online tasks

- Stage 4. Knowledge construction: collaboration between learners at this stage is very important in developing knowledge, negotiation of perspectives and discussions of interpretations. Group collaboration and dynamics are very important at this stage. This phase is characterised by knowledge development as a result of the group discussion and interaction. This resulted collaboration and effective communication can be established through a shared understanding. At this stage students need support and scaffolding to enhance their critical thinking.
- Stage 5. Development: this stage focuses on reflection as an approach to help to interpret knowledge and test any solutions or assumptions.

In this current study, this design of online PLC commenced by preparing pre-service teachers to be comfortable and familiar in using Facebook. Before the engagement of pre-service teachers in Facebook, several guidelines, tutorials and video were sent to their email addresses. All pre-service teachers were then invited to join the Facebook group. Next, an ice-breaking activity was conducted in order to allow pre-service teachers to get to know and interact with each other. This activity was focused on allowing pre-service teachers to introduce themselves. Practitioners were also encouraged to introduce themselves. Activities that were designed to develop collaboration between pre-service teachers started by encouraging them to review material that was provided to them in order to allow them to exchange information and share ideas relevant to the topic. The knowledge construction phase then began by giving opportunities to pre-service teachers to discuss the specific types of technology and how they could be used in the classroom. The pre-service teachers were required to discuss their ideas and opinions, as well as to support each other. During the presence of practitioners, their role was to provide feedback, scaffolding and make suggestions and to stimulate the pre-service teachers' curiosities towards technology and knowledge construction. The final stage comprised a focus on reflection, as the pre-service teachers were encouraged to reflect on their experiences by designing learning activities for the classroom.

The module was implemented via Facebook between 16th September 2017 and 2nd November 2017. It comprised of three online activities based on the three topics of the module, which would be completed over a six week period. The activities were designed to focus on teaching pre-service teachers how to use technology in practice. More details of the online activity can be found in Section 5.3.3 and Section 6.3.3.

4.5 Research Sample: Pre-service Teachers

The sample of female pre-service teachers was selected from the Saudi pre-service teachers' population. A research population can be defined as a large group of individuals, items or units from which a sample is drawn (Gravetter & Forzano, 2011). The population in this study was composed of pre-service teachers at UQU. UQU data on its student population indicated that there were 8,467 pre-service teachers in the School of Education: 5,931 females and 2,536 males (UQU, 2017). This number included pre-service teachers with different study specialities. A sample was selected from the population of female Saudi pre-service teachers at UQU, due to the difficulty of observing all individuals of a large population (Cohen et al., 2011).

There are two types of general sampling techniques: probability and non-probability (Cohen et al*.,* 2011). The main difference between these techniques is that non-probability sampling does not include random selection, while probability sampling does (Cohen et al*.,* 2011). Oliver and Jupp (2006, p. 244) defined purposive sampling as 'a form of non-probability sampling in which decisions concerning the individuals to be included in the sample are taken based upon a variety of criteria'. For several reasons described in the following paragraph, the non-probability purposive sampling technique was chosen for the present study.

The justification for this choice is as follows. This study focused solely on female pre-service teachers who were enrolled in the 'Educational Means and Technology' module, due to gender segregation in the Saudi educational system, as the researcher is female and therefore only had access to the female population. The 'Educational Means and Technology' module usually includes approximately six groups, with each group including around 40 pre-service teachers. The university assigns pre-service teachers to these groups, with each instructor normally teaching two groups. Although the instructors follow the same lesson plans, the course activities differ from one instructor to another. Therefore, one instructor who was willing to allow pre-service teachers to participate in the study was selected. This also assisted with variable control, as all pre-service teacher participants would receive the same teaching materials from the same instructor. Chandra and Sharma (2007) advised researchers of educational studies to provide students in both the control and experimental groups with the same environment, such as the same teacher.

The sample included 76 pre-service teachers enrolled in the 'Educational Means and Technology' module under the same instructor, extracted from the student registry of the School of Education. As stated by Gall, Borg and Gall (2009), a sample size of 30 is considered suitable for statistical analyses in experimental and correlative studies, however, a sample larger than 30 can increase the reliability of the findings. For the present experimental study, a sample size of 76 was considered reasonable to obtain accurate results (Cohen et al., 2011). The pre-service teachers were randomly assigned to the experimental and control groups, with each group containing 38 pre-service teachers.

4.6 Practitioners' Sampling and Training

Nathan and Petrosino (2003) advised that there are two key issues that should be carefully considered when practitioners are introduced into a learning activity: the choice of practitioners and the guidance and training that should be provided to help to promote learner engagement. In the present study, these two issues had been considered so that the practitioners could be successfully introduced to the pre-service teachers during the experimental phase. The following subsections provide an overview of the criteria used to select the practitioners and the training course provided to them, which explains their roles in the online activities.

4.6.1 Practitioner Selection Criteria

Alebaikan (2016) stated that choosing the right online expert is a crucial element, as a successful implementation of practitioners is affected by the experiences discussed during sessions, therefore purposive sampling techniques were used to select the practitioners. The main reason for using these techniques was to identify professionals with specific characteristics (Cohen, Manion & Morrison, 2011). The selection criteria were as follows:

- According to Lang (2008), practitioners who are selected to engage with learners should be knowledgeable about the current and contemporary issues of the course topic and be active in the field of the chosen topic. Therefore, for the present study, the practitioners should have sufficient abilities and experience in using technology for instruction. This can be verified by reviewing the number of training courses attended in the field of technology, achievements in the use of technology within the education field, and whether they were currently active in the use or design of technology within the education field.

- Nathan and Petrosino (2003) stated that the selected practitioners should have experience of interacting with learners of different abilities. The practitioners selected for the present study should have experience in conducting seminars and workshops on educational technology for in-service or pre-service teachers.
- The final criterion was related to Saudi culture. Only female practitioners were selected, as all pre-service teacher participants were female. Saudi females tend to avoid contact with males, and thus the inclusion of male practitioners may have caused pre-service teachers to be reluctant to participate (Abokhodair & Vieweg, 2016).

Two practitioners were selected to participate in the present study. The first practitioner was considered an expert science in-service teacher, with experience using technology for instruction and conducting several workshops for in-service teachers across different disciplines. These workshops focused on using modern technologies in teaching practice and implementing effective pedagogical strategies in combination with technology. The second practitioner was an expert social science in-service teacher and learning resources specialist working in secondary school. Her main role as a learning resources specialist in the school was to provide teachers with opportunities and information to use technology to support their teaching practices, as well as to provide training courses for teachers to utilise new technology in schools. The first practitioner was chosen because she could provide technological and pedagogical knowledge, and because the practitioner was aware of the issues regarding classroom management and student behaviour. Although she had a Bachelor's degree in mathematics and science, she had a Master's degree in curriculum and instruction and also provided several courses for teachers from different specialities. She therefore had the ability to support teachers from different disciplines and areas. In terms of the second practitioner, she had a better understanding of the types of technologies that schools provided, as well as potential technical issues. She had a Bachelor's degree in social science and a diploma in educational technology. Both practitioners were voluntary participants, and they were willing to help raise the awareness of pre-service teachers to the importance of technology in teaching. Both the practitioners have experience in working with interdisciplinary teams.

4.6.2 The Practitioner Training Programme

According to Kumari (2001), to effectively engage practitioners with learners, a training course should be provided to practitioners. Most studies on the role of practitioners and online experts do not include training courses for practitioners. Therefore, this study filled this gap by designing

a training programme for practitioners. The purpose of the training programme was to help practitioners to understand how they could improve pre-service teachers' engagement in learning to teach via online PLC. The training programme provided useful guidelines for engaging pre-service teachers and supporting educational changes (Lang, 2009).

The content of the training programme was selected based on several factors, which were extracted from the literature related to general and online guest experts. According to Dorner & Kumar (2016; 2017), there are two factors that lead to a successful connection between practitioners and students. First, practitioners should be familiarised with the course content and the learning environment. Second, practitioners should be allowed to evaluate learners and provide feedback. This was also confirmed by Hemphill and Hemphill (2007), who stated that an online expert should have the ability to facilitate learner discourse by moving students from a low level to a high level of knowledge construction. In addition, practitioners should be able to engage learners in the learning activities. The training programme in the present study was designed with these factors in mind, and the programme was conducted online via Facebook. The main reason for offering an online form of training programme was to allow the practitioners to participate based on their availability. The training programme was divided into five sessions, with the content of each session described in Table 4-1.

Table 4-1: The practitioner training programme

Session Number	Topic	Objective
1	Overview of the pre-service teacher programme and the educational technology module	Familiarise the practitioners with the pre-service teacher environment
2	Overview of pre-service teacher engagement in teacher education via an online learning community	Clarify the practitioners' roles and provide them with the essential elements for engaging pre-service teachers (Conrad & Donaldson, 2011; Salmon, 2002; Palloff & Pratt, 2010; Garrison, 2007).
3	Facilitating interactions in online discussions	Provide practitioners with effective strategies for facilitating interactions between pre-service teachers and moving them from a low level to a high level of knowledge construction (Garrison et al., 1999, 2001; Garrison, 2007).
4	Introduce the practitioners to the pre-service teachers (a small, five-day trial exercise)	Familiarise the practitioners with their roles in an online learning environment.
5	Reflections	Identify any difficulties faced by the practitioners so that these can be resolved.

4.7 Data Collection

A mixed-methods approach was used to obtain in-depth information on whether practitioner participation had an influence on pre-service teacher engagement in learning to teach with technology in an online PLC. Data were collected using multiple sources and methods, including questionnaire, SNA, CA and semi-structured interviews. These are further discussed in the following subsections. The alignment of the research questions with the data collection methods and data analysis methods are outlined in Figure 4-4.

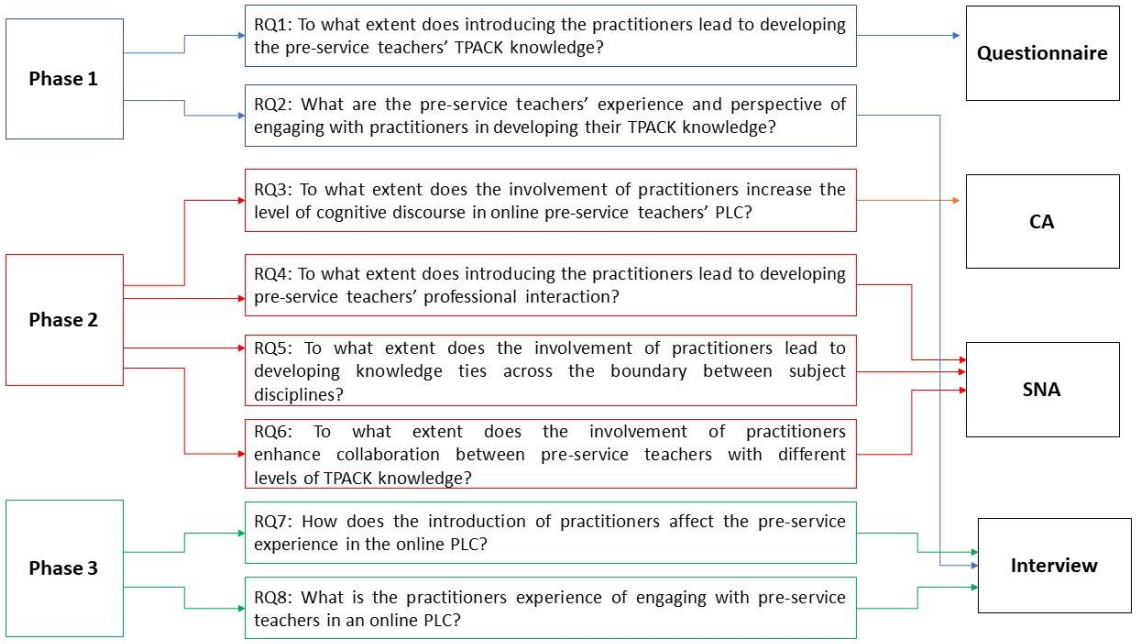


Figure 4-4: The alignment of the research questions with the data collection methods and the three research phases

4.7.1 Questionnaires

Questionnaires are 'information-collection methods used to describe, compare or explain individual and societal knowledge, feelings, values, preferences and behaviour' (Fink, 2013, p. 1). Questionnaires are self-report instruments used for gathering data regarding participants' points of view about a particular topic (Cohen et al., 2011). The use of questionnaire is considered to be a valuable method for measuring participants' perceptions, experiences and knowledge regarding specific experiences (Creswell, 2012). Given that the present study measured pre-service teachers' perceptions of their level of TPACK knowledge, it was important to gather this information directly from them. The questionnaire focused on measuring the pre-service teachers' levels of TPACK development, which were related to RQ1. The questionnaire approach was adopted primarily because it was considered an efficient approach for collecting a large

amount of data from a wide range of participants within a short timeframe (Creswell, 2009). The questionnaire allowed the researcher to collect information regarding the levels of TPACK from the whole sample. The TPACK questionnaire was triangulated with SNA in order to examine the impact of pre-service teachers' TPACK levels on forming the group in order to answer RQ 5 and 6. However, one of the main weaknesses of the questionnaire was that it did not allow the participants to provide some justification or explanation of their responses, in addition to the possibility that they may have misunderstood some items. Therefore, this study carried out piloting the questionnaire and used a questionnaire previously validated by other researchers (Wolf et al., 2016). More details about this process can be found in Phase 1 (Chapter 5, Section 5.3.4) and Section 4.9.

4.7.2 Content Analysis (CA)

Although the questionnaire in Phase 1 (RQ1) provided insight into some aspects of cognitive engagement (TPACK development), it did not provide an explanation of the depth of cognitive discussion about technology integration in an online PLC. Therefore, CA was used to examine the influence of practitioner participation on the types and levels of knowledge construction of pre-school teachers. An online post was considered to be a rich source of data, as it could describe the process of online learning (Henri, 1992). Chappel et al. (2002) stated that online posts provide 'strong interpretative clues to the character of online learning'. For instance, they can illustrate the depth of discussion and users' attitudes and behaviours (Rourke & Anderson, 2002). Denscombe (2010) indicated that collecting data from the internet could offer a high level of rationality, because this data was generated within an environment that was largely familiar to users and based on a familiar tool of communication. Analysing online activity thus allows for a better understanding of the way in which practitioner participation impacts on pre-service teachers' cognitive engagement.

According to Strijbos, Martens, Prins and Jochems (2006), there are two methods used for analysing computer-mediated communication (CMC) transcripts: quantitative and qualitative. For the qualitative approach, the researcher typically observed, summarised and drew inferences from phenomena found in the communication transcripts. The qualitative approach is important because it provides information regarding the types of knowledge that pre-service teachers construct. For the quantitative approach, the communication transcripts were coded and frequencies were calculated for use in comparisons and statistical analyses. The quantitative approach helps in understanding the development of knowledge construction by means of online

discussions, offering a way to compare differences between control and experimental groups (RQ 3). The content of the pre-service teachers' posts and contributions were collected and analysed using both quantitative and qualitative approaches. One of the main disadvantages of CA is that the process of analysis may include some subjectivity. Therefore, this study used inter-rate reliability (See Chapter 6, Section 6.3.4). Another disadvantage is that this method does not provide an insight into patterns of interaction. Therefore, this study applied SNA to overcome this difficulty.

4.7.3 Social Network Analysis (SNA)

To examine the influence of practitioner participation on pre-service teachers' collaboration and network development (RQs 4, 5 and 6), a social network analysis (SNA) was used in phase 2. SNA is used 'to identify underlying patterns of social relations based on the way actors are connected to each other', providing unique perspectives on group interactions (Kellogg et al., 2014). For these reasons, SNA was selected to determine the ways that pre-service teachers interacted and collaborated with each other in an online PLC. This provides a way of visualising and mapping patterns of interaction in order to assist with developing an understanding of the interface between individuals within an online PLC. A social network includes nodes (actors) and relations (ties). In the present study, the 'actors' represent the practitioners and pre-service teachers, while the 'ties' represent the learning exchange. Figure 4-5 provides a visualisation of a social network.

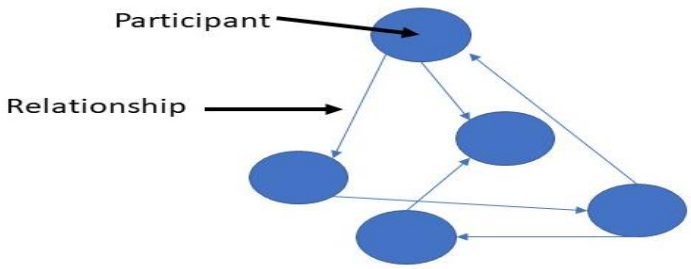


Figure 4-5: An example of social network visualization

SNA can be used in combination with content analysis, which can help to understand the process of knowledge construction in an online collaborative environment (Rienties et al., 2009). The data collected in this current study for the SNA included all pre-service teachers' and practitioners' interactions (posts) on the online PLC. The analysis focused on the pattern and frequency of interactions, in terms of sending and receiving posts. In order to evaluate the network of knowledge building and sharing within an online PLC, many researchers in the field of networked learning have applied a directed network. For example, Rienties et al. (2012) used a directed

network to measure students' interactions, which was achieved by observing who responded to or built on other ideas within the network. This method proved to be very useful in terms of understanding and identifying who was actively contributing to the online learning environment (Rienties et al., 2012; Ruane & Lee, 2016). Therefore, the current study also applied this technique by recoding the interaction into a matrix based on the pre-service teachers' identification numbers. For example, if pre-service teacher A had replied or built on an idea to pre-service teacher B, I would record 1 in the cell of row A and column B. This indicated that the network would be direct, which was completed by observing the authors of responses or contributions to ideas. There are many advantages to using a direct network (graph) to understand the network of an online PLC. For example, this allows for a better understanding of who contribute in the network and who responses to the contributions (Durairaj & Umar, 2014). The SNA can also be used alongside questionnaire data. In this current study, the TPACK questionnaire was used with SNA to understand how pre-service teachers with different levels of TPACK knowledge collaborated in an online PLC (RQ 6 in Phase 2). However, a limitation of SNA is that it does not address reasons why the members of an online PLC behave or make relationships with others in a specific way (Scott, 2013). Therefore, this study used face-to-face interviews as another method to explore this view.

4.7.4 Interviews

Interviews were employed as another source of data collection. The interviews helped to determine the ways that pre-service teachers perceived their roles and their contributions to an online PLC with the presence of practitioners. It has been determined that this method is an optimal approach for understanding the perceptions and meanings of participants regarding their experiences and interactions with professionals in a PLC (Brenner, 2006; Heo, 2015). This method can also identify the extent to which these experiences influenced participants and framed their engagement in learning to teach. Interviews have been identified as a valuable tool when the data cannot be observed or described by using other methods (Cohen et al., 2011). This is certainly the case in this study, as it was apparent that SNA, CA and TPACK questionnaire alone would not reveal the reasons behind the specific behaviours of pre-service teachers. For example, the SNA could provide information regarding pre-service teachers' relationships with others and the positions of individuals in the group, while the CA and TPACK questionnaire could provide information about the levels of cognitive engagement. However, these analyses did not allow for an exploration or understanding of the reasons behind the levels of engagement in the same manner as an interview would. The one aim of Phase 1 (Chapter 5) is to understand the impact of practitioners on pre-service teachers' experience and perspectives of TPACK development.

Similarly, Phase 3 (Chapter 7) was focused on understanding pre-service teachers and practitioners' experience and perspectives of their engagement in an online PLC. According to Robson (2002, p. 272), interviews can be a 'virtually unique window that opens on what lies behind our actions'.

Interviews are considered a suitable method for collecting data on perspectives and experiences from different participants (Brenner, 2006). Gay et al. (2009) defined an interview as a conversation between participants and the researcher, the purpose of which is to obtain data related to the research aims. One-to-one semi-structured interviews were conducted to explore pre-service teachers' experiences in greater depth and to clarify issues not addressed by quantitative methods. The main reason for conducting individual interviews was to explore individual experiences. As this study involved pre-service teachers with different levels of engagement, interviews allowed for an exploration of the in-depth understanding of pre-service teachers within different levels of engagement (Creswell & Plano Clark, 2011). Therefore, interview could provide more in-depth understanding of quantitative data (Bryman, 2006) gathered from TPACK (Phase 1), SNA and CA (Phase 2). This approach could help to triangulate coverage of data explored in RQ1, 3, 4, 5 and 6 with RQ2, 7 and 8. This triangulation could reduce the weaknesses of SNA, CA and questionnaire methods.

However, one of the main limitations of interviews was that these relied on individual participant's points of view, which may have led to subjectivity and analysis bias in interpretation. Therefore, several techniques were used to enhance the trustworthiness of the research including member checking, multiple coders and peer debriefing (See Chapter 5, Section 5.3.5 and Chapter 7, Section 7.3.4).

4.8 Language Translation and Interpretation

Because this research was conducted in Saudi Arabia, the language used by practitioners, pre-service teachers and the researcher was Arabic. All instruments (questionnaire and interview questions) were translated into Arabic. The online activity was also conducted in the Arabic language. Therefore, this study used several techniques to ensure that translations were correct and accurate in order to enhance the validity of the study (Squires, 2009). One of the techniques used in this study was the back-translation method, which is recommended by many researchers because of its adequacy and relative simplicity in assessing the accuracy of translation work (Harkness & Schoua-Glusberg, 1998). The back-translation method was conducted for the questionnaire and CA coding schema because it was designed by previous researchers in English

and was also conducted for the interview questions, as I designed the questions in English. The back-translation method has three phases: 1) translation of instruments from the source to the target language; 2) another translator back-translates the translated version into the original language; and 3) the original questionnaire is then compared with the back-translated version (Brislin, 1980). Therefore, the following procedure was conducted:

- I translated the instruments from English into Arabic
- Three Saudi Arabian doctoral students from Southampton University, who were considered to have high proficiency levels in both Arabic and English, were invited to check the accuracy of the translation and revise the translated version
- Two Saudi lecturers from UQU, who specialised in educational technology, checked and reviewed the translated instruments to verify the questionnaire items and interview questions in terms of the study's objectives, clarity of expression, the accuracy of Arabic and cultural suitability. They provided recommendations and suggestions to improve the clarification of certain items in an effort to avoid literal translation, which may have been unclear or inappropriate to the Arab reader
- The last stage of the development of the study instruments was back-translating into English by an independent person. In addition, two Saudi Arabian doctoral students, who were studying in the United States and were considered to have high proficiency levels in both Arabic and English, compared both versions. The outcome of the back-translation was that the two versions of the instruments were almost identical.

The outcome of this process helped the researcher to check the cultural suitability of the instruments. Another technique that was adopted to ensure the translation of interview responses involved seeking some advice from an individual considered to be a professional translator (Van Nes, Abma, Jonsson & Degg, 2010). This translator was a female Saudi graduate student who was studying for a PhD in the UK and had previous experience in translation before moving to the UK. The researcher asked her about some wording and gave her some of the translation samples to check for accuracy.

4.9 Pilot Study

A pilot study can provide information on the suitability of research instruments and procedures, thus contributing to the success of fieldwork and research studies. Furthermore, a pilot study provides insight for researchers, allowing them to obtain experience before conducting the main study and helping to reduce any problems (Punch, 2009). Mackey and Gass (2005) define a pilot study as a small-scale trial that potentially leads to a revision of the research procedures,

instruments and materials. These revisions can include an examination of the coding schema and analytic choices. Cohen et al. (2007) state that a pilot study is usually conducted to help researchers, in specific cultural or social contexts, to try different data collection instruments, observation schemas and questions in order to help them to recognise misunderstandings in the choice of research instruments.

For the current research, the pilot study was conducted with the following aims in mind. The first was to examine the research design procedure and data collection methods in order to identify any potential problems, while the second was to prepare the researcher for the main study by familiarisation with research procedures, methods, instruments and data analysis. The plan to test the research procedures was conducted in two phases. The first phase tested the validity of the questionnaire, interview questions and coding schema for online interactions in order to make them more appropriate for the target population (pre-service teachers) and the study's context (Saudi Arabia). The second phase focused on testing the research design and intervention as well as focusing on cognitive processing in terms of procedure and preparedness to engage.

For the first phase, piloting the questionnaire can increase its reliability and validity. Cohen et al. (2011) state that piloting a questionnaire has several functions, such as checking the clarity of the questionnaire items, layout and instructions, as well as editing ambiguities in wording, in order to make questions easier to read. The piloting of the data collection process was conducted with four pre-service teachers, the main aim being to ensure that the questionnaire was understood by target participants, checked for clarity and to establish how long it took to complete the questionnaire. After each questionnaire was completed, there were discussions with each participant in order to understand the process of filling in the questionnaire from their viewpoints. The participants agreed upon the appropriateness of questionnaire statements and they suggested changing the time of completion from ten to 15 minutes in order to provide pre-service teachers with more time to think. These outcomes from piloting the questionnaire helped me to take cross-cultural validity into account when translating the questionnaire.

In terms of the interviews, the interview questions were piloted with two pre-service teachers. After the interviews, there were discussions with the interviewees to identify any possibly repetitive or unrelated questions. There was an agreement among the interviewees upon the appropriateness of the interview questions and suggestions on minor changes, such as providing

certain definitions of terms, e.g. 'online PLC'. This feedback resulted in the interview questions being slightly altered for use in the main study and also played a role in improving the researcher's performance in conducting the interviews.

Because this study sought to measure levels of knowledge constructs in an online environment, the researcher identified a coding schema that measured the quality of knowledge in an online environment. According to Cohen et al. (2011), piloting a coding schema is considered to be an important phase before it is deployed on the full data, as the outcomes of a pilot study can help to find inadequacies in category construction or the coder's ability to apply it. Therefore, the researcher may revise the instrument and coding procedures or provide further training for the coders, as any such problem should be addressed before a study is conducted (Cohen et al., 2011). The piloting of the coding schema involved several steps. First, the researcher identified five coding schemas from the literature in order to examine the quality of online interactions. Then, different types of coding schemas were discussed with the researcher's supervisors. After these discussions, the researcher chose two particular coding schemas (IAM and cognitive presence). The coding schema applied to the data obtain from the pilot study. During the initial analysis, the researcher found the cognitive coding schema to be more suitable for the data than IAM. Therefore, the researcher decided to use cognitive presence as the coding schema.

The second phase was focused on testing experiment design and its procedure. The initial plan was to conduct this pilot study over a period of one month, but the Ministry of Education decided to have exams early due to them coinciding with the month of Ramadan. Thus, there were changes to the second semester timetable that affected the plans for this phase of the pilot study. Therefore, it was decided to make the online activity last for only two weeks. The pilot study took place in May 2017 on the online learning platform Facebook. The pilot sample consisted of a small number (14) of Saudi female pre-service teachers who were studying the Educational Technology module at UQU. Generally, the research design and procedure were considered suitable, but there were some minor issues that needed to be considered for the main study. Pre-service teachers pointed out that there was a need to know some background about their peers, such as their speciality subjects, to help them to interact with each other. To solve this issue in the main study, a social introduction activity that allowed pre-service teachers to introduce themselves to each other was included.

4.10 Ethical Considerations

Ethical considerations are an important aspect of research. Miller and Brewer (2003) noted that ethical responsibility is 'essential at all stages of the research process, from the design of a study including how participants are recruited, to how they are treated through the course of these procedures, and finally to the consequences of their participation' (p. 95). The purpose of research ethics is to ensure that participants will not be harmed in the research process (Cohen et al., 2011). Thus, ethical considerations were considered at all stages of conducting and reporting the research. Prior to commencing the research study, ethical approval was sought and obtained from the University of Southampton (See Appendix A.1). Moreover, permission from UQU was obtained (See Appendix A.2) and also at the end of fieldwork a letter confirming that the study had been conducted in UQU was provided (See Appendix A.3). The research followed the British Education Research Association's (BERA) ethical guidelines in order to ensure the ethics in this research were followed.

All participants in this study were informed of the purpose of this study and of their right to withdraw at any stage without any consequences, as their participation in this study was voluntary and not mandatory. Each participant read the information sheet followed by the consent form, which was signed as their formal agreement to participate in the study (See Appendix B). Both the information sheets and consent forms were translated into Arabic before distribution (See Appendix B). In addition, participants were informed that their participation would not impact on programme assessments. Furthermore, they were informed that all comments and responses would not be identified and that their identities would not be disclosed when reporting the data. Pseudonyms were used to report the data. In addition, no sensitive information about participants was collected. Ethical issues are considered more challenging when research takes place in digitally mediated social spaces. Challenges arise in terms of ensuring the privacy and confidentiality of the participants in an online space (Busher & James, 2015). Therefore, online activities were conducted in private groups on Facebook, and only the participants and the researcher had access to the online group. This was also mentioned in the participants' information sheet. Also, the participants provided option to use pseudonym. However, all of them use real name for their user account.

4.11 Reflectivity on Research Positioning

The position of the researcher with respect to others in the study and his or her influence on research is referred to as researcher positionality (Hammond & Wellington, 2013). In this research, participants are considered as main providers of data, whereas I am an insider-researcher in the institution, data collector and the analyser of participants' views. Thus, this subsection discusses my positionality in the study.

Scholars suggest that a researcher takes on various roles when conducting research. These roles can vary from being an insider, i.e. a member of the group being researched, to being an outsider, i.e. a stranger to the group being investigated (Dwyer and Buckle, 2009). In this study, I considered myself as an insider-researcher, working as a lecturer in Curriculum and Instruction at UQU. In addition, I was the supervisor for pre-service teachers, which enabled me to gain experience in contacting practitioners in schools, such as in-service teachers and learning resource specialists. Being an insider-researcher can have many benefits in conducting this research study. One of the main advantages is that, as a member of UQU, I have a strong understanding of the cultural and educational practices of the context of the study as well as the explicit and implicit rules of the UQU (Bonner and Tolhurst, 2002). As a result of this understanding, I know how best to approach participants in the study (Dwyer and Buckle, 2009). Being an insider-researcher can play a significant role in facilitating the research process as being a speaker of the same language who is aware of the local rules and values, and able to obtain the necessary permission to conduct the research and interviews and gain access to the online PLC (Rouney, 2005). According to Young (2004) and Coloma (2008), it will not be easy to obtain participants' trust if researchers do not share any of the key features of the participants, such as gender, educational level, or language. In this sense, sharing one or some of these characteristics facilitates the interaction with participants and maintains trust and a high level of understanding during the time of collecting of the data.

Recognising the influence of my position on research, I tried to separate myself from my professional and personal beliefs or views. This could help in reducing the influence on the participants' views or the interaction in online PLC. Moreover, a balance was trying to be reached to maintain a good level of sensitivity as a researcher and consider the insider's perspective. For example, my role as a non-participant observer of participants' interactions on online PLC can help me to be objective (Tsagar and Banerjee, 2015). It should be noted that I was returning to

the UQU as a researcher and not as an instructor. This means that I were not have any teaching role that may make pre-service teachers worried, nor I have any authority that may discourage the pre-service teachers from taking part in the research (Smyth and Holian, 2008).

4.12 Summary

This chapter discussed the pragmatic approach as well as the experimental and mixed-methods design, and methods used in this study. The study's setting, sampling, piloting, research positionality and ethical consideration have also been explained and discussed. The next three chapters (Chapters 5 to 7) explore in depth the three phases of the study with in-depth explanations of the uses of specific methods and analysis and then illustrate the findings and the discussion of each phase. At the end, Chapter 8 provides conclusions to this study.

Chapter 5 The Role of Experienced Practitioners in Developing Saudi Female Preservice Teachers' TPACK through Participation in an Online PLC (Phase 1)

Abstract

This study sought to investigate the role of experienced practitioners in developing pre-service teachers' technological pedagogical content knowledge (TPACK) through participation in an online professional learning community. A pre-test-post-test control and experimental group design was used. The practitioners participated only with pre-service teachers in the experimental group to discuss issues around technology integration, while the control group was not exposed to the stimulus provided by the practitioners. The practitioners' role was to focus on providing some guidelines and feedback and to ask questions. Two practitioners and 76 female pre-service teachers participated in the study. The pre-service teachers were assigned one of two groups, with 38 pre-service teachers in each. The result from the TPACK questionnaire revealed that the experimental group had significantly higher scores in technological pedagogical knowledge (TPK) and TPACK than the control group. The interview findings showed that practitioners increased pre-service teachers' awareness of up-to-date technology, technologies designed for specific subjects, the pedagogical affordance of technology and factors that need to be considered during the use of a particular technological tool. There were some recommendations regarding the change in the structure of the teacher education programme.

Keywords: Pre-service teacher, TPACK, Practitioner, Technology integration, Teacher Education

5.1 Introduction

With the rapid development of information and communications technology (ICT), the integration of technology in teaching and learning has become very important. Teachers' awareness and level of knowledge can play a role in affecting their use of technology in their practice (Balchin & Wild, 2019). Mishra and Koehler (2006) developed the Technological Pedagogical Content Knowledge (TPACK) framework, which is a model to facilitate effective teaching with the integration of technology. This model involves three different elements of knowledge that teachers might consider in order to effectively implement technology in their practice: content, pedagogy and technology (Mishra & Koehler, 2006). The integration in this framework can help teachers to understand how to prepare lessons that integrate these three elements (Adulyasas, 2018).

Initial teacher education programmes can have an impact in developing pre-service teachers' TPACK and awareness of the use of technology in future classroom practice (Adulyasas, 2018; Lim, Chai & Churchill, 2010). However, it has been reported that many pre-service teacher education programmes have not effectively developed pre-service teachers' ability to use ICT in their teaching practice (Al-Zahrani, 2015; Saltan, Arslan & Wang, 2017; Bakir 2015). Therefore, several researchers have explored approaches for enhancing pre-service teacher's technology integration and TPACK development.

One of these approaches is to engage pre-service teachers in an online professional learning community (PLC) with experienced practitioners who are expert in-service teachers in the area of technology use in education. The participation of pre-service teachers, with practitioners, in teaching practices can help them to acquire teaching skills and knowledge (Hammerness et al., 2005). It has been found that this online collaboration provides a supportive environment that facilitates discussion, and receiving constructive feedback, which leads to enhanced pre-service teacher's technology integration (Dorner & Kumar, 2016). Zhang, Liu and Wang (2017) argue that such experts can provide teachers with up-to-date knowledge and effective practice. Indeed, practitioners such as in-service teachers have been used in various ways to enhance pre-service teachers' learning about technology. For example, it has been found that expert in-service teachers enhance pre-service teachers' computer skills (Dorner & Kumar, 2016), provide new practical experience (Alebakian, 2016) and enhance the collaboration and communication among pre-service teachers in online PLC during their discussion about technology integration (Dorner & Kumar, 2017). However, little empirical research evaluating the impact of practitioners on developing pre-service teachers' knowledge and awareness of TPACK exists. Phillips (2017) found that TPACK can be enhanced through negotiation and discussion in a learning community and that networking with others has an influence in developing TPACK. This study seeks to examine the role of experienced practitioners in developing pre-service teachers' TPACK through participation in an online PLC.

5.2 Literature Review

5.2.1 Issues of Information and Communications Technology (ICT) Training in Pre-service Teacher Education Programmes

Recently, increased attention has been paid to the teacher education programme in general and ICT training in particular. Effectively preparing pre-service teachers in using ICT during the pre-service teacher education programme can have a positive impact on helping them to employ it effectively in their future classroom practice (Adulyasas, 2018). Pre-service teachers need to acquire sufficient skills and knowledge of technology integration in their teacher education programme (Baran, Bilici, Sari & Tondeur, 2019). It is recognised that the high self-efficacy of computer use in classrooms for pre-service teachers is related to attending effective ICT training (Lee et al., 2008). However, many researchers acknowledge that there are some obstacles during the design of technology integration courses and training programmes for pre-service teachers (Almulhim, 2014; Aslan & Zhu, 2015; Giovannin, 2017; Al-Abdullatif, 2019). One of the main problems is that pre-service teacher programmes usually focus on enhancing ICT skills, such as understanding the basic function of technology and solving technical problems, without paying attention to pedagogical aspects, such as incorporating technology into teaching methods, classroom activities, and identifying the technological affordances that supports a learner-centred approach (Martin 2015; Mishra, Koehler & Kereluik, 2009). Al-Abdullatif (2019) argues that focusing only on ICT skills cannot prepare pre-service teachers to effectively integrate technology.

Another limitation is that the content of an ICT course may not align with teachers' future practice. Goktas et al. (2008) examine ICT courses in pre-service teacher preparation programmes in Turkey and find that stakeholders advocate redesigning the courses by linking examples and course activities to future practice. Another limitation is the separation of ICT courses from subject specialism and teaching methods. Bakir (2015) recommends that pre-service teacher programmes should not detach ICT courses from subject specialism courses and teaching methods and should find a way to link them in order to effectively enhance technology integration. Some researchers report that pre-service teachers lack knowledge of both the technology resources available in schools and their application within a school context (Hsu, 2102). Hsu (2012) attributes this to a lack of pre-service teacher engagement with in-service teachers' current practice in schools. Some studies have found that the lack of collaboration between university teaching staff and schools during their university phase leads to a lack of preparation in technology for pre-service teachers (Dorner & Kumar, 2016). Kenny et al. (2016)

suggest that a major problem is that policymakers and academics in universities see school and university communities as separate communities in the context of teacher education partnerships, which leads to decreased mutual understanding and shared practice. This lack of interaction may also result in university lecturers not being fully aware of current teaching practices or existing school materials that their pre-service teachers will be assigned during school placement (Zeichner, 2010). This problem may influence pre-service teachers' future practice, hindering their understanding of day-to-day school culture. This study seeks to improve pre-service teachers' practice by enhancing the partnership between pre-service teachers and practitioners (in-service teachers) in university-based experience. Having established an understanding of the current issues concerning the ICT training of pre-service teachers, the next section addresses the place of technology in pre-service teachers' education in Saudi Arabia.

5.2.2 Technology in Pre-service Teacher Education Programmes in the Kingdom of Saudi Arabia

Over the last decade, higher education policies in the Kingdom of Saudi Arabia (KSA) have increasingly recognised the importance of employing ICT in teacher education in order to enhance teachers' knowledge of technology integration and the process of learning and teaching (Al-Madani & Allaafiajiy, 2014). The Ministry of Higher Education introduced a national plan for integrating technology into higher education and established the National Centre for e-Learning and distance education (NCEL) in 2006. The main aim of the national plan and NCEL is to integrate technologies and e-learning. The Ministry of Education and education policy in KSA require teachers to incorporate ICT in their teaching practice in order to enhance the learning and teaching process. There have been three development programmes designed by the Saudi government to improve education since 2004: the Watani Project, the Tatweer Public Education Programme, and the Jehazi Project (Al-Madani & Allaafiajiy, 2014). A shared objective of these programmes is to develop teachers' technology skills and knowledge.

Although these initiatives were established to develop and enhance ICT integration in Saudi schools, they focused on technological issues, such as the competent use of hardware and software, more than pedagogical awareness of ICT (Al-Faki & Khamis, 2014). Al-Zahrani (2015) found that the programme developers and decision makers involved with pre-service teacher programmes focus their attention on technological skills alone, without considering pedagogy, which negatively influences the programmes in terms of development of strategies for effective technology integration. Several scholars find that pre-service teacher programmes in KSA are

limited in the use of digital technologies in learning and teaching (Albugami & Ahmed, 2015; Al-Zahrani, 2015). A recent study conducted by Al-Abdullatif (2019) found that Saudi pre-service teachers have a very low level of competence in the use of some software, such as developing multimedia, editing digital video, the use of online systems and solving their own technical problems. Al-Zahrani (2015) recommends that pre-service teacher education programmes should encourage pre-service teachers to engage with new technologies in their learning activities. Recently, KSA launched the SAUDI vision 2030 initiative, to express its goals for the future. One of the aims of this vision is to improve education outcomes by providing different teaching and learning methods and effective professional learning opportunities for teachers and focusing on investment in the use of advanced technologies (Saudi Vision 2030, 2017). To align with this vision, teacher professional development programmes need to focus on enhancing teachers' professional knowledge and technological and pedagogical capacity.

From the above review of issues related to ICT training in general and particularly in KSA, it is apparent that pre-service teacher education programme might benefit from design activities that enhance pre-service teachers' experience of technology integration. Hsu (2012) recommends that, in order to enhance the teacher preparation programme, professional learning activities should be designed to allow pre-service teachers to update with new technology as well as with technology available in schools. Koch, Heo and Kush (2012) conducted a study that focused on using technology modelling and design activities in teacher education programmes, which could facilitate pre-service teachers' technology integration. Al-Abdullatif (2019) and Gao et al. (2009) recommend that enhancing TPACK among pre-service teachers requires solid effort and support. They suggest that teacher education programmes require development of strategies and activities, for instance, providing pre-service teachers with some support, guidelines, and scaffolding in order to encourage effective technology integration. It has been found that online collaboration between expert and pre-service teachers provides a supportive environment that facilitates discussion and the receipt of constructive feedback, leading to the enhancement of pre-service teacher integration of technology (Dorner & Kumar, 2016). Zhang et al. (2017) state that inviting experts can provide teachers with up-to-date knowledge or effective practice. This current study was conducted to address these issues and seeks to enhance pre-service teachers' experience of technology integration by engaging them with experienced practitioners in order to provide some scaffolding and support.

5.2.3 Technological Pedagogical Content Knowledge (TPACK) Framework

Integrating technologies requires teachers to have adequate knowledge of how they can effectively use modern technology in the learning and teaching process. Because of the complexities involved in determining the knowledge required of teachers in the digital era, an important theoretical framework has emerged: TPACK. This framework builds on Shulman's (1986) conception of pedagogical content knowledge (PCK). Mishra and Koehler (2006) stress that technology should not be considered in isolation from the teaching process, because good teaching practice should link technology with pedagogy and content. As illustrated in Figure 5-1, three core forms of teacher knowledge are considered in the TPACK framework: content knowledge (CK); pedagogical knowledge (PK); and technological knowledge (TK). From the intersection of the core forms of knowledge, four components of teacher knowledge emerged: pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), technological pedagogical content knowledge (TPACK). Table 5-1 provides some examples and definitions of TPACK components from Chai, Koh and Tsai's (2013) study, which synthesises different sources (Cox & Graham, 2009; Koehler & Mishra, 2009; Mishra & Koehler, 2006).

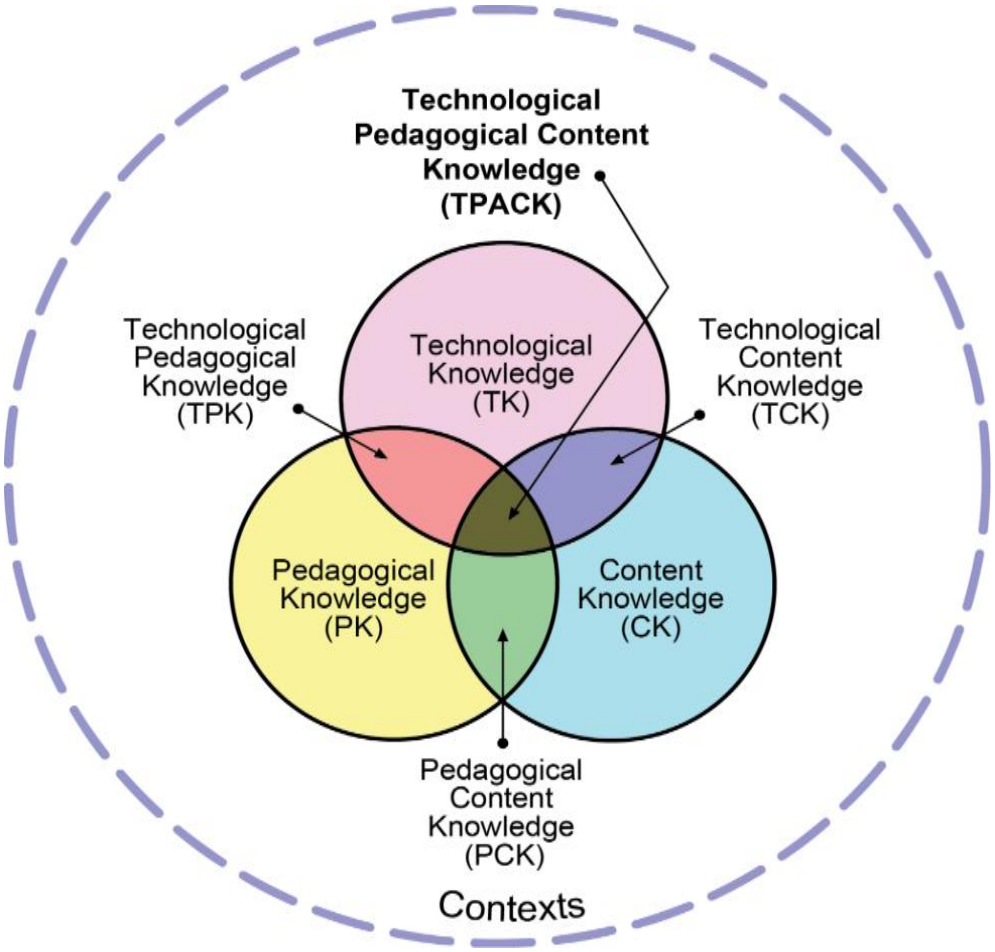


Figure 5-1: Technological pedagogical content knowledge (retrieved from http://tpack.org)

Table 5-1: Definition and examples of TPACK elements

TPACK Constructs	Definition	Example
TK	Knowledge about how to use ICT hardware and software and associated peripherals	Knowledge about how to use Web 2.0 tools (e.g., Wiki, Blogs, Facebook)
PK	Knowledge about the students' learning, instructional methods, different educational theories, and learning assessment to teach a subject matter without references towards content	Knowledge about how to use problem-based learning (PBL) in teaching
CK	Knowledge of the subject matter without consideration about teaching the subject matter	Knowledge about Science or Mathematics subjects
PCK	Knowledge of representing content knowledge and adopting pedagogical strategies to make the specific content/topic more understandable for the learners	Knowledge of using analogies to teach electricity (see Shulman, 1986)
TPK	Knowledge of the existence and specifications of various technologies to enable teaching approaches without reference towards subject matter	The notion of Webquest, KBC, using ICT as cognitive tools, computer-supported collaborative learning
TCK	Knowledge about how to use technology to represent/research and create the content in different ways without consideration about teaching	Knowledge about online dictionary, SPSS, subject specific ICT tools e.g. Geometer's Sketchpad, topic specific simulation
TPACK	Knowledge of using various technologies to teach and/represent and/ facilitate knowledge creation of specific subject content	Knowledge about how to use Wiki as an communication tool to enhance collaborative learning in social science

Note. Retrieved from "A Review of Technological Pedagogical Content Knowledge" by C. Ching, J. Koh and C. Tsai.2013, Educational Technology & Society,16(2), p.33. Copyright [2004] Br by International Forum of Educational Technology & Society.

Mishra and Koehler (2006) state that teachers' awareness of the interrelationship between content, pedagogy and technology can play a role in providing an effective learning experience. This framework was chosen because it can facilitate effective teaching with the integration of technology (Adulyasas, 2018). Furthermore, it can help pre-service teachers to understand how to prepare lessons that integrate these three elements (Koehler & Mishra, 2009). Several researchers argue that pre-service teachers may find it difficult to link the three types of knowledge together. For example, So and Kim (2009) find that pre-service teachers deal with each

element of knowledge in isolation. Hao (2016) and Pamuk (2012) report that a lack of PK and teaching experience may hinder the development of TPACK. Furthermore, So and Kim (2009) find that pre-service teachers' views about the integration of technology may hinder TPACK development, due to the fact that they tend to use technology to present information, rather than focus on pupil learning. Therefore, teacher education programmes should carefully design learning activities and provide learning experiences that effectively develop TPACK. Several studies have tried to enhance pre-service teachers' TPACK experience by applying an authentic learning experience in a collaborative learning environment. Phillips (2017) found that TPACK can be formed and developed through negotiation in a social environment. For example, Koehler, Mishra, and Yahya (2007) study the impact of a collaborative group working among graduate students and faculty members on designing an ICT project on TPACK development. The content analysis of their study found that, in time, the participants increased their discussion on TPK, TCK, and TPACK, compared to at the beginning of the semester, when there was a focus on TK, PK, and CK in isolation. The explanation provided for this development is that the group developed the meaning through time. Boschman, McKenney and Voogt (2015) find that engaging teachers in the collaborative design of rich early technology literacy activities enhances TPACK development and depth of teacher discussion.

5.2.4 Professional Learning Communities and Pre-service Teachers' TPACK Development

Teacher professional learning has increasingly been recognised as a situated social practice (Samaras & Gismondi, 1998; Phillips, 2017) in which pre-service teachers build their knowledge of issues about teaching by interacting with their peers and practitioners in the education field (Hou, 2015). As referred to in sociocultural theory, human learning is seen as a vital process that occurs in social contexts (Vygotsky, 1978). Pre-service teachers can learn by engaging in a professional learning community (PLC). The value of PLC in enhancing teachers' technology integration is recognised in several studies (Phillips, 2017; Balchin & Wild, 2016; Chang, Hsu & Ciou, 2017; Adulyasas, 2018). Balchin and Wildw (2019) find that creating PLC enhances teachers' collaboration in technology integration and this community provides opportunities to share technology-related recourses and enhances thinking about the use of technology. Chang et al. (2017) find that, through online learning communities and peers support, pre-service teachers feel inspired by the ideas that they are discussing and thus improved their TPACK. Phillips (2017) found that TPACK can be developed through negotiation in a social environment. Phillips conducted a case study to investigate teachers' TPACK development and found that engaging in a learning community and networking with the members of the community is influential in developing TPACK. Saudelli & Ciampa (2016) find that PLC encourages teachers to integrate

mobile technology in the classroom, as the community provides a space that helps teachers to find new mobile resources.

Although there are benefits in face-to-face PLC, there are still some difficulties in managing the timing of meetings (Chang et al, 2017). One recommendation is to use an online environment for collaboration and creating PLC (Hou, 2015). Qasem and Viswanathappa (2016) conducted a study to investigate the difference between face-to-face and online PLC in developing TPACK and they found that TPACK scores of pre-service teachers who participated in the online environment increased significantly more than those in the face-to-face context. One reason for these differences was related to online PLC enhancing the interaction and providing a flexible time in which to improve their knowledge. Lloyd and Duncan-Howell (2010) argue that online communities can enhance and encourage continuing professional development. Marklund (2015) examined the online PLC among Swedish preschool teachers and found that in the generous level of discussion there were many questions which focused on TK, TPK and TCK. He also found that teachers discussed different types of knowledge in relation to the use of tablets.

However, the discussion in Marklund's study did not find posts regarding teachers' experience of tablet use or the justification for the use of tablets, as the majority of posts focused on questions and sharing information. Chang et al. (2017) also found that some of the topics of discussion were not clear, were limited and difficult to understand. These two problems can make the development of TPACK difficult. Baran and Uygun (2016) stress the importance of facilitating activities around TPACK development in order to improve TPACK effectively. Marklund (2015) recommends that discussion in an online PLC can be strengthened by inviting a person to act as moderator and direct the discussion to be more critical by providing challenging questions. One possible solution can be inviting experienced practitioners such as in-service teachers to undertake these tasks. Zeichner (1990) suggests that engaging pre-service teachers with expert in-service teachers can enhance pre-service teacher thinking and decision-making. Marino, Sameshima and Beecher (2009) recommend that engaging pre-service teachers with in-service teachers and experts in technology in an online PLC can enhance their knowledge about technology. Baran and Uygun (2016) argue that creating online PLC that involves pre-service and in-service teachers can provide pre-service teachers with the chance to discuss with in-service teachers ways to apply different types of TPACK in a school context. Thomas and Trainin (2019) argue that designing a course that involves practitioners can provide support and some sort of

scaffolding to enhance TPACK, as the practitioners encourage pre-service teachers to reflect on the integration of technology, content and pedagogy.

5.2.5 The Role of Experienced Practitioners in Developing Pre-service Teachers' Knowledge

Many studies indicate the need to provide pre-service teachers with support during their learning about technology integration through engaging with experienced practitioners. For example, Whipp, Eckman and Kieboom (2005, p.40) argue that "because sociocultural theory maintains that all learning is 'assisted performance', it follows that to learn new ways of teaching with technology, pre-service teachers need to constantly be in situations where they can access the guidance." Enabling pre-service teachers to access knowledge and experience gained from experienced practitioners working in schools, such as in-service teachers, during the university-based learning experience can help to minimise disconnection between theory and practice as well as improve their thinking (Zeichner, 2010). Collaboration between pre-service teachers and experienced practitioners regarding teaching practice can help pre-service teachers to obtain necessary skills (Hammerness, Darling-Hammond, & Bransford, 2005). According to Kopcha and Alger (2014), discussion between pre-service teachers and expert teachers helps pre-service teachers to understand knowledge effectively and the relationship between knowledge and social and cultural norms. McIntyre and Hobson (2016) argue that negotiation between beginner teachers and expert teachers helps beginner teachers to discuss issues around teaching and overcome any difficulties they faced during their professional learning. Nias (1985) found that pre-service teachers' learning is more likely to be mediated by beliefs and behaviours of pre-service teachers' 'reference groups' (e.g. peers, other teachers, university lecturers etc). Therefore, exposing pre-service teachers to experienced practitioners can help them to enhance their 'reference group'.

In the context of pre-service teacher education programmes, the benefits of engaging experienced practitioners, such as in-service teachers, with pre-service teachers, was observed. For example, Kenny (2012) created partnerships by allowing pre-service teachers to work collaboratively with in-service teachers in order to deliver science lessons in the classroom during the university-based context. He found that pre-service teachers gained new ideas and methods of teaching science. Although these approaches attempt to strengthen the connection between pre-service teachers and practitioners, there are still some difficulties in changing the structure of teacher education institutions with respect to managing the partnership between these two

parties (Zeichner, 2010). Several studies have used the online environment as a space in which to connect pre-service teachers with experts. For example, Liu (2005) conducted an experimental study to investigate the effect of connecting expert teachers with pre-service teachers in an online environment on pre-service teacher performance and their attitudes toward instructional planning. He found that expert teachers played a role in providing guidance for pre-service teachers, performance and attitudes towards instructional design more than those of pre-service teachers who participated in a face-to-face environment. Dorner and Kumar (2016) investigate collaborative mentoring through participation in an online learning community, to help pre-service teachers integrate technology into their teaching practices. This learning community involved expert teachers, educational researchers, teacher educators and pre-service teachers. It provided scaffolding and support for the pre-service teachers. Furthermore, this study found that interaction with experts enhanced pre-service teachers' computer use and internet ability and their satisfaction with the online learning community. In another study, Dorner and Kumar (2017) found that the involvement of expert teachers with pre-service teachers in an online PLC to discuss issues around technology integration enhanced the collaboration and communication among pre-service teachers as practitioners established share norms among pre-service teachers. Only one such study was found from the Arab Gulf, which was conducted by Alebaikan (2016). She carried out interviews to examine the perception of Saudi graduation students, considered as computer science teachers, of inviting a guest expert into their class, specifically an expert in education and technology. She found that the expert increased students' awareness of new practical experiences in the use of technology.

Although the benefits of practitioner involvement for pre-service teachers' professional learning have been noted, empirical research into the effects of developing their knowledge and awareness of TPACK has so far been limited. Phillips (2017) reports that the development of teachers' TPACK can be carried out through negotiation in a social environment such as PLC. Hsu (2012) found that pre-service teachers have a lack of knowledge of ICT resources available at school and how to use them in the school context. Hsu recommends inviting expert teachers with pre-service teachers in order to enhance some aspect of TPACK such as TCK. Several studies (e.g. Marino et al, 2009; Dorner & Kumar, 2016, 2017; Zipke, 2018) recommend that engaging pre-service teachers with a wider community, such as expert teachers and technology experts, can help them to understand the appropriate technology to use with pupils. Baran and Uygun (2016) recommend that engaging pre-service teachers with expert teachers can provide opportunities for pre-service teachers to understand how TPACK can be applied in field experiences. A significant limitation is that the majority of studies were conducted in Western countries, while

only one took place in the Gulf region in general and one in KSA in particular. Alebaikan (2016) state that the involvement of experts is not a commonly used teaching approach in the Gulf region, and she recommends that future studies should focus on how experts can influence the engagement of learners in the Saudi context, since many different social and cultural factors exist that influence their participation.

The current study seeks to fill the identified gap in the literature of the impact of engaging practitioners with pre-service teachers in developing their TPACK. It examines the use of practitioners as a learning approach in enhancing pre-service teachers' TPACK. Moreover, it fills the local context gap by focusing on the Gulf region and, more specifically, female Saudi pre-service teachers. This study seeks to investigate the following research questions:

RQ1: To what extent does introducing the practitioners lead to developing the pre-service teachers' TPACK knowledge?
RQ2: What are the pre-service teachers' experience and perspective of engaging with practitioners in developing their TPACK knowledge?

5.3 Methodology

5.3.1 Research Design

This current study applied a pre-test-post-test control and experimental group design (Cohen, Manion & Morrison, 2011). The main reason for using this is that it permits comparison between two different situations (the participation of practitioners in the experimental group versus the absence of practitioners in the control group), which allows any influence of the practitioner participation in the experimental group to be determined. In the experimental group, the experienced practitioners were participating with pre-service teachers in an online learning community. The pre-service teachers in the control group participated without the involvement of the practitioners. Pre-service teachers were randomly assigned to either the control or the experimental group. The main reason for the use of the random assignment technique is to reduce the effect of potential confounding variables (Cohen et al., 2011). This design allows for comparisons between two situations (i.e., the presence and absence of practitioners) in determining the influence of practitioner participation on pre-service teachers' TPACK , and it takes prior performance of both groups into account and helps determine whether there are any differences before and after the intervention is introduced (Chandra & Sharma, 2007).

5.3.2 Setting and Participants

The study was conducted at a Saudi University during Fall Semester 2017. The pre-service teacher education programme is a one-year programme. Pre-service teachers in the first semester take around seven modules that include teaching methods, Islamic education, education in Saudi Arabia and educational means. In the second semester, they take three modules, and the school placement. The 'Educational Means and Technology' module was selected for this study. It is mandatory for all pre-service teachers and must be taken before the school placement. This module focuses on the use of educational tools in education, more specifically ICT tools. The module provides pre-service teachers with the different ICT tools used, such as a white board, multimedia, and general online learning tools such as blackboards. The module typically consists of one two-hour lecture every week for a period of 15 weeks.

The participants in this study involved 76 female pre-service teachers, enrolled in the 'Educational Means and Technology' module. They were assigned to two groups of 38. The pre-service teachers in this study were female with different majors; either social sciences (39) or science (37), and their average age was 22 years. The experimental group included 19 social science and 19 science pre-service teachers, while the control group included 18 science and 20 social science pre-service teachers. The main reason for selecting female participants was related to the gender segregation in educational settings in Saudi Arabia, as the researcher is female and does not have access to male participants. Two experienced practitioners in educational technology participated in the study. These two practitioners were working in the schools that have partnerships with the university and where some of pre-service teachers usually do their placement. According to Li et al. (2014), the experience of practitioners who are selected to engage with learners should be related to the course topic. Therefore, for the present study, the practitioners needed to have sufficient abilities and experience in using technology for instruction. The first practitioner was an expert in-service teacher, who had experience of using technology for teaching and learning. She has conducted many workshops in the use of technology in teaching and learning for in-service teachers across different disciplines. The second practitioner was a social science teacher and learning resources specialist who works in a secondary school and whose main role is to provide teachers with opportunities and information to use technology to support their teaching practice. Both the practitioners are female and have experience in working with interdisciplinary teams.

5.3.3 Online Learning Platform and Activities

In the present study, Facebook served as a platform for the online learning community. Facebook was used because its key features include providing a secure, closed environment for collaboration, offering ways to share and store materials in a cloud-based system, and allowing teachers to create professional groups (Saunders, 2008). The module was to be implemented via Facebook for around eight weeks during the last few months of 2017. It comprised three online activities based on the three topics of the module (interactive whiteboard, multimedia applications and online learning tools), which were completed in six weeks. The activities focused on teaching pre-service teachers how to use technology in practice. For each activity, there were related videos, teaching plans and articles, and the pre-service teachers were encouraged to review these materials. They were then asked to discuss how the specific types of technology can be used in the classroom and the possible ways in which these learning activities could be designed for the classroom using technology. The pre-service teachers were required to discuss, reflect on and exchange their ideas and opinions, and to support each other. The first activity for both groups was conducted without facilitation by practitioners (see unfacilitated collaboration condition in Table 5-2). Activities two and three in the experimental group were facilitated by practitioners, while an unfacilitated collaboration condition existed in the control group (see Table 5-2). For the experimental group, the practitioners were asked to join the pre-service teachers in activities two and three. The practitioners' role focused on stimulating the pre-service teachers' curiosity about technology integration by providing them with guidelines and feedback and asking questions, as well as helping them to understand the current issues faced in the classroom. Table 5-3 provides examples of the practitioners' posts in an online PLC. Before the practitioners engaged in the experimental group, a training programme was conducted for them. According to Barrett and Wuetherick (2012), to effectively engage practitioners with learners, preparation should be provided for them. This training programme focused on providing practitioners with information about the context of the pre-service teachers, and knowledge of facilitating interactions in online discussions and providing the pre-service teachers with guidelines and feedback.

Table 5-2: Online Activities

Condition	Activity
Unfacilitated Collaboration	• Pre-service teachers were asked to review some materials related to how particular types of technology, such as videos, teaching plans, online resources and articles, are used in teaching and learning. • Pre-service teachers were given the opportunity to discuss and share their perspectives and understandings of the possible uses of specific types of technology in their teaching practices. • Pre-service teachers were asked to discuss, reflect on and exchange their ideas and opinions, as well as to support each other in an online PLC. • At the end of the activity, pre-service teachers were required to provide final conclusions and reflection regarding the advantages, limitations, obstacles and considerations of the use of specific types of technology in teaching and learning.
Facilitated by Practitioners	• Pre-service teachers were asked to review some materials related to how particular types of technology, such as videos, teaching plans, online resources and articles, are used in teaching and learning. • Practitioners joined pre-service teachers in the experimental group. • Pre-service teachers were encouraged to start the discussion. • Pre-service teachers were given the opportunity to discuss and share their perspectives and understandings of the possible uses of specific types of technology in their teaching practices. • Pre-service teachers were asked to discuss, reflect on and exchange their ideas and opinions, as well as to support each other in an online PLC. • Practitioners focused on promoting the pre-service teachers' interest and understanding regarding technology integration by providing real examples, asking questions and facilitating reflection, collaborating, constructing knowledge and developing exchanges between pre-service teachers. • At the end of the activity, the practitioners focused on encouraging and guiding pre-service teachers to make final conclusions and reflection regarding the advantages, limitations, obstacles and considerations of the use of specific types of technology in teaching and learning.

Table 5-3: Example of the practitioners' posts

Type of practitioners' post	Example
Provide real example	From my experience in the classroom, I used this App (Socrative) in my lesson. There are some advantages. You have the ability to collect students' responses very quickly and the students were active and enjoyed this experience.
Ask question	In your posting, you provided the question for the students about doing the activity, but you did not provide the steps of collaborative learning during the use of this tool. Please can you explain how the students can perform the activities and what the students' and teachers' role in this activity is?
Provide Feedback	I like your design of the use of electronic mind mapping in your lesson. But I think you should focus more on which App can support collaborative mind mapping.
Acknowledge students' contributions	I really like your ideas. Keep doing this.
Encourage participation	You will be the teachers who guide the new generation. Please, make this discussion come alive. You can improve the teaching and learning with your smart ideas.

5.3.4 Method

TPACK questionnaire. The TPACK questionnaire was used as an instrument to measure pre-service teachers' knowledge. The TPACK survey was designed by Schmidt, Bran, Thompson, Koehler, Shin and Mishra (2009). Schmidt et al. designed this survey for pre-service teachers who teach PK–6 classrooms to measure: PK, CK, TK, PCK, TCK, TPK, and TPACK. Because the participants in this study involved social science and science teachers, some of these items were not suitable to measure their knowledge. Therefore, the survey used in this study was adapted from a modified version of that of Chai, Ng, Li, Hong and Koh (2013). This instrument includes 31 items and consists of four TK items, four CK items, five PK items, five PCK items, four TCK items, four TPK items and five TPACK items. It consists of a five-point Likert scale: 1) strongly disagree, 2) disagree, 3) neither agree nor disagree, 4) agree, and 5) strongly agree. Appendix C provides the questionnaire. The Chai et al. (2013) instrument is reliable; as according to Cronbach's alpha reliability, the seven scales were all greater than 0.70. Moreover, they conducted confirmatory factor analysis to assess the model fit. The fit indices for the survey were $\chi 2= 1134.5$, $p < .001$, $\chi 2/df=2.51$, TLI=0.95, CFI=0.96, RMSEA=0.057, which indicate that all the seven factors of the instrument are accepted. According to Hu and Bentler (1999), CFI ≥ 0.90 is considered as a good fit and the RMSEA closed to 0.06 is considered as a good fit. Similarly, Khine, Ali and Afari (2017) conducted CFA to assess the model fit of the TPACK survey in the Arab Gulf context and they found the model fit was acceptable ($\chi 2= 794.29$; df = 545; $\chi 2$ /df = 1.46; CFI = 0.92; ; RMSEA =

0.053; SRMR = 0.048). The questionnaire was translated into the Arabic language (See Appendix C.2).

In terms of reliability of the translated instrument used in the current study, Cronbach's alpha reliability was conducted for both pre- and post-questionnaire and pilot study. As outlined in Table 5-4, the instrument is considered a reliable, as Cronbach's alpha of the seven scales ≥ 0.70 indicates reasonable reliability. Regarding the content validity of the instrument, two experts in the fields of educational technology assessed the items of the questionnaire. Additionally, back translation techniques were conducted, as three Saudi Arabian doctoral students, who are considered to have a high proficiency in both Arabic and English, were invited to check the accuracy of the translation. Furthermore, the Think-Aloud Protocol (Ericsson & Simon, 1980) was used in the piloting of the questionnaire with four participants to ensure that pre-service teachers' interpretation of the survey elements was similar to the researcher's intention. In front of the researcher, each participant individually was asked to read the questionnaire and provide her interpretation of each item.

Table 5-4: TPACK and reliabilities

Scale	Alpha Piloting study N= 37	Alpha Pre-questionnaire N= 76	Alpha Post-questionnaire N= 76
TK	0.90	0.80	0.71
CK	0.75	0.75	0.71
PK	0.90	0.72	0.74
PCK	0.76	0.75	0.74
TCK	0.90	0.75	0.73
TPK	0.87	0.71	0.78
TPACK	0.83	0.81	0.83
Total	0.82	0.88	0.86

Interview. Individual interviews were conducted at the end of online activity to explore the pre-service teachers' experience and perspective of TPACK development and the role of practitioners in affecting this experience. It has been determined that this method is an optimal approach for understanding the perceptions and meanings of participants (Brenner, 2006). The semi-structured interview was chosen as the format for the interview. The main reason for choosing this format is that the interviewer does not follow a strict schedule, which allows her/him to ask other questions that emerge during the interview (Cohen et al., 2011). The interview questions were drawn from the literature on TPACK development (Baran & Uygun, 2016; Hao, 2016). The

interview questions are listed in Appendix D. All interviews were conducted in a private meeting room at the university. The interview took around 20-30 minutes.

A sub-sample of pre-service teachers was chosen for the interviews. The process involved selecting pre-service teachers with different levels of TPACK development. In each group, four pre-service teachers with a high level of TPACK and three with a low level of TPACK were selected. The median split technique was used to divide the pre-service teachers into a high or low level of TPACK. The mean score of total TPACK above 3.6 was considered as high and less than 3.6 was considered as low. In the experimental group, pre-service teachers (ST1 (pseudonym), ST2, ST3, ST4) were considered as high and (ST5, ST6, ST7) were considered low. Pre-service teachers in the control group (ST8, ST9, ST10, ST11) were high and (ST12, ST13, ST14) were low. An interview was also conducted with the two practitioners (P1 and P2).

5.3.5 Data Analyses

For quantitative data, the normal distribution of the variables was examined by a visual review of normal distribution curves and a check of the skewness and kurtosis values and their z values (Field, 2009). The z value of skewness can be calculated by dividing the skewness by the standard error of skewness and the z value of kurtosis is the division of kurtosis by the standard error of kurtosis. The value of skewness, kurtosis and their z value of the data fell within acceptable limits of -1.96 to +1.96 (Hair, Black, Babin & Anderson, 2010), which reveals that the data approximately followed a normal distribution. An independent t-test was carried out to examine the change between groups, and a paired-samples t-test was conducted to examine the change within groups. Cohen *d*-value was calculated to provide an interpretation of the effect size. Cohen (1988) provides an interpretation of the effect size: 0.2 = small, 0.6 = medium, and 0.8 ≥ large. Because this study applied multiple t-tests to compare the differences between groups, a Bonferroni correction was conducted in order to take into account the possibility of type-I error (Field, 2013). An adjusted significance level of $p < 0.007$ was used as result of dividing 0.05 by the number of variables (0.05/7). The variables in this study are TK, CK, PK, PCK, TCK, TPK and TPACK.

For qualitative data, a constant comparison method was selected. The constant comparison method is a technique for analysing data to develop grounded theory (Glaser & Strauss, 1967). The codes and categories in this study were identified inductively. One of the main objectives of this study was to obtain a clearer perception about pre-service teachers, who described their

experience of participating in an online community and the role of practitioners in this experience. Grounded theory can help to explore how participants describe and create meaning of their experiences (Glaser & Strauss, 1967). The main reason for selecting this particular method is that it enabled the researcher to develop a more comprehensive understanding of the experience of the practitioners participating with the pre-service teachers and the differences between the two groups through the practitioners' and the pre-service teachers' views and interpretations. This method depends on taking one part of the data such as one participant's interview and comparing it with that of other participants. This was carried out by comparing participant to participant within groups and then comparing between groups (experimental, control and practitioner).

There are three stages to analysing data: open coding, axial coding, and selective coding (Strauss & Corbin, 1990). Figure 5-2 provides an explanation of the process of this analysis. In relation to open coding, the researcher tries to create and develop initial codes by dividing the data into small parts (Strauss & Corbin, 1998). In the axial coding process, the researcher focuses on creating categories for the groups of data by drawing comparisons and creating relationships, and also focusing on defining the categories by determining their properties and dimensions (Saldaña, 2009; Charmaz, 2006). In selective coding, the focus is on finding one core category and what can be considered as one core phenomenon that can explain the research question (Strauss & Corbin, 1998). This could be done by linking all the categories and codes to this phenomenon in order to provide an explanation of pre-service teachers' experience of TPACK development (Strauss & Corbin, 1998). Selective coding also focuses on integrating the theory by providing the narrative of the relationship of the categories into core phenomena (Creswell, 2006).

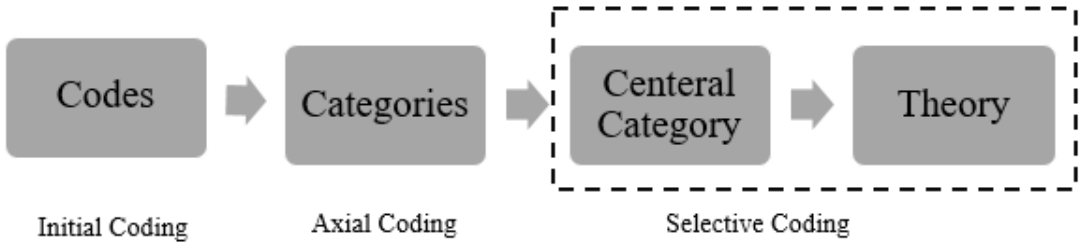


Figure 5-2: The process of data coding.

Note. Adapted from The coding manual for qualitative researcher (p.12), by J. Saldana, 2009, Los Angeles: SAGE Publications. Copyright [1988] by the Copyright, Designs and Patents Ace.

In order to ensure the trustworthiness of the interview questions in this current study, experts in the fields of the use of ICT in education assessed the interview questions. Peer debriefing was used as another way of ensuring the reliability and validity of the analysis of the interview (Lincoln and Guba, 1985). The process of peer debriefing was carried out between the researcher and her supervisors. Each one independently coded a part of an interview, which was then compared. Most of the coding was similar across the team and there was some suggestion about rewording some codes and themes to reflect the views of the participants. After that, the researcher invited independent coder to analyse some sections from the interviews using the coding that developed by researcher as recommended by Campbell, Quincy, Osserman and Pedersen (2013). Cohen's kappa was used to measure inter-rater reliability. The value of Cohen's kappa was (K=0.818) which indicated excellent agreement. Krippendorff (1980) state that a Cohen's kappa value of 0.75 and above represents excellent agreement. Trustworthiness was also undertaken through member checks. This was done by sending interview transcript through email to the participants to check any area of misunderstanding either by the researcher or the participant. The sample of the interpretation of the interview was also given to the participant to check clarity and accuracy.

5.3.6 Ethical Consideration

Ethical considerations were taken into account in all stages of conducting and reporting the research. The research followed the British Education Research Association (BERA)'s ethical guidelines (BERA, 2011) and the ethical review board of a university in UK approved the study's ethical documents. Prior to commencing the research study, permission to conduct the study was obtained from the Saudi university. All participants read the information sheet followed by the consent form if they agreed to participate in the study.

5.4 Results

5.4.1 Preliminary Analysis: Check the Pre-differences between Groups before the Intervention

This section presents the findings on the level of TPACK for the control and experimental groups before engaging in the online PLC and at the beginning of the course. In order to compare the differences between the control and experimental groups, an independent t-test was conducted. Table 5-5 shows that there are no significant differences in the mean scores between the control and experimental groups in all types of TPACK before the start of the intervention.

Table 5-5: Independent t-test of the pre- questionnaire of the experimental and control groups

	Control Group		Experimental Group		Mean Differences	T-Test	Cohen d-value
	M	SD	M	SD			
TK	2.89	0.75	2.87	0.71	0.02	0.12	0.02
CK	3.77	0.56	3.74	0.57	0.03	0.25	0.05
PK	2.97	0.51	2.95	0.51	0.02	0.14	0.03
PCK	2.79	0.61	2.85	0.60	-0.05	-0.37	0.001
TCK	2.62	0.62	2.50	0.61	0.13	0.87	0.10
TPK	2.58	0.48	2.48	0.49	0.12	0.95	0.20
TPACK	2.38	0.57	2.32	0.51	0.06	0.50	0.12

N= 38 for control and N =38 for experimental group

5.4.2 Research Question 1: Changes in the level of knowledge after introducing the practitioners into the experimental group

This section provides information on a comparison of TPACK knowledge after the pre-service teachers engaged in online PLC and after the practitioners engaged in the experimental group to support and develop a discussion of technology integration between pre-service teachers.

A comparison of pre-and post-measurements of TPACK within group. Table 5-6 examines pre- and post-measurement changes in TPACK within group for both control and experimental groups. It shows that the mean post- questionnaire scores of the seven types of knowledge for both groups were all greater than 3.0. This means that they believed that they had a fair amount of knowledge in these topic areas. As shown in Table 5-6, the results of a paired-sample t-test for the control group and the experimental group showed that there were significant increases between the pre- and post- questionnaire of knowledge in all seven areas. In the experimental group, the increment was large in all seven type of knowledge. In the control group, there was increase with large effect size in TK, CK, PK and TPACK and medium for PCK and TPK.

A comparison of TPACK between groups after the intervention. The independent t-test was used to identify differences between the groups. As shown in Table 5-7, after the intervention, there were significant differences between the control and experimental groups in the results for TPK and TPACK with a moderate effect size in favour of the experimental group. However, there were no significant differences in the results for TK, CK, PK, PCK and TCK, although the mean scores of the experimental group were greater than those of the control group.

Table 5-6: The paired sample t-test of the pre- and post- questionnaire for the control and experimental group

		Pre-questionnaire		Post-questionnaire		Mean Differences	T-Test	Cohen *d*-value
		M	SD	M	SD			
Control group	TK	2.89	0.75	3.74	0.65	-0.85	-5.56**	0.90
	CK	3.77	0.56	4.05	0.43	-0.28	-6.68**	1.08
	PK	2.97	0.51	3.75	0.55	-0.78	-5.91**	0.95
	PCK	2.79	0.61	3.38	0.53	-0.59	-4.82**	0.78
	TCK	2.62	0.62	3.76	0.53	-1.14	-9.08**	1.47
	TPK	2.58	0.48	3.08	0.62	-0.50	-4.43**	0.72
	TPACK	2.38	0.57	3.37	0.70	-0.99	-6.77**	1.09
Experimental group	TK	2.87	0.71	4.03	0.55	-1.16	-7.26**	1.65
	CK	3.74	0.57	4.13	0.42	-0.38	-6.45**	1.02
	PK	2.95	0.51	3.82	0.60	-0.86	-7.14**	1.15
	PCK	2.85	0.60	3.51	0.56	-0.67	-5.28**	0.86
	TCK	2.50	0.61	3.82	0.58	-1.32	-10.31**	1.67
	TPK	2.48	0.49	3.58	0.68	-1.10	-9.56**	1.55
	TPACK	2.32	0.51	3.82	0.62	-1.50	-12.08**	1.96

*p< 0.007; **p< 0.001
N= 38 for control and N =38 for experimental group

Table 5-7: Independent t-test of the post- questionnaire of the control and experimental groups

	Mean Differences (Control-Experiment)	T-Test	Cohen *d*-value
TK	-0.30	-2.15	0.48
CK	-0.07	-0.75	0.19
PK	-0.07	-0.52	0.14
PCK	-0.13	-0.98	0.24
TCK	-0.06	-0.47	0.11
TPK	-0.50	-3.36**	0.76
TPACK	-0.45	-2.95*	0.68

*p< 0.007; **p< 0.001
N= 38 for control and N =38 for experimental group

5.4.3 Research Question 2: Pre-service teachers' TPACK development experience and perspective

This section presents the findings of the interview, which focused on the pre-service teachers' TPACK development experience. The interviews were conducted with both the control and experimental groups. The main purpose of this was to explore the pre-service teachers' views on the impact of the presence of practitioners on TPACK development experience and to compare these views with those of the control group. The interview was conducted with seven pre-service

teachers from the control group, seven pre-service teachers from the experimental group and two practitioners. Table 5-8 represents the categories and codes that relate to the core category, 'the enhancement of TPACK development experience'.

Table 5-8: Categories and codes of the interview

Category 1: Change in pre-service teacher awareness of TPACK knowledge	Codes relating to how pre-service teachers' awareness of TPACK knowledge changed when they participated in an online learning community ***'Raising awareness of up-to-date technologies'***: Statements relating to pre-service teachers' awareness of up-to-date technologies ***'Recognise the value of incorporating content with technologies'***: Statements relating to pre-service awareness of the importance of incorporating CK with TK ***'Raising awareness of pedagogical affordance of technology'***: Statements relating to pre-service awareness of incorporating PK with TK ***'Different aspects of technology integration'***: Statements relating to pre-service awareness of the different elements of TPACK
Category 2: Issues relating to the design of the pre-service teacher programme	Codes relating to how the design of pre-service teachers program influence the TPACK development experience ***'The structure of the teacher education programme':*** Statements relating to how the structure of the course affects pre-service teachers' TPACK development ***'The content of the module'***: Statements relating to how the content of the educational technology module affects pre-service teachers' TPACK development

Category 1: Change in pre-service teacher awareness of TPACK knowledge. This category focuses on the pre-service teachers' views of their awareness of TPACK knowledge and how the practitioners' participation played a role in increasing their awareness of TPACK knowledge.

'Raising awareness of up-to-date technologies'. Pre-service teachers in the experimental group found that practitioners played a role in their awareness of up-to-date technologies. For example, one pre-service teacher mentioned, "She [the practitioner] provided us with a lot of new resources, software and teaching strategies, that were not covered in our current course" (ST4, Science, experimental group). Other pre-service teachers also explained the benefits of the presence of practitioners in making them aware of up-to-date technologies. One participant said, "She helped us to understand how we can employ these technologies [the new technologies] in our teaching… As you know, it may be difficult to apply new things that were not included in our course" (ST1, Social Science, experimental group). The practitioners also mentioned the benefit of making pre-service teachers aware of new technologies. For example, P2 stated,

> I found some pre-service teachers sometimes stuck to the use of technologies that were only provided in their curriculum… I tried to make our discussion focus on new digital tools… I told them you will face a new generation who have a vast knowledge of technology.

The pre-service teachers in the control group also revealed that they discussed new up-to-date technologies, but they sometimes found it difficult to understand how to apply them. As one mentioned, "We discussed new technologies that emerged… but sometimes we did not know how they worked in the classroom because they were not discussed in the module… So, we preferred to discuss something that took place in the module" (ST13, Science, control group).

The pre-service teachers in the experimental group appreciated the role of practitioners not only for making them aware of up-to-date technology but also the range of technologies currently used in school. For example, ST5 said, "Discussion with practitioners opened my eyes to the current technologies used in school… I was surprised … There are iPads and also a fast internet service… This did not exist during my studies in secondary school" (Social Science, experimental group). The practitioners also commented on their role in supporting pre-service teachers' awareness of new technologies used in school. For example, P1 stated, "I also made them aware of some digital tools that the Ministry of Education provide and encourage teachers to use."

'Recognise the value of incorporating content with technologies'. The interview analysis revealed that pre-service teachers in both groups were aware of the importance of integrating CK with technology. For example, one pre-service teacher from the control group commented, "Our discussion helped me to link many topics of my subject with different ICT tools… I think it is very important to make a connection between them… How can we use technologies without linking them to our subject?" (ST9, Social Science, control group). Pre-service teachers in the experimental group expressed the same point, but they found the practitioners beneficial. They stated that the practitioners helped them to become aware of technologies that were designed for their specific topic. For example, one participant said, "It is nice to know about the technologies that are designed for topics in my subject… The practitioners usually help us to be aware of digital tools that are designed for our subject area" (ST2, Science, experimental group). Furthermore, the practitioners help them to understand how they can use technology in specific content contexts. For example, one said, "They [the practitioners] provided real samples of some in-service teachers' works, and this helps us to understand how we can use technology in our subject area in a specific classroom context" (ST5, Social Science, experimental group).

'Raising awareness of pedagogical affordance of technology'. Pre-service teachers in the experimental group appreciated the role of practitioners in making them aware of incorporating PK with TK. For example, ST7 stated,

> The practitioners helped me to recognise the importance of pedagogy with technology… I thought the most important thing is to know how I can use technology to present my subject… but the technology integration process needs to pay attention to many pedagogy aspects with apply to technology... We should take into consideration how technology works with our teaching methods, my students' prior knowledge and class management issues. (Social science, experimental group)

Three pre-service teachers in the control group commented on the importance of matching technology with pedagogy. As ST11 remarked, "I think the incorporation of technology in the lesson is important, but we should also focus on other elements such as organising the lesson" (Science, control group). Although both groups mentioned the importance of incorporating technologies with pedagogy, each had a different view of the pedagogical affordance of technology. The control group seemed to focus only on technical procedures such as technology-facilitated delivery of information, managing and saving time in class and organising the lesson. For example, ST10 stated, "Our discussions help us to understand how technology can help us as teachers to facilitate delivery of information and present some images and video and help to organise the lesson and achieve the objectives of the lesson much quicker". (Social Science, control group).

In contrast, the experimental group, in outlining their views on the pedagogical affordance of technology not only focused on facilitated delivery of information and organising the lesson but also on the impact on pupils' learning. They concentrated on how they can engage pupils with technology in order to create a more interactive learning atmosphere. They also focused on a learner-centred approach in order to make pupils more active participants. ST3 stated, "We need to make the students more active in the use of technologies… We discussed many technologies that support collaborative learning like Padlet because I think we should make students more able to build their knowledge" (Science, experimental group). Pre-service teachers explained how practitioners raise their awareness of the pedagogical affordance of technology. For example, ST7 said,

> I think technology integration requires more attention to the students' learning process… The practitioners explained that if you did not engage the students in technologies and make them active participants, you would lose their motivation to learn. (Social Science, experimental group)

The practitioners explained their role in making them aware of TPK and not only focusing on teaching but also pupils' learning. For example, P1 stated,

> In the beginning of the discussion, I saw the pre-service teachers discuss the simple use of technology such as using PowerPoint for presenting the lesson… So I tried to make them aware of PK when they discuss issues of technology… and encourage them to focus on the role of the learners in building their knowledge when using technology, and how they can address the lack of engagement in students' learning.

'Different aspects of technology integration'. The pre-service teachers in the experimental group recognised the value of the central overlap of technical, pedagogical and content knowledge (TPACK) in the process of technology integration. They recognised the elements which need to be considered during the use of a particular technology tool. For example, ST1 stated,

> Technology integration is not a simple process… It is a challenging task for teachers especially new teachers like us… We need to think about the content of the lesson, the role of learners and our teaching methods, and digital tools that can support this. (Social Science, experimental group)

The pre-service teachers in the experimental group saw technology as one element that complements content and pedagogy and, more importantly, the learner should be an active participant in the process. For example, ST6 stated, "We should think about technology, the topic of the lesson and our instruction methods and more importantly how the students actively learn" (Science, experimental group). However, the control group seemed to have a different view, as they believed that technology is the main element in the process of technology integration. They focused on technology more than other elements. For example, ST8 remarked, "I believe the main element of the integration of technology depends first on the digital tools that I use" (Science, control group). ST12 said,

> In our discussion, we realise the role of technology… We think the most important thing for us as teachers is to find the technology that makes my students excited when we present the information in class… We prefer to find technologies that have features that

> enable us to present the sounds and images in a more enjoyable way. (Social Science, control group)

Category 2: Issues relating to the design of pre-service teacher programmes. This category focused on the pre-service teachers and practitioners' views of the impact of the design of the pre-service teacher programme on pre-service teachers' TPACK development.

'The structure of the teacher education programme'. Pre-service teachers in both groups and practitioners acknowledge that the structure of the teacher education programme may not allow pre-service teachers to develop their TPACK effectively. For example, ST1 from the experimental group remarked,

> I think it was difficult sometimes to know which pedagogical method is suitable for my subject and technology as I have just started the teacher education programme and I do not have sufficient prior PK. We only take one course of teaching methods at a time with this course. (Social Science, experimental group).

The practitioners also recognised this problem. For example, P1 stated, "I think I could engage the pre-service teachers in developing their TPACK better if they had solid PK and PCK before taking this module".

'The content of the module'. Both groups and practitioners expressed some issues relating to the content of the module. Pre-service teachers in both groups and practitioners suggested that the content of the module should reflect new technologies that have been recently used. ST4 from the experimental group stated, "The practitioners provided recent technologies that are used currently in school but not covered in the module… I think the curriculum should match the new technologies that exist in the school" (Science, experimental group). The practitioners also suggested including the TPACK framework in the module. As P2 stated, "The module should include some of the definitions of the key elements of the TPACK framework in order to make the students aware of it".

5.5 Discussion

5.5.1 Research Question 1: Development of Pre-service Teachers' TPACK Knowledge

What has emerged from the TPACK survey analysis is that the pre-service teachers in both groups increased their TPACK knowledge after they participated in an online PLC. This result corresponds with those of other studies in that peer collaboration, discussion and participation in an online learning community play a role in enhancing pre-service teachers' knowledge. For example, Koh

and Divaharan (2013) found that group learning plays a role in helping Singaporean pre-service teachers to develop their conceptions of TPACK. Furthermore, Johnson (2014) found that the pre-service teachers who participated in a collaborative learning environment developed their TPACK knowledge in all seven components more than pre-service teachers who did not work in a collaborative environment. Another explanation for this finding may be related to Saudi teachers' preference to learn. Mansour, El-Deghaday, Alshamrani and Aldahmash (2014) found that Saudi teachers prefer to learn in a social context environment through networking with other peers, peer mentoring and sharing ideas with other teachers and learning in a community. In addition, Alharbi and Kinchin (2012) found that Saudi in-service teachers enjoyed open professional discussion as a means to sharing experiences during a professional development programme. This indicates that teachers can learn best in a social atmosphere with their colleagues (Dewey, 1938; Mansour et al., 2014).

However, this current study found that the gain in mean scores of TPK and TPACK in the experimental group was significantly greater than those of the control group. Pamuk (2012) found that the lack of teaching and pedagogical experience for pre-service teachers is one factor hindering the development of TPK and TPACK. Furthermore, he suggests that pre-service teachers should be provided with some guidance on technology integration and effective technology modelling use in teaching and with some good examples of the use of technology in classrooms before engaging in real teaching. It seems possible that in this current study practitioners provide additional support, scaffolding, guidance, and role modelling, which raises pre-service teachers' awareness of the important of pedagogy in technology integration. Another possible explanation is mentioned in Mansour et al.'s (2014) study, which found that Saudi teachers prefer to learn in an environment that involves some sort of interaction with more knowledgeable teachers.

5.5.2 Research Question 2: Perspective and Experience of TPACK Development

The second research question focused on understanding the pre-service teachers' experiences and perspectives of the impact of practitioners on their TPACK development and compared this view with that of the control group, which did not benefit from the stimulus provided by the practitioners. The findings from examining pre-service teachers and practitioners' responses during the interviews indicate that pre-service teachers considered that the practitioners played a role in raising their awareness of different elements of technological integration.

The findings of the current study are consistent with those of Kamoun and Selim (2007), who examined the effect of inviting IT (information technology) professionals to IT courses. They found that inviting experts to IT courses increased IT students' awareness of up-to-date technology and made them aware of rapid changes in technology. Similarly, in this current study, pre-service teachers in the experimental group found that the practitioners played a crucial role in raising their awareness of up-to-date technology and how it works, while the control group experienced some difficulty in understanding how up-to-date technology can work and be implemented. Furthermore, the pre-service teachers in the experimental group found that the practitioners helped them to be aware of the technology currently used in schools, which did not feature in their own experiences as pupils.

The current study shows that both groups found that an online learning environment played a role in raising their awareness of linking content with technology. This finding agrees with those of Graham, Borup and Smith (2012) and Hao (2016), who demonstrated that teaching candidates and pre-service teachers pay great attention to content during the process of technological integration. A possible explanation for this result may be that the pre-service teachers started the course and had sufficient knowledge of the content of their subject, having started the programme when they had studied their subjects for four years. In the experimental group, the practitioners could play a role in increasing the pre-service teachers' awareness of specific tools that had been designed for their subject and make them aware of how technology can be used for specific subject content in the context of the classroom. Hus (2012) found that pre-service teachers lack TCK awareness due to limited exposure to examples of real classroom context. He suggests that collaboration with schoolteachers during a teacher education programme can enhance the awareness of TCK. It seems that in this current study the opportunity to collaborate with practitioners solved this issues and enhance the pre-service teachers' awareness of TCK.

The current study also reveals that, although both groups realised the importance of incorporating technologies with pedagogy and there was no significant difference in PK, the groups had different views about the pedagogical affordance of technology. One potential explanation for these differences in the views is related to the role that practitioners played in raising pre-service teachers' awareness of the pedagogical affordances of technology integration. The low degree of recognition of the pedagogical affordances of technology in the control group may be related to the lack of teaching experience and guidance. Many studies have explained the reason for the limited consideration given to PK in technology integration and found that a lack of

teaching experience of pre-service teachers and scaffolding leads them to focus on the use of technology in their own teaching as a medium for delivering information and rather than as tools to support pupil learning (Hao, 2016; Pumk, 2012; So & Kim, 2009). Whipp et al. (2005) and Al-Abdullatif (2019) suggest that, in order for pre-service teachers to learn new ways of teaching effectively with technology, they always need to be in positions where they have the ability to obtain guidance. In addition, Luguetti et al. (2018) found that teachers' pedagogical identity is constructed and developed through participation in a learning community that involves different members from different backgrounds. It appears that the practitioners can play role in developing their understanding of the incorporate PK with technology.

It is interesting to note that pre-service teachers in the experimental group showed a good understanding of the factors that need to be considered when contemplating the use of a particular technological tool, as they recognized the different elements (content, technology and pedagogy) that are needed for technology integration. Moreover, they saw technology as one element that complements content and pedagogy, while the control group saw technology as the main element of technology integration. One explanation for this result is that the practitioners tried to increase awareness of the importance of these three elements in the experimental group. According to So and Kim (2009), novice teachers may see each element (content, technology and pedagogy) in isolation due to their lack of experience. So and Kim (2009) conducted a study to explore pre-service teachers' perceptions of TPACK development when they used technology in designing their lessons. They found that pre-service teachers had some obstacles in combining technology, pedagogy and content. They provided two reasons for this lack of engagement: the failure to expose pre-service teachers to understanding how technology can be integrated into innovative teaching and the failure to provide sufficient resources for using technology with specific teaching methods. It seems that, in this present study, practitioners may have acted as a resource that helped pre-service teachers to understand how technology can work in practice and provided some explanations in order to make a connection between these three elements. Several researchers suggest that guidance, modelling and examples should be provided for pre-service teachers in order for them to link the three elements (Gao et al., 2009; Estes & Dailey-Hebert 2018; Tondeur, van Braak, Sang, Voogt, Fisser & Ottenbreit-Leftwich, 2012).

Although the presence of practitioners enhanced pre-service teachers' experiences, there were several issues observed by participants that may act as obstacles in developing TPACK. One of the main findings of the current study relates to the structure of teacher education programmes. Both

groups mentioned that they did not have sufficient prior PK before taking the technology course. This problem has been mentioned in many studies in different countries. These studies have found that the lack of PK and a limited pedagogy course taken before an ICT course can hinder the development of TPACK (Chai, Koh & Tsai, 2010; Hao, 2016; Pamuk, 2012; So & Kim 2009). The current study recommends that pre-service teachers should take a pedagogy course before taking an ICT course in order to enhance their TPACK development.

Furthermore, both groups and practitioners were of the opinion that the content of the module should include some new trends in technology. The finding of the present study is similar to the results of a study conducted by Aslan and Zhu (2015) in Turkey, who reported that some pre-service teachers in the interview revealed that the content of some ICT courses required some up-to-date computer programmes. Saltan et al. (2017) found that pre-service teachers training programmes do not provide up-to-date training. In the current study, practitioners suggested the inclusion of the TPACK framework within the content of the module. The finding of this current study corroborates the ideas of Jang (2010), who started an interactive whiteboard training course for teachers by discussing TPACK concepts and theories in order to improve teachers' comprehension of TPACK and their understanding of each element before they engage in the course. This current study recommends that the content of the ICT course should be improved. The recommendations of this study are aligned with the SAUDI vision 2030, as it focuses on reforming the curriculum to be suitable for future work.

5.6 Limitations

Several limitations should be taken into account when interpreting the findings of the present study. First, this study was conducted with a relatively small sample and only female participants. It is important that any future research replicates and builds on this work, particularly in different universities, and includes male participants. Another limitation is that this study does not offer an insight into the extent of the impact of the intervention on pre-service teacher's classroom practices and pupils' learning when they progress to school placement and become teachers. Therefore, further longitudinal research needs to be conducted and potentially tracking some of the participants in this study. This research relied on the use of self-reporting instruments to measure pre-service teachers' knowledge development and did not have insight into actual knowledge development. Future research could focus on analysing pre-service teachers' instructional materials of technology integration. Another limitation is that this study did not focus on other factors that may play a role in improving pre-service teachers' TPACK, knowledge

such as their beliefs about technology, motivation and self-efficacy. However, this study applied random allocation of the participants, which can help to control factors that this study did not measure.

5.7 Conclusion

This study found that practitioners played a role in raising pre-service teachers' awareness of the different elements of technological integration. Pre-service teachers in the experimental group had significantly higher scores in TPK and TPACK than those in the control group. More importantly, practitioners can help to develop pre-service teachers' pedagogical understanding and awareness as well as their ability to link technology with PK and PCK. There were some suggestions regarding the change of structure of the teacher education programme and the content of the module, in order to enhance the development of pre-service teachers' TPACK experience. This study has shown the role of practitioners in affecting pre-service teachers' TPACK development. Future studies can focus on engaging pre-service teachers with practitioners in designing the technology integration lesson together. Collaborative design has been effective in enhancing technology integration among teachers (Agyei & Voogt, 2012). Another area of study would be to examine pre-service teachers' learning behaviours in terms of network development and the knowledge building process through the use of social network analysis and content analysis. Teachers' social interaction and engaging in the knowledge building process can play a role in enhancing teachers' knowledge development (Fox & Wilson, 2015). This research will be extended in the future (Phase 2 and Phase 3) to show the effect of practitioners on pre-service teachers' social interactions in an online environment and the knowledge building process. Moreover, it will show how pre-service teachers' TPACK can affect their interaction and exchange of knowledge.

Chapter 6 Promoting Pre-service Teachers' Knowledge Construction and Social Interaction in an Online PLC through Engaging with Experience Practitioners (Phase 2)[1]

Abstract

This study investigated the role of experienced practitioners in promoting pre-service teachers' knowledge construction and social interaction in an online professional learning community. A repeated- measurement experiment design was adopted. Two practitioners supported pre-service teachers in an experimental group to discuss issues around technology integration. Content analysis revealed that practitioners increased their levels of knowledge construction and high-cognitive discourse. The practitioners enhanced pre-service teachers' network size and the extent of collaboration between those with varying levels of TPACK knowledge. In both groups, collaboration in high knowledge building occurred predominantly with peers in the same discipline, and interdisciplinary collaboration was limited.

6.1 Introduction

In recent years, the online professional learning community (PLC) has been recognised as a useful collaborative learning environment to enhance pre-service teachers' professional growth (Kirschner & Lai, 2007). Pre-service teachers' collaboration in an online PLC can enhance their sense of collective responsibility for improving learning and teaching (Bond, 2011). The collaboration of pre-service teachers with experienced practitioners, such as expert, in-service teachers who are actively involved in the teaching profession and have experience in teaching, can engage pre-service teachers in the process of learning to teach (Hammerness et al., 2005). Prior studies concerning pre-service teachers have shown that networking and establishing social relations with other practitioners can provide pre-service teachers with access to knowledge regarding the practice of teaching (Liu, 2005; Risser, 2013). Rachamim and Orland-Barak (2018) found that participating expert teachers, who act as a mentor, with student teacher in a community can stimulate student teacher learning. Engaging with practitioners can provide

[1] The findings of this study were presented in Sunbelt conference

cognitive and emotional support, which can prepare novice teachers to teach (Feiman-Nemser, 1998). Similarly, learning to integrate technology into classroom practice requires support and mentoring from experts (Dorner & Kumar, 2016). According to Dorner and Kumar (2017), experts in technology integration are not always available to pre-service teachers during their training. Studies on engaging experienced practitioners with pre-service teachers found that practitioners enhanced pre-service teachers' satisfaction in engaging in online learning (Dorner & Kumar, 2016) and developed both their computer skills (Dorner & Kumar, 2017) and practical knowledge (Alebaikan, 2016).

By contrast, there has been limited empirical research to evaluate the practitioners' effect on developing pre-service teachers' knowledge and network development in online PLC. Recent attention has focused on how and why pre-service teachers within a PLC form networks in which peers and practitioners can support their development (Fox & Wilson, 2015; Risser, 2013). Van Waes, De Maeyer, Moolenaar, Van Petegem and Van den Bossche (2018) support the use of interventions to strengthen teachers' networks to improve teaching and learning. In fact, most research on pre-service teachers' programmes in various countries has concentrated on enhancing knowledge acquisition and pedagogical and technological skills (e.g. Al-Abdullatif, 2019; Durdu & Dag, 2017; Kopcha & Leftwich, 2014). There has been limited focus on their development of cognition (knowledge construction) and social network growth (e.g. Bokhove & Downey, 2018; Liou et al., 2017). Liou et al. (2017) argue that both social and cognitive aspects of pre-service teachers' professional learning play an important role in developing their teaching and pedagogical skills, and there is increasing demand to enhance such skills. There has been limited empirical research to examine the impact of practitioners on pre-service teachers' collaboration and engagement in an online PLC (Li et al., 2014). Therefore, this study responds to the paucity of research into the role of experienced practitioners in enhancing pre-service teachers' cognitive (knowledge-building) and social engagement (network development).

6.2 Literature Review

6.2.1 Knowledge-building in an Online PLC

Due to increased recognition of social interaction in professional learning, a key theme of recent literature has been how technology can promote the cognitive processes in knowledge construction among pre-service teachers (Namdar, 2017; Kucuk & Sahin, 2013). Garrison, Anderson and Archer (2001) define this as learners' ability in constructing and confirming

meaning collaboratively through ongoing interaction. In an online PLC, knowledge construction relies on a group of teachers having the ability to share information and to reach consensus over how it can be interpreted for professional practice (Zhang, Liu, Chen, Wang & Huang, 2017). Dorner and Kumar (2016) argue that knowledge-building activity can help pre-service teachers to integrate technology into their practice. Studies focused on cognitive engagement and knowledge construction in online environments have deployed content analysis (CA) to assess the quality and level of knowledge construction taking place in these spaces (Garrison, Anderson & Archer, 1999; Gunawardena, Lowe & Anderson, 1997). For example, Garrison et al. (1999) developed the community of inquiry framework, which regards cognitive presence as a one element. The cognitive presence coding schema was developed to evaluate the level of knowledge construction in a learning process, comprising four phases (Garrison et al., 1999):

- Triggering: This phase focuses on the posts involving some sort of identification of the problem, such as asking a question;
- Explanation: This phase focuses on sharing information and knowledge;
- Exploration: This process focuses on connecting ideas and creating solutions; and
- Resolution: This involves testing and critically assessing the solution.

These successive phases, as experienced by learners, represent a shift from lower to higher cognitive demand. The first two describe the process of knowledge-sharing, which involves a lower level of cognitive demand, while the latter two are knowledge-building processes and represent higher-level cognitive discourse (Hemphill & Hemphill, 2007; Lu & Jeng, 2006). In recent years, studies have used cognitive presence to investigate the level of cognitive engagement and knowledge construction in the context of teacher education. Some studies have shown that most online posts are in the Trigger and Explanation phases, and are limited in the Exploration and Resolution phases (Redmond & Mander, 2006; Arnold & Ducate, 2006). According to Conaway, Easton and Schmidt (2005), engaging learners in higher-order thinking in an online context is challenging. Therefore, several factors need to be considered in promoting knowledge construction. Garrison and Cleveland-Innes (2005) recommend appropriate activities to promote challenging questions and deep discussion, allowing people to examine their ideas to generate an environment that supports deep levels of knowledge construction. Ioannou, Demetriou and Mama (2014) highlighted the benefits of teachers networking with others of dissimilar levels of expertise. Zhang et al. (2017) found that facilitating discussions with expert teachers can allow pre-service teachers to engage in knowledge-building. Overall, it appears that online activities should promote a high level of knowledge construction among pre-service teachers through designing activities and facilitating discussions that support the co-construction of knowledge

through enhancing both the extent and quality of their social networks. Therefore, the next section will discuss some aspect of teacher network.

6.2.2 Teachers Network in PLC

Studies on knowledge-building among teachers in an online PLC have typically focused on social interaction (Zhang et al., 2017). Teachers' professional learning is not regarded as an isolated learning process but as a web of social interaction (Moolenaar, 2012). Both social capital and social network theory are increasingly used by researchers to understand the professional learning of teachers. Lin (2001, p.12) defined social capital as "resources embedded in a social structure which are accessed and/or mobilised in purposive action". Studies have shown that social capital can play a role in knowledge-sharing (e.g. Tseng & Kuo, 2014; Quinn & Kim, 2017) and construction (e.g. Daniel, Schwier, & McCalla, 2003; Nahapiet & Ghosha, 1998). Application of social capital theory can facilitate knowledge-building among pre-service teachers. In the context of teachers' education, most social network studies use social capital theory to understand how teachers can develop relationships with others regarding professional learning (e.g. Quinn & Kim, 2017; Rienties & Kinchin, 2014). Teacher networks can provide several cognitive and affective advantages to enhance group outcomes through allowing teachers access to different resources and the opportunity to apply them, while affective benefits emerge from encouragement and support (Fox & Wilson, 2015). Beyerbach, Vannatta and Walsh (2001) state that enhancing pre-service teachers' connections in PLC can help their technology integration. Hence, engaging pre-service teachers in online PLC can give access to support from expert practitioners and peers, which may enhance their use of technology.

Social network theory supposes that the behaviour and outcomes of individuals can be related to the larger network of social relations (Burt, 1992). A teacher's social network includes nodes (i.e., members of an online PLC) and ties (connections) between them. This theory relies on examining the relations between members in the entities (PLC). Social network studies in teacher education usually focus on two key features in order to understand the quality of the network: network size and diversity (e.g. experience, department and level of teaching performance) (Liou et al., 2017; Van Waes et al., 2018). Regarding network size, teachers with many social ties can access useful resources through these social relations (Moolenaar & Daly, 2012). The diversity is considered a significant factor that positively influences teachers' professional learning (Van Waes et al., 2015). However, according to Fox and Wilson (2015), contacting teachers with similar interests may not result in the acquisition of new teaching practice ideas; diversity in the network can enhance

teachers' outcomes as a result of receiving different perspectives from people with dissimilar experiences (Burt, 1992). Van Waes et al. (2015) found that teachers who achieved high teaching performance, in terms of high levels of pedagogical and content knowledge, and who were considered effective in the classroom usually had a large and diverse network in terms of teaching experience and expertise. Liou et al. (2017) found that collaboration between high- and low-teaching performing pre-service teachers can enhance the collaborative environment and the flow of knowledge.

Much of the current literature on pre-service teachers' technology integration focuses on the development of technological pedagogical content knowledge (TPACK) (e.g. Al-Abdullatif, 2019; Durdu & Dag, 2017; Kopcha & Leftwich, 2014). The TPACK framework contains seven types of knowledge: technological knowledge (TK), pedagogical knowledge (PK), content knowledge (CK), pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK). Limited research has focused on how the level of pre-service teachers TPACK knowledge affect the group interaction. Moreover, these studies do not examine whether pre-service teachers with a high TPACK level collaboratively exchange and build knowledge with pre-service teachers with a low TPACK level, which is what this current study seeks to investigate. Phillips (2017) found that teachers' social relations and networks have impact on developing TPACK. So, it is very important to examine the teachers' relations in an online PLC in order to understand how these relations can impact on the context of forming the TPACK among the teachers.

Engaging in an online PLC does not automatically develop teachers' networks. According to Van Waes et al. (2018), there is a need to strengthen teachers' networks by applying some sort of network-based intervention. Also, several studies (e.g. Fox & Wilson, 2015; Liou et al., 2017) recommend that future research should focus on how to support network development among pre-service teachers in the online environment and, more specifically, in constructing their knowledge.

6.2.3 Experienced Practitioners as a Tool to Engage Pre-service Teachers in Knowledge-building and Social Interaction

The involvement of expert practitioners, such as expert in-service teachers who have experience in teaching and are involved in the teaching profession may bring about many benefits for pre-

service teachers. Their presence is considered a way of enculturating pre-service teachers into professional communities, which can engage them in the process of learning to teach. Li et al. (2014) indicated that the presence of practitioners not only improves learning outcomes but strengthens engagement in the process of learning. Liu (2005) argues that cognitive and collaboration skills among pre-service teachers can be improved through conversation with expert teachers in an online environment. In a face-to-face context, Chaliès, Ria, Bertone, Trohel and Durand (2004) found that such conversation with more experienced professionals, such as other teachers, helped pre-service teachers to engage in the process of knowledge construction by encouraging critical reflection. Hemphill and Hemphill (2007) found that engaging with experts online was more interactive than meeting them face-to-face, since learners could discuss with them anytime and anywhere and can enhance the collaboration. Although it is possible to argue that online facilitators can play a similar role, experienced practitioners can stimulate learners' thinking and make their learning more authentic and interesting, since it helps them to feel that they belong to a community of professionals (Dorner & Kumar, 2017).

Although the benefits of expert practitioners' involvement for pre-service teachers' learning have been noted, empirical research evaluating their effect on online PLC has so far been limited. Wearmouth, Smith and Soler (2004) found that practitioners facilitated reflection of potential teachers and increased the frequency of posts in the online PLC. Dorner and Kumar (2016) surveyed pre-service teachers' satisfaction with the participation of expert teachers in an online mentoring environment and found that they were satisfied with experts' activity and their role in enhancing their collaboration and communication with their peers. However, there are some limitations in their study. They only focused on measuring their perception of the collaboration but they did not explore the pattern of collaboration such as the number of ties that pre-service teachers developed or the interaction between members from different departments. In terms of studies focusing on the knowledge-building process, only two studies were found. Hemphill and Hemphill (2007) investigated the role of experience in practitioners' interactions with pre-service teachers in online learning environments; they found that experienced teachers enhanced their level of knowledge construction. Redmond and Mander (2006) found that engaging in-service teachers with pre-service teachers enhanced their problem-solving and thinking skills, but the extent of high-cognitive discourse was restricted due to their limited experience of online collaboration. This means that subject experience alone is not enough, without the experience of facilitating collaboration. According to Dorner and Kumar (2017), the role of the experts should be considered during the design of the activity. Although these two studies investigated knowledge-building, there are limitations since neither included a control group, making it difficult to justify

the role played by the practitioners, nor prepared the practitioners to facilitate pre-service teachers' knowledge construction. Thus, this current study seeks to enhance the practitioner involvement through a training programme to develop their skills in facilitating high-level exchange online and comparing the results achieved in the presence of practitioners and in their absence.

From the above discussion, it appears that most studies do not explain how pre-service teachers become engaged in the learning process. This is consistent with Costello (2012), who found that studies investigating the presence of online experts have not examined their impact on the community's group activity, such as the level of interaction and network development. Li et al. (2014) recommend that future studies focus on the mechanism by which learners engage in the learning process with practitioners. Previous studies have focused on only one type of engagement, typically cognitive engagement, without considering social interaction and network development, and have methodological limitations. For example, most have relied on a single research method, such as interviews, survey or CA, not a combination of more powerful methods, such as social network analysis (SNA) and CA.

Therefore, this study seeks to address the gap identified in the literature concerning various aspects of the impact of practitioners' presence on engaging pre-service teachers' in professional learning within an online PLC. First, it attempts to understand the impact of practitioners' presence on knowledge-building and the social behaviour of pre-service teachers online. Second, it seeks to fill the methodological gap by combining research methods, including CA and SNA, to examine professional learning. Therefore, this study seeks to investigate the following research questions:

RQ3. To what extent does the involvement of practitioners increase the level of cognitive discourse in online pre-service teachers' PLC?

RQ4. To what extent does introducing the practitioners lead to developing pre-service teachers' professional interaction?

RQ5. To what extent does the involvement of practitioners lead to developing knowledge ties across the boundary between subject disciplines?

RQ6. To what extent does the involvement of practitioners enhance collaboration between pre-service teachers with different levels of TPACK knowledge?

6.3 Methodology

6.3.1 Research Design

This study employed a repeated-measurement experimental design with control and experimental groups (Cohen, Manion & Morrison, 2011). The main reason for using this design is that this helps to take the prior level of knowledge-building and network development of both the control and experimental groups into account before the intervention to determine whether there are any between-group differences. The reason for using repeated measurements is to allow the effect of the intervention to be observed at various time points, after controlling for the prior level of knowledge-building and network development. Figure 6-1 shows the procedure of the experimental design.

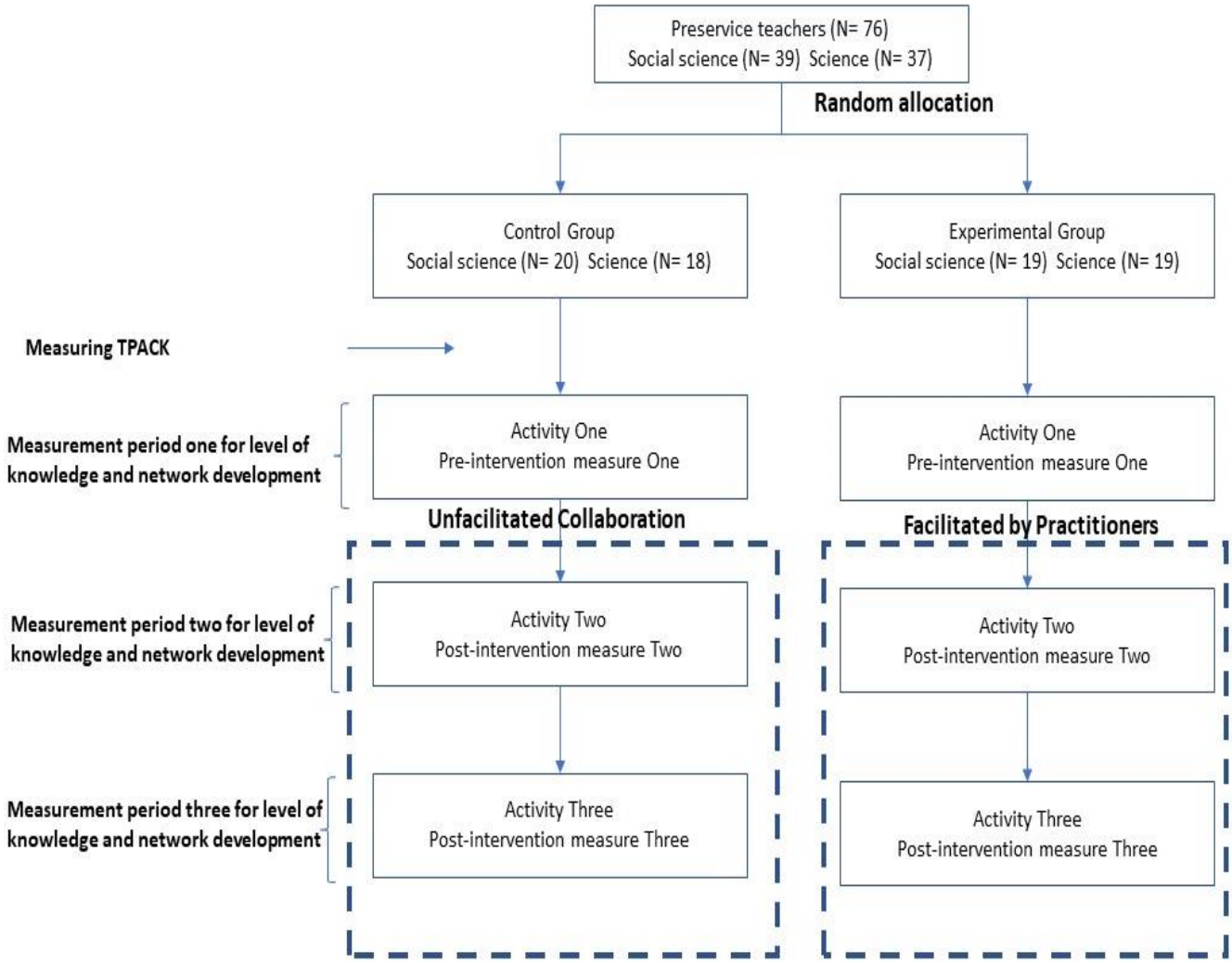


Figure 6-1: Experimental procedure

6.3.2 Participants and Settings

The study was conducted at a Saudi University during Fall Semester 2017. The pre-service teacher education programme is a one-year programme. One module was selected for this study, which is mandatory for all pre-service teachers, on the use of educational resources in education, specifically ICT tools. Pre-service teachers take this module in the first semester as part of their campus-based study, and it typically consists of a two-hour lecture every week for 15 weeks.

In total, 76 pre-service teachers were registered on the module, all female with different majors; either social science (39) or science (37), and their average age was 22 years. Two experienced female practitioners in educational technology participated. The first was an expert in-service teacher with experience of using technology in teaching and learning. The second was an expert in-service teacher and a learning resources specialist at a secondary school, where her role was to provide teachers with opportunities and information to use technology to support their teaching. Both of the practitioners were female and had experience in working with interdisciplinary team.

6.3.3 Online Environment and Activities

In the present study, the module was implemented via Facebook for eight weeks during the last few months of 2017. Facebook was used as a medium for communication and collaboration among pre-service teachers and practitioners. A private group was created on Facebook for each group. The module comprised three online activities based on the three topics of the module (interactive whiteboard, multimedia applications and online learning tools). The activities focused on teaching pre-service teachers how to use technology in their classroom practice. Activity one for both groups was conducted without facilitation by practitioners (see unfacilitated collaboration condition in Table 6-1). Activity two and three in the experimental group were facilitated by practitioners, and there was an unfacilitated collaboration in the control group (see Table 6-1). The TPACK survey was distributed to all pre-service teachers, in both the experimental and control groups, before participation in the online environment.

A training programme for the practitioners before they joined the experimental group provided information on the context of the pre-service teachers, facilitating interactions in online discussions and suggestions on how they could give them guidelines and feedback (Garrison & Arbaugh, 2007).

Table 6-1: Online activity for both conditions

Condition	Activity
Unfacilitated Collaboration	Pre-service teachers were provided some videos, teaching plans and articles that related to the use of specific type of technology Pre-service teachers were asked to discuss how the specific types of technology might be used in the classroom and possible learning activities Preservice teachers started the discussion Pre-service teachers were required to discuss, reflect and exchange their ideas and opinions, as well as to support each other. In the end of activity, pre-service teachers were encouraged to make final summary and reflection of the benefit, challenges and several considerations of the use of this type of technology.
Facilitated by Practitioners	Pre-service teachers were provided some videos, teaching plans and articles that related to the use of specific type of technology The practitioners participated in the group Preservice teachers started the discussion Pre-service teachers were asked to discuss how the specific types of technology might be used in the classroom and possible learning activities Pre-service teachers were required to discuss, reflect and exchange their ideas and opinions, as well as to support each other. The role of practitioners focused on stimulating the pre-service teachers' curiosities toward technology integration by providing real examples, asking questions and encourage reflection as well as helping them to build knowledge collaboratively and developing exchanges between pre-service teachers. In the end of activity, practitioners encouraged and guide preservice teachers to make final summary and reflection of the benefit, challenges and several consideration of the use of this type of technology.

6.3.4 Data Collection

TPACK questionnaire. The TPACK questionnaire used in this study was adapted from that designed by Chai, Ng, Li, Hong and Koh (2013), measuring seven types of pre-service teachers' knowledge. This instrument includes 32 items and consists of four TK items, four CK items, five PK items, five PCK items, four TCK items, four TPK items, and five TPACK items. In terms of the reliability of the instrument, Cronbach's alpha for the seven scales is ≥ 0.70, indicating reasonable reliability. Chai et al. (2013) conducted confirmatory factor analysis (CFA) to assess the model fit and indicated acceptability ($\chi2$= 1134.5, $p < .001$, $\chi2/df$=2.51, CFI=0.96, RMSEA=0.057). According to Hu and Bentler (1999), a CFI ≥ 0.90 and an RMSEA close to 0.06 are both considered a good fit. Similarly, Khine, Ali and Afari (2017) conducted CFA to assess the model fit of the TPACK survey in an Arab Gulf context and found that the model had an acceptable fit ($\chi2$= 794.29; df = 545; $\chi2$ /df = 1.46; CFI = 0.92; ; RMSEA = .053; SRMR = .048). The response rate to the questionnaire in the current study was 100%.

Content analysis of knowledge construction. The main objective was to examine the level of knowledge construction among pre-service teachers in an online PLC. CA can provide insights into the construction of knowledge in online learning interactions (Zhang et al., 2017). Cognitive presence, developed by Garrison et al. (2001), was used as the coding scheme for this study. Garrison et al. developed it specifically to examine knowledge construction in computer-mediated communication environments. It has been used to analyse online discussions in a teacher education context (Redmond & Mander, 2006). Appendix F provides the indicators and examples from this current study of each element of the coding schema. CA can provide insight into the level of knowledge construction and offers a way to compare the differences between the control and experimental groups.

The unit of analysis to code the transcripts was chosen to be a complete message (post). Krippendorff (1980) defined the unit of analysis as a separate, observable element of a transcript. Many researchers in the field of computer-mediated communication, such as Anderson Rourke, Garrison, and Archer (2001) and Rienties, Tempelaar, Van de Bossche and Gijselaers (2009) also use a complete message. According to Rourke et al. (2001), there are several advantages to doing so: it is objectively identifiable and the author of the message can be identified. However, one message may include multiple phases of knowledge, so it permits a transcript to be coded accurately to one or several phases, based on their description, as in this study.

Inter-rater reliability tests were conducted to assess the objectivity of the analysis. This is the extent to which different coders working on the same transcript independently yield the same results (Rourke et al., 2001). In the present study, three members of the research team independently coded a part of an online discussion, which was then shared among the research team. Moreover, two independent coders, both Saudi educational technology lecturers with CA experience, were invited to the training session on coding. During this session, the researcher worked with the coders on providing exemplars for each level of knowledge construction and coding transcripts to help them understand the coding process. Then, the independent coders were asked to code a random sample of a transcript independently. A comparison was then made. Cohen's kappa statistic was used to determine the level of agreement, and the inter-reliability between Coder 1 and 2, 2 and 3 and 1 and 3 was 0.827, 0.844 and 0.817, respectively. Krippendorff (1980) state that a Cohen's kappa value of 0.75 and above represents excellent agreement.

Social network analysis (SNA). One means of identifying social capital and social networks within an online PLC networked learning environment is through SNA. SNA was used to identify the pattern of social interaction among pre-service teachers. The interaction identified by CA was translated into the SNA as a tie linking two individual pre-service teachers. The process of translating the CA into social network data starts by observing who responded to or built on the ideas of others within the network. In the Facebook discussion, any members of the group can post to the group's wall, and other members can comment on the post. Members can continue commenting on the original post or comment on comments made by other members. There are two networks in the study: knowledge-sharing (low cognitive interaction), which focuses on integrating Trigger and Explanation, and knowledge-building (high-cognitive interaction), which focuses on integrating Exploration and Resolution. For example, if Participant A replies to Participant B and the type of post was Explanation, one interaction was recorded (Row A, Column B) to indicate a tie in the knowledge-sharing network. The steps for how the Facebook discussion was translated into network were as follow. In the ***first step,*** the Facebook discussion was coded by using the cognitive presence coding schema developed by Garrison (2001). A translated exemplar of the narrative from the Facebook discussion, and how the discussion was coded follows below.

Example:

S1: Hi, everyone. Do you think that the Forum in Moodle software is a good tool for student engagement? I am thinking of using it with my students in the future. **(Code: Triggering)**

S2: Yes, S1. I think Forum has many features that engage the students in learning. It allows students to discuss and share their knowledge collaboratively. See this link. **(Code: Explanation)**

S3: I think… This tool can engage students in learning. You can provide questions related to the lesson and see how the students respond. I think it can increase the interactivity among students and their teacher. **(Code: Explanation)**

S4: Hi, S1. I think you should focus on the type of activity and teachers and students' roles during the use of Forum because using Forum without a clear plan may not engage students in the discussion. **(Code: Explanation)**

> S5: I agree with S4. The design of the activity is fundamental. You should focus on the type of activity that makes students engage in the discussion. For example, you could use peer-reviews as an activity to make the students support each other. Ali (2009) used Forum as a

peer-review activity by asking students to upload their essay and asking other students to review this essay and provide their comments. I think this encouraged students to respond to each other. **(Code: Exploration)**

58: Yes S4, the type of activity is crucial to engage the students in the discussion. There is one technique that can enhance the engagement, for example, the type of activity that involves a debate, which can engage students in discussion. I remember that my teachers used this technique, and we all engaged in the discussion because everyone had different ideas and perspectives, making the discussion more productive. Also, Al-Ali (2014) conducted study by applying debate as techniques to enhance the discussion and found the level of students' participation increased more than before **(Code: Exploration)**

S11: I think the students should have some communication and collaboration skills before they engage in the discussion as these skills help them to support their peers and enhance the depth and quality of the discussion. **(Code: Explanation)**

S6: I definitely agree with the comment by S4 regarding the importance of clarifying the students and teachers' role in the discussion. Dr Alamr explains this point in his article. He found that the students may not engage in discussions effectively because they may have insufficient scaffolding from teachers and thus do not know what should do in the discussion. So, teachers should be involved in discussions with students and provide feedback, and the students' role should clarify what the type of activity is, for example, a reflection or peer review. **(Code: Exploration)**

> S7: Hi S6. But I think sometimes teachers' involvement hinders the students' engagement because sometimes students merely want teachers' feedback and may not provide further support for their friends. **(Code: Exploration)**
>
> S6: Hi S7, I understand what you mean, but I think teachers should provide effective scaffolding techniques for students. They should provide not only feedback but also ask challenging questions. So, the teachers could balance the discussion because too much feedback may prevent the opportunity for students to provide comments, and too many challenges questions may tire students. Two reasons make me confident about this answer. First, providing effective scaffolding during the discussion can make the discussion ongoing. Dr Mohamad conducted a study to investigate the impact of different teachers' response techniques in the discussion and found that providing direct feedback alone hinders the interaction, but the balance between direct feedback and asking questions enhances the engagement. Second, the

teachers' involvement enhances the direction of the discussion. Salman (2013) investigated the role of teachers in discussions and found that teachers' comments in discussions encourage students to focus on the key objectives of the activity and help students focus on the questions posted by other students. So, the technology itself cannot help students engage in discussions without focusing on teachers' roles in this environment. **(Code: Resolution)**

S10: Thank you very much S6 for your clarification and justification. Your contribution highlighted the importance of teachers' facilitation techniques in discussions. So, the teachers should have some facilitation techniques before they engage with students in order to enhance students' learning experience as mentioned in Alrefai's study. Alrefai (2009) found that providing challenges questions enhance the discussion **(Code: Exploration)**

S11: Yes S6, both teachers and students should prepare before the discussion. Teachers should be trained on how to use different facilitation techniques, and the students should learn some communication skills. According to Majed (2012), preparing both students and teachers can provide effective online learning experiences and support. **(Code: Exploration)**

In the ***second step***, the interaction identified by CA was translated into social network data. The process of translating the CA into social network data starts by observing who responded to or built on the ideas of others within the network. From the previous discussion, the structure of the conversation can be described as follows. S1 posted a question regarding the use of the Forum tool, and S2, S3 and S4 each commented on the original post written by S1. Then, S5, S8, S11, and S6 commented on the post by S4. S7 commented on the post by S6, and S6 subsequently replied to S7. Then, S10 and S11 replied to the second comment provided by S6. Figure 6-2 shows the social network visualisation of the previous discussion (This includes both knowledge sharing and knowledge building ties).

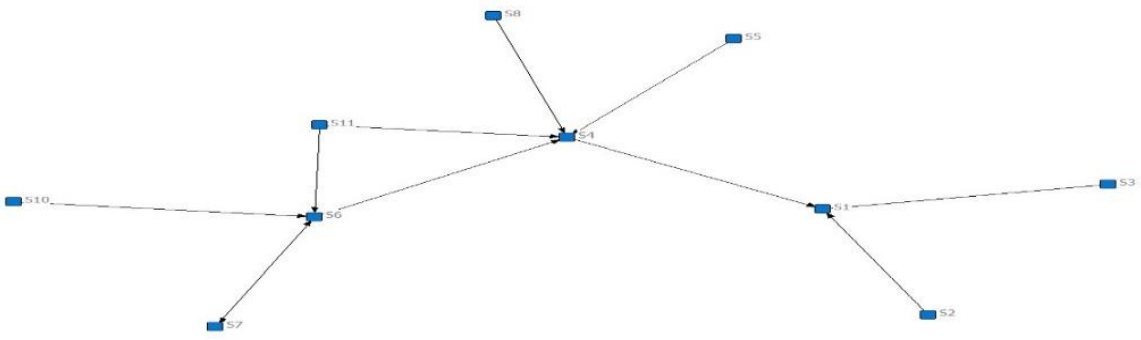


Figure 6-2: The social network of the whole discussion

This study has two networks: knowledge-sharing (low cognitive interaction), which focuses on integrating the Trigger and Explanation stages, and knowledge-building (high-cognitive interaction), which focuses on integrating the Exploration and Resolution stages. For example, if Participant A replies to Participant B and the type of post was rated at the Explanation stage, one interaction was recorded (Row A, Column B) to indicate a tie in the knowledge-sharing network. In the previous example, S2, S3 and S4 replied to S1 (original post) by providing a comment at the Explanation stage (low level of interaction). Also, S11 replied to S4 by providing a comment at the Explanation stage (low level of interaction). These interactions represent the knowledge sharing network. Figure 6-3 shows a visualisation of the knowledge sharing network. In terms of the knowledge building network, S5, S8, S6 replied to S4 by providing comments at the high cognitive level. S7 replied to S6 and then S6 replied to S7 by providing comments also at the high cognitive level. Then, S11 and S10 commented to S6 by providing comments also at the high cognitive level. Figure 6-4 below shows the translation of these interactions into a visualisation of the knowledge building network.

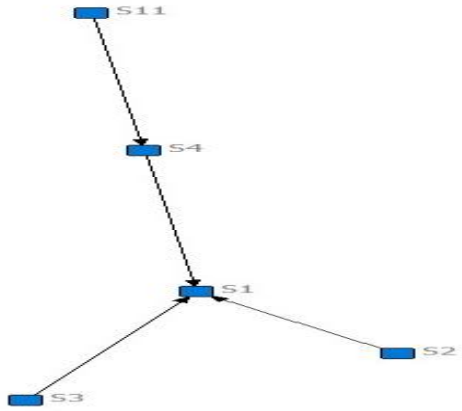


Figure 6-3: The knowledge sharing network

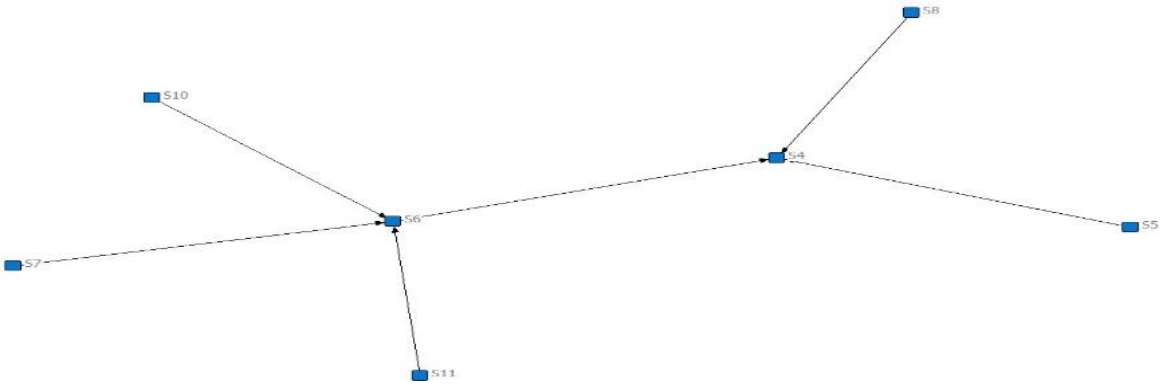


Figure 6-4: The knowledge building network

This study provides information on two levels of social network data: whole network and ego network. The main difference is that whole-network data provide an overview of all interactions in the group, while the ego-network data provide information on an individual's interactions. Analysis of the whole network was undertaken using of multiple regression quadratic assignment procedures (MRQAP) (Krackhardt, 1988) and visualisations. Visualisations of networks can offer insights into their changing patterns over time, while MRQAP examines the associations between the level of TPACK knowledge or the affiliation to the subject department in the overall collaborative network. Multiple regression techniques, appropriate for the interdependent nature of network data, were conducted to examine the relationships between networks. MRQAP was used to answer RQ5 and RQ6. The ego-network data measured the ego-network size and the extent of network homophily, known as the E-I index. Studies have used these measures with pre-service teachers (Bokhove & Downey, 2018) and in interventions studies to compare network development between control and experimental groups (Van Waes et al., 2018; Rienties & Héliot, 2018). An understanding of pre-service teachers' network sizes can gauge the level of engagement in an online learning community, and seeks to answer RQ4. The ego-network density (size) of each participant's presence in the network was used to measure how many other participants each is directly linked to (Rienties et al., 2009). To measure the diversity of the network, the Internal–External (E–I) index was used to examine whether pre-service teachers interact with peers in their same department (internal tie – I) or other departments (external tie – E). Krackhardt and Stern (1988) state that the value of the index ranges from –1 (all ties are only within the same department, or homophily) to +1 (all ties are to individuals outside the ego's own department, or heterophily). The measure of network homophily seeks to answer RQ5. To measure the E–I index (RQ 5), the following formula was used (Krackhardt & Stern, 1988):

$$E - I\ Index = \frac{E - I}{E + I}$$

The social-network data were analysed using the network analysis software packages UCINET v6.658 and NetDraw v2.163 (Borgatti, Everett, & Freeman 2002).

6.3.5 Statistical Analysis

The distributional characteristics of the dependent variable(s) were examined to check for assumptions associated with using t-test and ANOVA. This was established through visual review of normal distribution curves and checking the skewness and kurtosis and z values of skewness and kurtosis of the dependent variables (Field, 2009). The values fell within acceptable limits of -1.96 to +1.96 (Hair, Black, Babin & Anderson, 2010). To examine the change between groups, an independent t-test was used. A repeat-measure ANOVA was adapted to examine the change

between three time points within groups. An effect size (Cohen's d) was calculated to reveal the strength of the difference between the mean scores of the control and experimental groups (Pallant, 2007). Cohen (1988) provides an interpretation of the effect size: 0.2 = small, 0.6 = medium and 0.8 >= large. Partial eta squared ($\eta 2$) was used in repeat-measures ANOVA to indicate within-group variation, with $\eta 2 > 0.01$ constituting a small effect, > 0.06 a medium and > 0.14 a large effect (Pallant, 2007). A Bonferroni correction was applied to adjust for the possibility of Type-I error (Field, 2009). In this study, 14 variables were measured, so an adjusted significance level of $p < 0.003$ was used (0.05/14). MRQAPs (Krackhardt, 1988) examined the associations between the level of seven types of TPACK knowledge (TK, CK, PK, PCK, TPK, TCK, TPACK) and affiliation to the subject department in the teachers' overall collaborative network. Mundfrom et al. (2006) recommend conducting a Bonferroni adjustment for multiple regression analysis to reduce Type-I error. An adjusted significance level of $p < 0.006$ was used as result of dividing the number of variables on 0.05 (0.05/8).

6.4 Results

6.4.1 Research Question 3: The Level of Knowledge Construct

Table 6-2 shows that both groups posted a similar volume of messages both in the total number of cognitive messages and the number in each of the categories in Time 1 (T1). To reveal whether any significant differences emerged after the practitioners' introduction into the experimental group, a repeated-ANOVA was performed separately among the experimental and control group. Two separate one-way repeated-measures ANOVA with a Greenhouse-Geisser correction determined that the total messages in both the control and experimental groups increased significantly between the three time points. Post-hoc tests with a Bonferroni correction revealed a significant increase between each of the time points (Appendix G shows post-hoc tests). As shown in Table 6-2, for the experimental group, changes in the volume of messages coded to the lowest cognitive level of Trigger did not increase significantly over time, but the increases in Explanation and those coded to the higher levels of Exploration and Resolution were significant between the three time points. Post-hoc analysis with the Bonferroni correction showed that the volume at these three levels increased significantly over time. For the control group, there was an increase over time in the volume of messages coded at Explanation. The messages coded at the level of Explanation increased from T1 to Time 2 (T2) and stayed constant between T2 and Time 3 (T3).

Table 6-2: Within-group differences at various levels of knowledge

		T1		T2		T3		Df	F	η2
		M	SD	M	SD	M	SD			
Trigger	Control	0.94	0.51	1.21	0.74	1.26	0.72	2	4.35	0.10
	Experiment	0.81	0.60	1.13	0.66	1.18	0.69	2	4.04	0.09
Explanation	Control	2.86	1.25	3.65	1.56	4.10	1.79	2	18.52*	0.33
	Experiment	2.92	1.45	3.84	1.93	5.05	1.45	2	37.74*	0.51
Exploration	Control	2.05	1.29	2.00	1.19	2.63	1.69	2	5.57	0.13
	Experiment	1.86	1.18	4.52	1.48	7.47	1.85	2	316.53*	0.89
Resolution	Control	0.50	0.56	0.79	0.66	0.71	0.73	2	3.86	0.09
	Experiment	0.44	0.55	1.42	0.82	2.49	1.35	1.47	47.91*	0.56
Total	Control	6.36	2.67	7.65	3.08	8.71	3.46	1.64	34.97*	0.48
	Experiment	6.05	2.82	10.92	3.51	16.15	3.56	1.52	377.47*	0.91

* p< 0.003 (Bonferroni adjustment was made for p value)

In terms of between-group differences, independent samples t-tests indicated there were no significant differences between the experimental and control groups in terms of the total volume of communication during the period of collaboration T1, prior to the practitioners engaging with the experimental group (see Table 6-3). However, in T2 and T3, the independent samples t-test found that a significant difference between the control and experimental groups in the total volume of messages, with the experimental group posting more, with a large effect size. Also at T2 and at T3, there was evidence of significantly more messages coded at the highest two levels, Exploration and Resolution, being posted by the experimental group than the control group, with a large effect size.

Table 6-3: Comparison of level of knowledge construction between the control and experimental groups

Time	Level of Knowledge	Mean Differences (Experiment- Control)	T-test	Cohen *d*-value
Time 1	Trigger	-0.13	-1.01	0.23
	Explanation	0.06	-0.16	0.04
	Exploration	-0.19	-0.64	0.15
	Resolution	-0.06	-0.41	0.10
	Total	-031	-0.50	0.11
Time 2	Trigger	-0.08	-0.48	0.11
	Explanation	0.19	0.45	0.10
	Exploration	2.52	8.20*	1.87
	Resolution	0.63	3.67*	0.84
	Total	3.27	4.30*	2.55
Time 3	Trigger	-0.08	-0.48	0.11
	Explanation	0.95	2.52	0.58
	Exploration	4.84	11.86*	2.73
	Resolution	1.79	7.18*	1.64
	Total	7.44	9.24*	2.11

* p< 0.003 (Bonferroni adjustment was made for p value)

As mentioned earlier, the Exploration and Resolution phases represent high-quality cognitive discourse. These phases were aggregated to understand the total high-cognitive messages. In terms of change in the groups over time, two separate repeated-ANOVA procedures were conducted. There was growth over time in high-cognitive messages for the experimental group, but not for the control group, where the number did not change. The t-test revealed that the experimental group posted on average a significantly greater number at these two higher cognitive levels than the control group, both at T2 $t(74) = 8.63$, $p < 0.003$ and T3 $t(74) = 13.43$, $p < 0.003$, with a large effect size.

6.4.2 Visualisations of Social Networks

To detect any difference in the social structure between the control and the experimental groups, graphical analysis was conducted using NetDraw v2.163 (Borgatti et al., 2002) network visualisation software. As recommended by Hernández-Nanclares, García-Muñiz and Rienties (2017), graphical analysis can help to perceive the overall social network structure and discover possible patterns of group dynamics to perceive how the knowledge-building network of pre-service teachers develops over time. Figure 6-5 shows how pre-service teachers worked collaboratively in sharing knowledge, and Figure 6-6 illustrates knowledge-building in an online PLC at three different time points. As mentioned in Section 6.3.4, there are two networks in the study: knowledge-sharing (low cognitive interaction), which focuses on integrating Trigger and Explanation, and knowledge-building (high-cognitive interaction), which focuses on integrating Exploration and Resolution. In terms of the direction of the link, a tie sent from Actor A to Actor B means that Actor A contributes to the discussion topic of Actor B, and Actor B receives a tie for the contribution made by Actor A. The coloured nodes represent pre-service teachers and practitioners. The blue nodes represent pre-service teachers in the science department, while the pink nodes represent those in the social science department. Practitioners are represented as green nodes. In NetDraw, nodes are positioned using an algorithm that effectively pushes nodes apart in space then draws them back together according to the number of ties that each node has to specific nodes in the network. Positioning a node at the left of the graph does not mean that it is better than one at the right, and this also applies to those at the top or the bottom (Rienties & Héliot, 2018).

From the graphs (Figures 6-5 and 6-6), two trends can be observed. First, over time there was an increase in the experimental group in terms of the density of the network in both the knowledge-sharing and knowledge-building networks. Similarly, those in the control group increased their

links with peers in the knowledge-sharing network, yet it seems that there was no obvious growth in links in the knowledge-building network. Moreover, pre-service teachers in the experimental group developed substantially more links with peers over time than the control group. Second, in all graphs for the control group the relatively clear boundary between social science and science pre-service teachers remained distinct across the three time periods. In the experimental group, while the number of boundary-spanning ties across the departments between pre-service teachers increased in both networks, the departments remained more distinct in the knowledge-building network. However, in the knowledge-sharing network, the boundary grew less distinct over time, especially from T1 and T2 to T3.

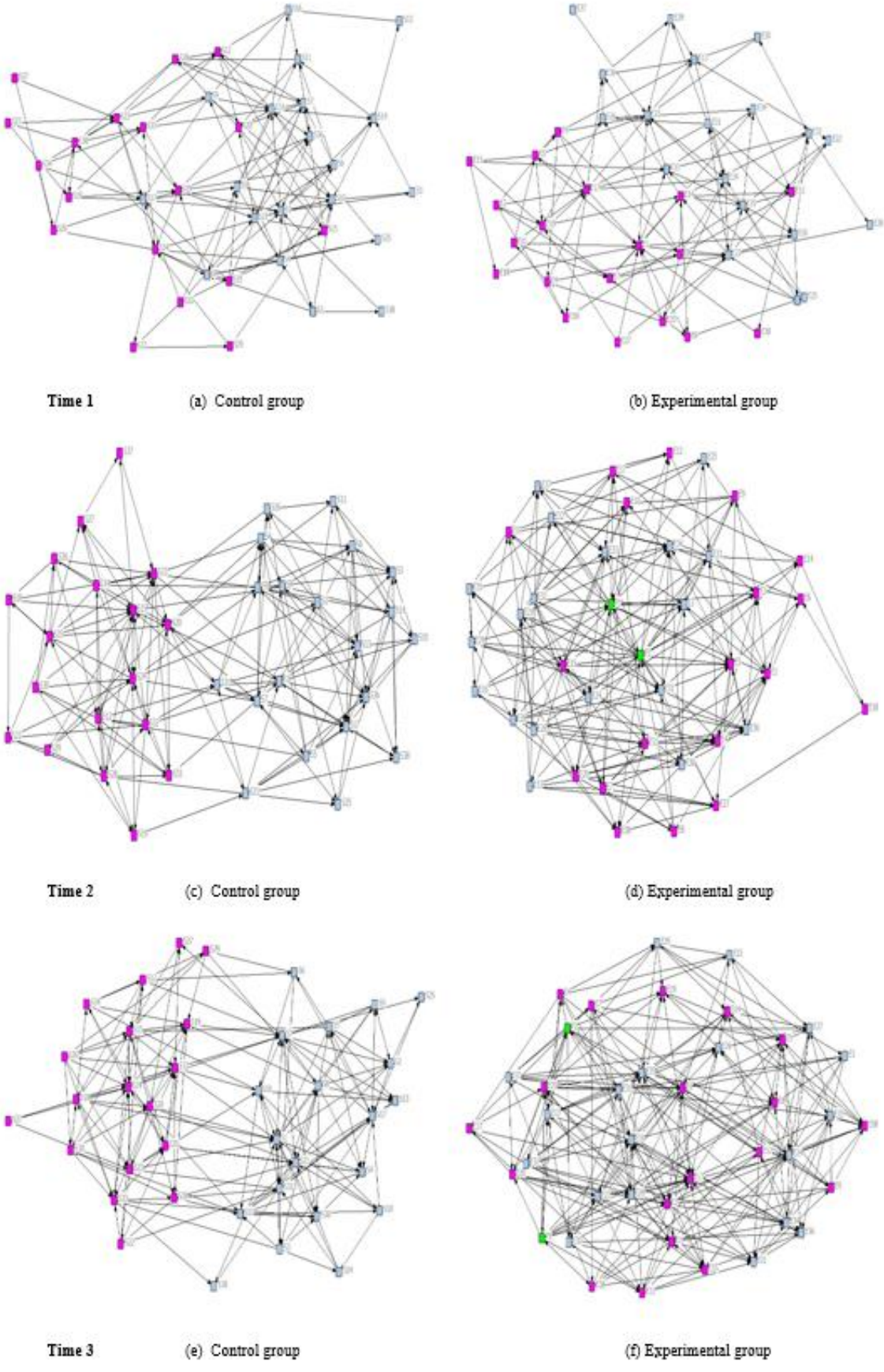


Figure 6-5: Knowledge sharing network for different three points

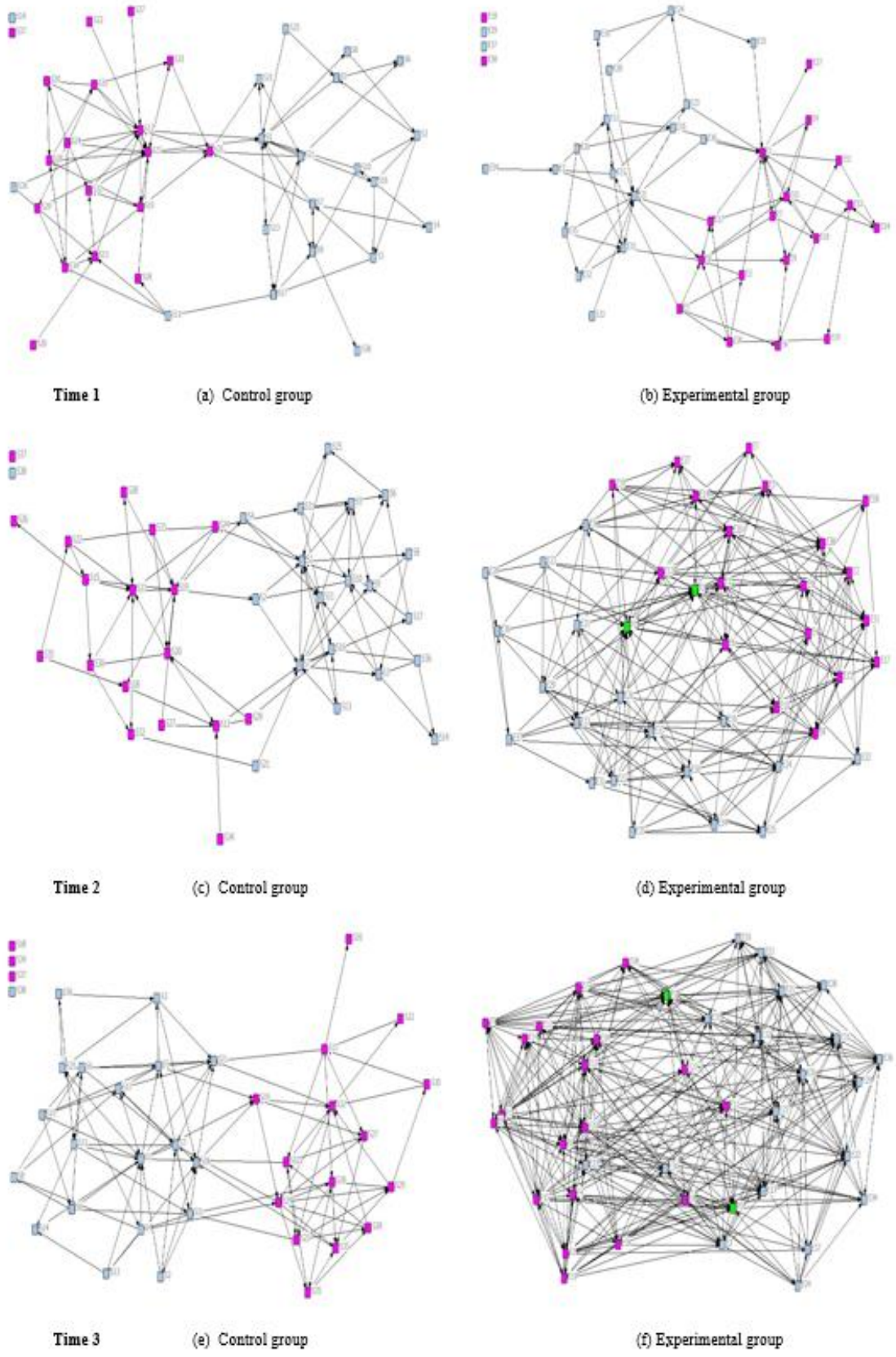


Figure 6-6: Knowledge building network for different three points

The visualisation reveals the changing patterns over time. A quantitative analysis of network change at individual level, using ego-network data and global level by MRQAP, would yield further insights into the between-group differences in terms of network growth and the effects of the practitioners on the experimental group.

6.4.3 Research Question 4: Ego-Network Size

The size (density) of pre-service teachers' ego networks helps gauge the level of engagement in an online PLC. In this study two ego-network sizes were measured; one for knowledge-sharing and one for knowledge-building networks. The average network size for these two networks is highlighted in Table 6-4.

Table 6-4: Within-group differences of ego-network size

Type of Network	Group	T1		T2		T3		Df	F	$\eta 2$
		M	SD	M	SD	M	SD			
Knowledge building	Control	4.21	2.92	4.26	2.65	5.37	3.03	2	4.85	0.11
	Experimental	3.89	2.96	9.45	2.37	15.15	2.78	2	284.58*	0.89
Knowledge sharing	Control	6.79	3.10	8.84	2.81	8.94	2.81	2	14.75*	0.28
	Experimental	6.32	3.26	9.05	2.39	11.18	3.48	2	38.78*	0.51

* $p < 0.003$ (Bonferroni adjustment was made for p value)

In terms of the size of the knowledge-building network, which describes the higher-cognitive level of engagement between pre-service teachers, the groups were nearly the same average network size before engaging the practitioners in the experimental group at T1. Over time and after the introduction of the practitioners, a repeated-measures ANOVA showed that increase in mean ego-network size was significant across all three time points for the experimental group (see Table 6-4). Post-hoc tests using the Bonferroni correction for multiple tests revealed that the network size increased significantly between each of the time points. However, as shown in Table 6-4, the changes to the ego-network size observed in the control group were not significant. Each pre-service teacher in the experimental group had on average 5.28 ties more than their peers in the control group at T2 and around 9.78 more ties at T3. The t-test in Table 6-5 showed that there is a significant difference between the control and the experimental group at T2 and T3, with a large effect size, favouring the intervention or the practitioners in the experimental group.

Table 6-5: Comparison of network size for the two groups

Time	Type of Network	Mean Differences (Experiment – control)	T-test	Cohen *d*-value
Time 1	Knowledge Sharing	-0.47	-0.64	0.15
	Knowledge building	-0.32	-0.46	0.10
Time2	Knowledge Sharing	0.21	0.35	0.08
	Knowledge building	5.18	9.01*	2.05
Time3	Knowledge Sharing	2.23	3.22*	0.74
	Knowledge building	9.89	14.97*	3.43

* p< 0.003 (Bonferroni adjustment was made for p value)

In the knowledge-sharing network, both groups had a similar average network size at T1, before the intervention, as shown in Table 6-4. The Post-hoc tests with a Bonferroni correction revealed that the mean network size of the experimental group increased significantly between each of the times, yet that the mean size of the network for the control group only grew from T1 to T2 and then remained constant. Both groups developed similarly in terms of network size between T1 and T2. However, by T3 the experimental group had a slightly larger average network size, of around 2.23 ties more than the control group. As shown in Table 6-5, the t-test reveals a significant difference between two conditions by T3, with a medium effect size, for the intervention of the practitioners in the experimental group.

6.4.4 Research Questions 5 and 6: Collaboration with Diverse Pre-service Teachers and Different Level of TPACK Knowledge

This section starts to analyse RQ5 by two analytical techniques (network homophily, known as the E-I index & MRQAP) and RQ6 by MRQAP. Starting with network homophily, which focuses on collaboration with diverse pre-service teachers in the knowledge-building network, Table 6-6 shows that both groups relatively have the same average of the three variables at T1. Regarding difference within group, a repeated-measure ANOVA was performed separately under both research conditions to examine whether any significant differences occurred over time. As illustrated in Table 6-6, the control group did not change significantly over time in all three variables, while the experimental group changed significantly over time in all three: internal, external and E-I index. The Post-hoc test with a Bonferroni correction shows that the pre-service teachers in the experimental group over time significantly increased their number of ties with participants both within and outside their department. The Post-hoc test with a Bonferroni correction shows that the E-I index grew significantly only from T1 to T2, then stayed constant in T3. This indicates that although the experimental group developed internal and external ties, these pre-service teachers interacted most with peers from similar departments, as the negative sign value of E-I index indicates.

Table 6-6: Change over time for collaboration among members of the knowledge-building network

		T1		T2		T3		Df	F	η^2
		M	S.D	M	S.D	M	S.D			
Internal	Control	3.68	2.63	3.89	2.44	4.78	2.53	2	4.32	0.10
	Experimental	3.47	2.39	6.55	1.92	10.02	2.48	2	111.15*	0.75
External	Control	0.53	0.89	0.37	0.59	0.57	0.83	1.33	0.98	0.03
	Experimental	0.42	0.83	2.89	1.39	5.24	1.95	2	111.25*	0.75
E-I	Control	-0.72	0.48	-0.79	0.33	-0.75	0.34	2	2.46	0.06
	Experimental	-0.74	0.37	-0.39	0.25	-0.32	0.23	1.64	19.93*	0.35

* p< 0.003 (Bonferroni adjustment was made for p value)

In terms of differences between groups, after engaging the practitioners in the experimental group in T2 and T3, the t-test in Table 6-7 demonstrates that the experimental group developed ties with other participants from both within and outside the department significantly more than the control group, with a large effect size.

Table 6-7: Comparison of internal, external and E-I index between the groups for the knowledge-building network

		Mean Differences (Experiment- Control)	T-test	Cohen *d*-value
Time 1	Internal	-0.21	-0.36	0.08
	External	-0.11	-0.53	0.12
	E-I	-0.02	-0.19	0.04
Time 2	Internal	2.66	5.26*	1.20
	External	2.53	10.31*	2.36
	E-I	0.39	5.87*	1.36
Time 3	Internal	5.23	9.12*	2.09
	External	4.66	13.55*	3.11
	E-I	0.43	6.53*	1.54

* p< 0.003 (Bonferroni adjustment was made for p value)

In terms of the knowledge-sharing network, throughout and after the intervention a repeated-ANOVA indicated that the experimental group increased the mean of their ties with participants from different departments and the E-I index significantly, whereas the control group members underwent significant change in the mean score of their ties with those in their department and the E-I index (see Table 6-8). The Post-hoc test with a Bonferroni correction for the experimental group indicates that there was significant growth in the ties with pre-service teachers outside the department and in the E-I index between each of the time points. However, for the control group, the Post-hoc tests with a Bonferroni correction show that the pre-service teachers increased the number of their ties with peers in similar departments significantly from T1 to T2, which led to a decrease in E-I index score from T1 to T2. This means that the control group developed more

internal ties in T2 and T3 than the experimental group, and that the experimental group developed external ties to a greater extent than did the control group in T2 and T3.

Table 6-8: Changes over time for internal, external ties and E-I index for knowledge-sharing

		T1		T2		T3		Df	F	η2
		M	S.D	M	S.D	M	S.D			
Internal	Control	4.89	2.31	7.63	2.01	7.36	2.70	2	23.62*	0.38
	Experimental	4.53	2.02	5.50	2.00	5.26	1.50	2	3.54	0.08
External	Control	1.89	1.64	1.21	1.4	1.57	1.29	2	4.81	0.12
	Experimental	1.78	1.67	3.55	1.34	5.92	2.11	2	68.65*	0.65
E-I	Control	-0.51	0.39	-0.77	0.24	-0.67	0.23	2	10.87*	0.23
	Experimental	-0.52	0.33	-0.21	0.27	0.04	0.26	2	45.24*	0.55

* p< 0.003 (Bonferroni adjustment was made for p value)

As shown in Table 6-9, after the intervention in T2 and T3, the t-test reveals significant differences between the control and experimental groups in mean scores for ties with participants in a similar department, favouring the control group. Moreover, there were significant differences in the number of ties with participants outside their department and in the E-I index, favouring the experimental group, with a large effect size.

Table 6-9: Comparison of internal, external and E-I between the control and experimental groups for the knowledge-sharing network

		Mena Differences (Experiment – Control)	T-test	Cohen *d*-value
Time 1	Internal	-0.37	-0.73	0.16
	External	-0.11	-0.27	0.06
	E-I	-.01	-0.08	0.02
Time 2	Internal	-2.13	-4.69*	1.07
	External	2.34	7.32*	1.68
	E-I	0.56	9.56*	2.19
Time 3	Internal	-2.11	-4.19*	0.97
	External	4.34	10.83*	2.48
	E-I	0.72	12.48*	2.89

* p< 0.003 (Bonferroni adjustment was made for p value)

To identify the magnitude of the impact of the level of TPACK knowledge and department on knowledge-sharing and knowledge-building ties, MRQAP were applied as in Tables 6-10 and 6-11. Before conducting the MRQAP, eight attribute variables were converted into matrices. This process is typically similar to making a dummy variable for each category (Rienties, Nanclares, Jindal-Snape, & Alcott, 2013). The scores for TK, PK, CK, PCK, TCK, TPK and TPACK were divided into high and low scores, using medium split techniques. MRQAP can estimate which of the eight

matrices (similarity in TK, PK, CK, PCK, TCK, TPK, TPACK and department) had the strongest influence on the dependent variable (knowledge ties).

For the high knowledge-building network for the control group (see Table 6-10), in Model 1, knowledge ties after the first three weeks were significantly associated with discipline of study (β=0.202; p< 0.001), followed by the same level of TCK (β=0.094; p< 0.006), where β represents standardised betas. It can be seen that the similarity of department was the primary predictor of the high knowledge- building network as betas increased over time and the standardised beta of TCK increased from T1 and T2 to T3. Moreover, similarity in the level of TPK was a predictor in T3. In the experimental group, knowledge ties after the first three weeks were significantly predicted by the department (β=0.204; p< 0.001), followed by the same level of TCK (β=0.080; p< 0.006) and level of PK (β=073; p< 0.006), where β represents standardised betas. In Models 5 and 6, after engaging the practitioners with the experimental group, department was only the predictor of a knowledge tie. This indicates that the high knowledge-building network in the experimental group supported collaboration between pre-service teachers with a high level of TPACK knowledge with others who have a low level of TPACK knowledge, relative to the control group. However, both groups are more likely to build knowledge with participants in their own department. The R square values of both group are low. This may relate to there are other factors that may influence the group interaction. However, the R square values for the experimental group are lower than the control group after the intervention. This may relate to the role of practitioners in enhancing the collaboration between two departments.

Table 6-10: MRQAP regression analyses of the knowledge-building network

	Model 1 Control Time1	Model 2 Control Time2	Model 3 Control Time3	Model 4 Experiment Time1	Model 5 Experiment Time2	Model 6 Experiment Time3
TK	-0.007	0.026	-0.001	0.030	0.039	0.027
PK	0.006	0.003	-0.027	0.073*	0.003	0.016
CK	-0.002	0.008	0.008	0.039	-0.003	0.000
PCK	0.028	0.038	0.001	-0.001	0.042	0.016
TCK	0.094*	0.093*	0.113**	0.080*	-0.013	0.028
TPK	0.042	-0.008	0.088*	0.050	-0.043	0.024
TPACK	-0.004	0.069	0.009	-0.011	0.010	-0.002
Department	0.202**	0.224**	0.234**	0.204**	0.165**	0.201**
R-squared adjusted	0.047	0.063	0.069	0.059	0.027	0.040

* p< 0.006, ** p< 0.001 (Bonferroni adjustment was made for p value)

Regarding the knowledge-sharing network (see Table 6-11), in the control group the department was the primary predictor of knowledge ties for the entire time period, followed by similarity in the level of TPK only in T3. By contrast, in the experimental group, department was the predictor

of knowledge ties in T1 and T2 but no longer in T3, as beta decreased over time. For the experimental group in Model 4 (before the engagement by practitioners), the similarity in TCK and TPK represents the predictor of knowledge ties. In Model 6, none of these variables predict the group dynamics. This means that, over time, the experimental group were more likely to collaborate with those from different departments, while the control group were more likely to collaborate with those from similar departments. In knowledge sharing network, the values of R square in the experimental group are lower than for knowledge building networks. This means that the practitioners can play role in enhance the knowledge sharing among pre-service teachers from different departments.

Table 6-11: MRQAP regression analyses of knowledge-sharing network

	Model 1 Control Time1	Model 2 Control Time2	Model 3 Control Time3	Model 4 Experiment Time1	Model 5 Experiment Time2	Model 6 Experiment Time3
TK	-0.028	0.029	-0.036	-0.021	-0.014	0.004
PK	-0.012	-0.012	0.014	0.008	0.038	0.013
CK	0.006	-0.025	0.037	0.025	0.026	0.003
PCK	0.008	0.030	-0.002	0.027	0.026	-0.052
TCK	0.051	0.034	0.018	0.109**	0.049	0.009
TPK	0.062	0.012	0.074*	-0.086*	0.003	0.012
TPACK	0.040	-0.015	-0.012	0.069	-0.013	-0.000
Department	0.154**	0.284**	0.273**	0.155**	0.093**	-0.007
R-squared adjusted	0.026	0.094	0.074	0.035	0.009	-0.002

* p< 0.006, ** p< 0.001 (Bonferroni adjustment was made for p value)

6.5 Discussion

6.5.1 Research Question 3: The Level of Knowledge Construct

After the involvement of practitioners, the experimental group posted on average more cognitive messages than the control group. One possible explanation may relate to the presence of the practitioners. Liu (2005) found that the online environment was appropriate for expert teachers to support pre-service teachers to collaboratively develop knowledge and enhance cognitive thinking skills. The results of this current study differ from those of Hemphill and Hemphill (2007), who found that the level of cognitive messages did not change over time in the presence of experts. One possible explanation would be that in Hemphill & Hemphill's study participants were required to post two messages, and this may have inhibited pre-service teachers from posting more, whereas this current study did not present any guidelines on number. Another possible explanation is that in Hemphill and Hemphill's study it was the first time that the experts had served as online guests and no training had been provided. According to Dorner and Kumar

(2017), preparing practitioners to be involved with learners is a key factor that can enhance the learning experience. Training was provided for the practitioners in this current study before they engaged with pre-service teachers, and the training included guidelines for facilitating interaction.

Regarding the differences in each category, both groups posted a relatively similar volume of Trigger and Explanation messages in each of the three time bands. The experimental group had a steeper increase over time in Exploration and Resolution than the control group. Unlike the experimental group, the control group focused on exchanging information (Explanation) more than connecting and testing ideas (Exploration and Resolution). The results demonstrate that, although the experimental group increased its Resolution messages, the number was low compared to Explanation and Exploration. Redmond and Mander (2006) found that restricted opportunity to test a solution was one reason for the limited number of Resolution messages posted by pre-service teachers. In this current study, pre-service teachers had no opportunity to test any solutions in a classroom of pupils, due to their lack of engagement in teaching practice. This study recommends engaging pre-service teachers in micro-teaching in a university context to help them to test solutions. According to Saban and Coklar (2013), microteaching can allow pre-service teachers to trial different teaching strategies which play role in enhancing their understanding of the effective method of teaching.

In terms of high-cognitive discourse, the experimental group underwent steeper growth over time, in terms of the high level of cognitive discourse, than the control group. Liu (2005) argues that pre-service teachers' cognitive skills can be improved through engaging in conversation with experienced teachers. Zeichner (1996) points out that pre-service teachers during campus-based experience lack access to the thinking and decision-making process of experienced practitioners, which is considered extremely important if they are to learn. It appears that, in this current study, pre-service teachers had opportunities to interact with experts and to learn how they think, which led to the increase in high-cognitive messages. In contrast, Redmond and Mander (2006) found no increase in high-cognitive discourse in the presence of experts, inferring that the experts had difficulty in coaching pre-service teachers to achieve a high level of cognitive messages, and recommending work on enhancing the experts' role to develop a high-cognitive message. It seems that the training programme for practitioners in this current study allowed them to establish how to facilitate pre-service teachers' high-cognitive thinking.

6.5.2 Research Question 4: Network Size

The quantitative data findings show that the experimental group underwent steeper growth over time in the size of both the knowledge-sharing and knowledge-building networks than the control group. Although the control group saw an increase in links with peers in knowledge-sharing, it did not sustain this growth to the end of the online activity or develop ties with peers over time in the knowledge-building network. This finding is consistent with a qualitative study by Willegems et al. (2018), who found that in-service teachers played a role in engaging and coaching peers in collaborative activity and supported them to work as a team. Moreover, it aligns with Wearmouth et al. (2004), who interviewed teachers concerning their experience and found that practitioners encouraged teachers to take part in collaborative problem-solving with other teachers. The low level of engagement in the control group, in terms of developing their ties in a collaborative environment, may relate to the lack of coaching from experts. Kervinen et al. (2016) found that some pre-service teachers lacked experience in engaging in collaborative planning of a science lesson and needed support to collaborate. The result of this current study suggests that the presence of practitioners establishes the norm of collaboration and reaching out for support in sharing and building knowledge among pre-service teachers.

6.5.3 Research Question 5: The Development of Ties with Pre-service teachers Within and Outside the Department

In terms of developing ties with pre-service teachers from within and outside their department, in the knowledge-sharing network the control group developed more internal ties than the experimental group, while the experimental group developed more external ties than the control group over time. This was confirmed by using MRQAP, which found that, after the involvement of practitioners, department was no longer a predictor of network in the experimental group, but remained so for the control group. This means that, for the experimental group, there was collaboration in knowledge-sharing between the two departments that led to decreased homophily and increased heterophily over time, while the control group decreased its collaboration to some extend between the two departments and increased its homophily. One explanation for this result is that practitioners may have tried to enhance their norm of sharing resources by engaging pre-service teachers in interdisciplinary activities. Brown, Hartwell and Thomas (2018) argue that the lack of engaging experts with experience in an interdisciplinary environment with teachers may act as an obstacle in interdisciplinary design team collaboration. Brown et al. recommend inviting an external expert to guide teachers to work in interdisciplinary

teams. In this current study, both practitioners had experience of working with teachers from different departments and of interdisciplinary team activities.

Regarding the high knowledge-building, the results of this study indicate that pre-service teachers in the experimental group increased their external and internal ties more than the control group, which did not change over time, while collaborations by the experimental group rose significantly. Although the experimental group developed internal and external ties, the members interacted more with peers from similar departments, as indicated by the negative sign value of the E-I index. MRQAP showed a similar result as both groups were more likely to build knowledge with participants from the same department. Similarly, Downey (2018) found that secondary school teachers tended to collaborate with teachers within their department. One possible explanation for this result in this current study is the type of online learning activity. In this study there was no joint task or common goal to work to as an interdisciplinary activity, which may have increased the level of collaboration with different departments (Rienties & Kinchin, 2014). Perhaps dividing the pre-service teachers into small groups and mixing them would encourage engagement with teachers from different departments (Rienties & Kinchin, 2014). Moreover, Rienties and Héliot (2018) argue that mixing participants without providing effective coaching techniques may not enhance learning ties between departments. Although in this study the practitioners may have attempted to increase their interaction with pre-service teachers from different department, their training did not include guidelines on enhancing interdisciplinary activity in high-cognitive thinking with those outside their department.

6.5.4 Research Question 6: Collaboration between Pre-service Teachers with Contrasting TPACK Levels

The results of this study indicate that in the knowledge-building and knowledge-sharing networks in the experimental group, after the engagement of the practitioners, those pre-service teachers with a high level of TPACK knowledge worked collaboratively with those with a low level more than the control group. Liou et al. (2017) stressed the importance of facilitating collaboration among pre-service teachers with dissimilar knowledge to remove any barriers to collaboration and rich support. One possible explanation may be the role of the practitioners in creating an atmosphere that supports collaboration and a culture of a shared network. Dorner and Kumar (2016) investigated pre-service teachers' perceptions about engaging in an online learning community with experts, and found that they appreciated the role of experts in creating a climate

of collaboration and enhancing the sense of community. Therefore, it is very important to create opportunities for pre-service teachers to access different expertise and to create an environment that fosters collaboration.

6.6 Limitations

Several limitations need to be considered in future research. First, this study had a relatively small sample, so it is important that any future research replicates and builds upon this work. Also, the current study examined only interactions in an online PLC, not face-to-face or those in an external support network (outside this online PLC) that pre-service teachers build to enhance their learning. Several studies found that teachers developed external networks to develop their learning and teaching with people outside the professional development programme (Rienties & Kinchin, 2014; Van Waes et al., 2018). Bokhove and Downey (2018) found that pre-service teachers sought support from family and friends outside their university community.

Another limitation is that this study did not examine any pre-existing relationships between pre-service teachers prior to engaging in online PLC. Rienties and Kinchin (2014) found that friendship can play a role in forming groups. Additionally, this study focused on the interactions between only female participants. It would be interesting to investigate social interaction between males and females in online PLC and would provide a different result, especially in the Saudi context in which there is gender segregation at all levels of education. Therefore, future studies should investigate the interaction between the genders in online PLC.

6.7 Conclusion

In this investigation, the aim was to assess the role of experienced practitioners in developing pre-service teachers' social interaction and knowledge construction in an online PLC. It has shown that practitioners play a role in increasing pre-service teachers' cognitive messages, as well as their high-cognitive discourse. Furthermore, practitioners' presence increases social interaction among pre-service teachers; the experimental group experienced faster growth than the control group in the size of both its knowledge-sharing and knowledge-building networks, over time. Furthermore, the involvement of practitioners enhanced the collaboration between departments in the experimental group, as well as collaboration between pre-service teachers with high TPACK knowledge and those with low. Nevertheless, both groups were more likely to build knowledge

with participants from the same department in the knowledge-building network than from another.

This study has adopted a quantitative approach to assess knowledge construction and network development. This research will be extended in future (Phase 3) to gain further insight into the qualitative nature of these interactions in an online PLC and the impact of practitioners on these interactions.

Chapter 7 Preservice teachers' and Practitioners' Experience and Perspective Concerning their Participation in an online PLC (Phase 3)[2]

Abstract

This study investigates pre-service teachers' and practitioners' experiences and perspectives of their participation in an online PLC. Interviews were conducted with 14 pre-service teachers and two practitioners. The findings reveal that practitioners play a role in enhancing the quality and focus of discussion, linking theory with practice, and engaging pre-service teachers in sharing resources. It was also found that practitioners play a role in enhancing the depth and breadth of discussion. Moreover, practitioners enhance collaboration and social connections among pre-service teachers by strengthening their self-confidence, deepening the ethics of collaborative work within an Islamic cultural perspective, enhancing sense of community, linking pre-service teachers with each other, and encouraging them to use their external support resources to enhance the collaboration. The practitioners attempted to enhance the interdisciplinary activity among pre-service teachers, but the pre-service teachers faced obstacles in understanding the terminologies of other disciplines. The findings reveal that the online PLC helped practitioners to become more reflective practitioners, improved their facilitation techniques, and helped them to learn new ideas from pre-service teachers and to understand the context of pre-service teachers. Several recommendations were provided by participants in order to enhance the experience of learning to teach via an online PLC.

7.1 Introduction

In recent years, interest in ways in which an online PLC (PLC) can be used in initial teacher education has increased (Heo, 2015). An online PLC provides opportunities for participants to enhance collaboration in terms of knowledge, critical reflective practice and the exchanging of ideas at any time and anywhere (Booth, 2012; Zhang et al., 2017). Recently, there has been

[2] The findings of this study were presented on 8th International Conference on Educational and Information Technology

increased recognition that an online PLC can promote and enhance collaboration between pre-service teachers in a number of ways. One possibility is for pre-service teachers to engage with experienced practitioners in an online PLC. In Phase 1 of this current study, the results showed that practitioners enhanced pre-service teachers' TPACK development and increased their awareness. Moreover, in Phase 2 the results revealed that the presence of experienced practitioners enhanced the level of cognitive engagement and network development among pre-service teachers. However, pre-service teachers' and practitioners' perceptions and experiences of their engagement were not explored in this current study. It is therefore important to examine the degree to which practitioners played a role in enhancing pre-service teacher engagement and which factors contributed to this engagement (Li et al., 2014). Therefore, the purpose of this study was to explore the pre-service teachers' and practitioners' experiences and perspectives concerning their participation in an online PLC.

7.2 Literature Review

7.2.1 Teacher Collaboration and Engagement in an Online PLC: Benefits and Challenges

The engagement of pre-service teachers in an online PLC has received considerable attention in the field of initial teacher education. Teacher collaboration is considered to be the main factor that supports a PLC (Brown, Hartwell & Thomas, 2018). Collaboration in an online PLC can offer participants opportunities to enhance knowledge construction, critical reflective practice and the exchange of ideas (Booth, 2012; Zhang et al., 2017). Teacher collaboration is a situated social practice that focuses on mutual engagement and negotiation between different members in an online PLC (Heo, 2015). The principal aim of this type of collaborative practice is to improve teaching practice and outcomes for pupils (Brown et al., 2018). Powell & Bodur (2019) found that teachers' collaboration and engagement in online PLC can effectively support critical reflection and discussion around issues of teaching practice. Online PLC can also help to address teachers' needs and support teachers problem-solving regarding teaching and learning (Duncan-Howell, 2010). It also offers opportunities to rich and networking with people who have different expertise, access to the verities of resources (Booth, 2012) and support knowledge building and creation among teachers (Zhang et al., 2017).

Merely creating an online PLC does not guarantee collaboration. Such a development is considered a challenging task and needs to be fostered and sustained (Zhang et al., 2017; Brown et al., 2018). Several studies have found that teachers' collaboration in an online PLC was

regarded as shallow and short-lived, which decreased opportunities for in-depth discussions and a sense of belonging to the group (Zhang et al., 2017). One factor that can hinder teacher collaboration in an online PLC is the absence of facilitation and expert teachers who establish collaboration culture and norm (Yuan & Zhang, 2016; Suh & Michener, 2019). Yuan and Lee (2015) argue the seeking external support from people from different subject area can enhance the depth of the discussion and collaboration among teachers. Furthermore, a lack of engagement with diverse teachers with different experiences can also hinder effective collaborative learning (Brown et al., 2018). Risser (2013) analysed networking of one novice teacher on Twitter and found that this teacher usually interacted with other teachers from the same subject area and through the time her network decreased.

Other factors that can impede engagement in collaboration include lack of trust, inability to create shared norms and insufficient commitment to each other or the joint work (Gardiner & Robinson, 2011). Collaboration can be enhanced through establishing trust and creating networks with other teachers (Fox & Wilson, 2015). Lack of the sense of community in an online PLC due to limited of interaction can hinder the engagement and collaboration. According to Tang and Lam, (2014), creating feeling of belonging in an online PLC can enhance teachers' collaboration and sense of awareness of others. Limited collaboration skills among pre-service teachers have also been identified as a factor related to lack of engagement in collaboration practice (Brown et al., 2018). However, several studies have provided recommendations for enhancing collaboration among pre-service teachers and novice teachers. Of particular relevance to this paper is engaging pre-service teachers with some experienced practitioners. Indeed, some have demonstrated that in-service teachers can play a role in enhancing pre-service teacher collaboration and engagement (Dorner & Kumar, 2016; Zeichner, 2010*).*

7.2.2 Pre-service teachers' Perceptions of the Engagement of Practitioners

The involvement of practitioners is considered to be a way of enculturating pre-service teachers into professional communities, which can play a role in engaging them in professional learning. The integration of ICT can provide more opportunities for interaction with practitioners beyond face-to-face meetings. According to Hemphill and Hemphill (2007), the virtual expert experience is more flexible than meeting face to face with guest, since students can interact and discuss matters with them anytime and anywhere.

Although the benefits of practitioners' involvement for students' learning have been noted, there is a paucity of empirical research evaluating their effect on teacher education in general and pre-service teachers' professional learning in particular. Moreover, the previous studies generally explored some issues regarding pre-service teachers' experience of the role of practitioners in affecting their learning, but they did not address pre-service teachers' perceptions of the factors that facilitated their cognitive and social engagement in the learning process. For example, Liu (2005) found that expert teachers were able to provide some guidelines and scaffolding for pre-service teachers and enhance their thinking skills. Alebaikan (2016) carried out a qualitative study investigating computer science teachers' perceptions of engaging with expert in-service teachers. These teachers had a positive experience of the engagement of practitioners, who provided new practical ideas that enhanced their classroom experience, help them to understand how to create interactive learning environment. Wearmouth, Smith and Soler (2004) investigated the impact of practitioners' participation in an online PLC on pre-service teachers' professional growth in a special educational needs module. The interview of finding found that engagement with practitioners and other pre-service teachers help to build networking with other and reduce the teachers' professional isolation, enhance the pre-service teachers' understanding of issues regarding to teaching and develop the reflection practice among pre-service teachers. Dorner and Kumar (2016) investigated online collaborative mentoring through participation in an online learning community, with respect to helping pre-service teachers integrate technology into their teaching practices. Although Dorner & Kumar's found that pre-service teachers enhanced their computer use, internet ability and satisfaction with participating in an online environment, it did not consider the factors that impacted on pre-service teachers' engagement in an online PLC.

These previous studies have shed light on some aspects of pre-service teachers' perceptions of the role of practitioners, but they did not address pre-service teachers' perceptions of the factors that facilitated their cognitive and social engagement in the learning process. Li et al. (2014) noted that research into the presence of an online expert has yet to shed light on the role of the students within the learning environment. This observation is consistent with Costello (2012), who found that studies investigating the presence of online experts have neglected to examine the impact of experts on the community's group activity, enhancement of the learning experience or active engagement. Furthermore, the previous study focused only on learners' voice and did not explore how the practitioners affect the learners' engagement from practitioners' voice and perspectives. Moreover, the previous studies did not investigate the practitioners' experiences of

their participation with pre-service teachers. Although Phase 1 explored how the practitioners affect the pre-service teachers' TPACK development, it did not provide information regarding the impact of the collaboration process. In Phase 2 of this current study, the focus was on using SNA and content analysis to investigate the role of experienced practitioners in enhancing network development and the level of cognitive engagement. However, Phase 2 did not explore factors that encourage pre-service teachers to engage with practitioners. The current study seeks to fill the gap identified in the literature concerning pre-service teachers' perceptions and experiences of the role of experienced practitioners in enhancing social and cognitive engagement and the experiences of practitioners in engaging with pre-service teachers. In doing so, it will investigate the following research questions:

RQ7. How does the introduction of practitioners affect the pre-service experience in the online PLC?
RQ8. What are the practitioners' experiences of engaging with pre-service teachers in an online PLC?

7.3 Methodology

7.3.1 Research Approach

A qualitative approach was selected in this current study to explore pre-service teachers' and practitioners' experiences of engaging in an online PLC. The interview approach was adopted as a method to collect data from pre-service teachers and practitioners. According to Creswell (1998), the qualitative approach is appropriate for exploring the perceptions and experiences of the subject meaning of the participants.

7.3.2 Research Sample

The participants in this study were pre-service teachers and practitioners who had participated in an online PLC. A purposive sampling technique was adopted to select the pre-service teachers in both the control and experimental groups. The process involved selecting pre-service teachers with different levels of cognitive and social engagement. In each group, four pre-service teachers with a high level of cognitive and social engagement and three with a low level of cognitive and social engagement were selected. A median split technique was used to divide the pre-service teachers into high and low levels of cognitive and social engagement. Regarding the cognitive engagement, the mean score of total amounts of knowledge construction (across three times) above 9.33 was considered as high and less than 9.33 was considered as low while the mean score

of total ego network size above 14.32 was considered as high and less than 14.32 was considered as low. In the experimental group, pre-service teachers ST1, ST3, ST6 and ST7 (pseudonyms) were considered to be have a high level and ST2, ST4 and ST5 were considered to have a low level, while the pre-service teachers ST9, ST10, ST12 and ST13 in the control group had a high level and ST8, ST11 and ST14 had a low level. Interviews were also conducted with the two practitioners (P1 and P2) in the experimental group.

7.3.3 Method

Interview. Individual interviews were conducted at the end of the online activity to discover pre-service teachers' experiences and perspectives of their participation in an online PLC and the role of practitioners in affecting this experience. The interviews was conducted with pre-service teachers from both control and experimental group. The main reason for that it can allow to make comparison between the two groups and the role of practitioners in affecting the experimental group experience. Furthermore, interviews were conducted with the practitioners to investigate their experiences of being experts in this online PLC. A semi-structured interview approach was selected for this current study. This provides an opportunity for the interviewer to ask follow-up questions that emerge during the interviews (Cohen et al., 2011). All the interviews were conducted in Arabic and in a private meeting room at the university. Each interview took around 20–30 minutes. The interview questions are listed in Appendix E.

7.3.4 Data Analysis

A constant comparison method was selected as a technique for analysing data to develop a grounded theory (Glaser & Strauss, 1967). There are three stages involved in analysing the data: open coding, axial coding and selective coding (Strauss & Corbin, 1990). For more details of this technique, see Phase 1 (Section 5.3.5). In order to ensure content validity of the interview questions in this current study, experts (university lecturers) in the field of ICT use in education assessed the interview questions. The experts provided suggestions for improving the interview questions; they pointed out certain questions that might be difficult for pre-service teachers to understand and suggested changing the wording. In addition, they asked for some questions to be deleted since they felt there was some repetition. A pilot study was conducted with four pre-service teachers to ensure that the interview questions were clear. Peer debriefing was used as another way of ensuring the reliability and validity of the analysis of the interviews (Lincoln & Guba, 1985). The process of peer debriefing was carried out between the researcher and her supervisor. Each one independently coded a part of an interview, which was then compared.

Most of the coding was similar across the team and there was some suggestion about rewording some codes and themes to reflect the views of the participants. Cohen's kappa was used to measure inter-rater reliability. The value of Cohen's kappa was (K=0.821) which indicated excellent agreement. After that, the researcher invited independent coder to analyse some sections from the interviews using the coding that developed by researcher. Cohen's kappa was used to measure inter-rater reliability. The value of Cohen's kappa was (K=0.814) which indicated excellent agreement. Member checks was used as another mothed for checking the trustworthiness of the interview analysis. The interview transcript was sent to the participants to check any area of misunderstanding. The sample of the interpretation of the interview was also given to the participant to check clarity and accuracy.

7.4 Result

This section presents the findings from the interviews, which focused on the pre-service teachers' and practitioners' experiences of participation in an online PLC. Individual interviews were conducted with pre-service teachers from both the experimental and control groups. The main purpose of this was to explore the pre-service teachers' views on the impact of the presence of practitioners on their engagement and to compare these views with the those of participants in the control group. The interviews were conducted with seven pre-service teachers from the control group, seven pre-service teachers from the experimental group and two practitioners. Table 7-1 represents the categories and codes that relate to the core category 'the enhancement of engagement on online PLC'.

Table 7-1: The categories and codes that relate to the core category 'the enhancement of engagement on online PLC'.

Concept 1: Enhancing the quality of online discussion	Category 1.1: The nature of the online discussion environment	Codes relating to the key features that shape the online discussion ***'Real and rich discussion':*** *Statements relating to the authenticity of the discussion and issues relating to the productivity of the online discussion* ***'Relevance':*** *Statements focusing on the relevance of the online posts to course content and the discussion* ***'Linking theory with practice':*** *Statements relating to issues of knowledge application and practical connections* ***'Engaging in the sharing of resources':*** *Statements relating to ways in which the members contribute and respond to the sharing of resources and what factors affect their engagement in sharing recourse*
	Category 1.2: Depth and breadth of the discussion	Codes relating to the key factors that affect the depth and breadth of the discussion ***'Deepening and expanding knowledge':*** *Codes relating to how the online learning community play a role in expanding pre-service teachers' knowledge* ***'The No-spoon-feeding method':*** *Statements relating to how the practitioners provide feedback and answer the questions in the online PLC* ***'Practitioners as role models':*** *Statements relating to how pre-service teachers view practitioners as role models*
Concept 2: The development of social interaction and group dynamics	Category 2.1: Network development and connection	Codes relating to the factors that play a role in promoting or hindering the network size development ***'Strengthening confidence':*** *Statements focusing on how confidence and trust play a role in hindering or promoting the development of ties* ***'Practitioners as relationship-makers'****: Statements relating to the role of practitioners in making links between pre-service teachers* ***'Is my own family network enough?':*** *Statements relating to whether the external networks can prevent or promote the tie development* ***'Deepening the ethic of collaborative work with Islamic cultural perspectives'****: Statements focusing on how religious belief can affect the development of ties* ***'A sense of belonging and loyalty to the group':*** *Statements relating to whether the sense of belonging enhances or hinders the network development* ***'Pre-existing relationship'****: Statements relating to whether the pre-existing relationship affects the network connection*

	Category 2.2: Interaction with peers inside and outside the department	Codes relating to factors that hinder or promote the interaction between members outside the department ***'Interdisciplinary activity'****: Statements relating to the interdisciplinary activities and how these affect the interaction with other participants* ***'Common knowledge':*** *Statements focusing on how the common knowledge between two departments encourages pre-service teachers to interact with each other* ***'Academic language'****: Statements referring to how pre-service teachers engage with other members in an online learning community in high cognitive discourse*
Concept 3: Recommendation for enhancing the practitioner's participation in an online PLC	Category 3.1: Role of the lecturer	Codes relating to the importance of course lecturers' role in enhancing the pre-service teachers' experiences ***'Enhancing the quality of discussion'****: Statements relating to how the course lectures enhance the quality of the online discussion* ***'Links with classroom experience'****: Statement relating to how the course lectures enhance the experience in the classroom*
	Category 3.2: The selection of practitioners and activity	Codes relating to suggestions for the type of activity that can enhance pre-service teachers' experience and the selection of the practitioners ***'Suggestions for online activities':*** *Statements relating to suggestions for online activities that can enhance the pre-service teachers' experience of the presence of practitioners* ***'Suggestions for practitioners' selection'****: Statements relating to the numbers and varieties of practitioners who participate with pre-service teachers*
Concept 4: Enhancement of the practitioner experience	Category 4.1: Learning about their practice	Codes relating to ways in which the participation of practitioners in an online learning community helps them to learn about practice ***'Role reflection'****: Statements relating to practitioners' experience of becoming more reflective practitioners and the benefit of this reflection* ***'Critical incident reflection'****: Statements relating to practitioners' experience of engaging in the online discussion that reflect critical incident analysis and the benefit of this experience*
	Category 4.2: Learning about engaging learners	Codes relating to ways in which the participation of practitioners in an online learning community helps them to learn about issues relating to engaging learners in the learning process and online learning activity

		'Enhancing the facilitator role'*: Statements relating to how engaging practitioners in an online learning community helps them to improve their facilitator role* ***'Understanding the group interaction'****: Statements relating to how engaging practitioners in an online learning community helps them to understand the group dynamics and formation*
	Category 4.3: Learning from pre-service teachers	Codes relating to ways in which the practitioners who participate in an online learning community benefit from pre-service teachers ***'Learning new ideas'****: Statements relating to how the practitioners learn ideas associated with teaching practice from pre-service teachers* ***'Learning about pre-service teachers and the teachers' education programme'****: Statements relating to how the practitioners learn about issues associated with the design of the teachers' education programme and those concerning pre-service teachers*

7.4.1 Research Question 7: Pre-service Teachers Experience

Concept 1: Enhancing the quality of online discussion

One main concept related to cognitive engagement, which focused on 'Enhancing the quality of online discussion'. This concept included two categorises which now follow.

Category 1: The nature of the online discussion environment

As pre-service teachers and practitioners shared anecdotes about their participation in the online PLC, their ideas about how the practitioners affected the nature of online discussions emerged. The nature of the online discussion was one of the factors that affected the pre-service teachers' cognitive engagement in the discussion. This theme focuses on understanding and comparing the key characteristics and features of online discussions between the experimental and the control group.

'Real and rich discussion'. All pre-service teachers in the experimental group confirmed that the practitioners played a critical role in making the discussion more real and rich. The pre-service teachers in the experimental group conceptualised real discussion as the ways that practitioners provided examples about practice and provided practical examples of classroom contexts. They also described the methods used by the practitioners to improve the discussion. The practitioners tried using problem-solving methods with the pre-service teachers in order to make the discussion real. In this context, ST3 said:

> You may say that the experts make our discussion more rich and real… They [practitioners] provide real problems that happen in the real classroom…and asked us to find better solutions… I think they make the discussion more fruitful as many ideas were discussed and emerged. (Science, experimental group)

Another pre-service teacher, ST2, explained the use of *imagination* that practitioners employed in order to make the discussion more real:

> She asked me to imagine a situation in which I am in the classroom and attempt to use this technology with my students. Which activity or method should I use, and I considered… Yes,,, she explained some practical application of the use of this tool from her experience in the classroom… You may say that I felt our discussion reached a professional level. (Science, experimental group)

The practitioners similarly commented on their efforts to make the discussion more real, as P1 stated, 'I tried to provide some real scenarios and examples of classroom environment in order to make them understand the situation and to find a possible way to use the technology in the classroom.' Practitioners become the second pair of eyes for the pre-service teachers, watching what was happening in the classroom, making them aware of teaching and learning issues in their online discussion. For example, P2 stated:

> Sometimes pre-service teachers overlook some key issues that should be considered in the use of technology in learning and teaching… I feel that I am a reality check pair of eyes and I try to make them more aware of the issues… I give them some of my real-life teaching experiences.

In contrast, six out of seven pre-service teachers in the control group expressed some concern about the authenticity of the online discussion. Pre-service teachers in the control group conceptualised authenticity as the practicalities of the classroom. They acknowledged that the type of posts that existed in the online PLC may not reflect current practice in school and that there was lack of authenticity in the discussion. ST9 stated:

> The majority of online discussion topics focus on our understanding of what we read in an article or book, such as the features of technology and their advantages and disadvantages but rarely on how we can work effectively in the classroom. (Social Science, control group)

'Relevance'. Another element that shaped the nature of the discussion was the relevance of the content of online posts. Pre-service teachers in the experimental group felt that there was a connection between what they used in the classroom and online discussions, and they appreciated the role of practitioners in making the discussions more relevant. For example, ST4 made mention of the benefits of practitioners making the discussion more relevant:

> They [practitioners] helped me and my peers to connect what takes place in the class with our online discussion… It help us to keep building what we know by colouring it with their experience... It helps also in building on our ideas in the discussion. (Science, experimental group)

However, the majority of pre-service teachers in the control group stated that there were sometimes barriers to making the discussion relevant to the course content. For example, ST8 felt a sense of confusion and frustration and she stated, 'Sometimes I did not understand the goal of

our discussion... I felt a separation… The discussion did not connect to the objective of the module, and some comments were not considered useful to our topic' (Science, control group). Five out of seven pre-service teachers found that a lack of coherence in the discussions may have played a role in making the discussions irrelevant: 'It is like everyone posts comments without reading what the previous one has written... You will find a lot of unrelated and unconnected comments' (ST9, Social Science, control group).

'Engaging in the sharing of resources'. Another factor that affected the sharing of knowledge was engagement in the sharing of resources. Although both groups mentioned that online PLC played a role in the sharing of resources, the degree of sharing in the two groups was different. The pre-service teachers in the experimental group described the methods employed by practitioners to encourage them to engage in the discussion, as ST5 commented, 'She [the practitioner] asked me to look at the Twitter account of one of expert teachers in my subject area and we discussed her comments on the criteria of the use of iPads with students' (Social Science, experimental group). Another pre-service teacher stated, 'They asked me to evaluate the article that I shared with my friends and provide my opinion on this article' (ST2, Science, experimental group). However, five out of seven pre-service teachers mentioned a lack of engagement in resource sharing, as ST12 said:

> I do not like the way of only providing the link without providing comments on it. Everyone knows how to search on Google… We want some explanation at least of what she found useful on this website or how the website can benefit me. (Social Science, control group)

Another concern that emerged in the control group was the lack of providing useful comments when someone offered a resource. For example, ST10 stated, 'We need to enrich our discussion… We want others to engage with our resource that we shared, but it is difficult to know how we can do that as most of the comments are just agreeing or disagreeing, without further clarification.' (Social Science, control group). It seems that there were different degrees of engagement with sharing knowledge between the two groups. The control group shared information with limited clarification and explanation, whereas the experimental group engaged more in sharing the resources.

'Linking theory with practice'. The pre-service teachers in the experimental group acknowledged that online discussion helped them understand the practical connection with TPACK theory. For example, ST1 stated, 'Some explanation and examples of how to use technology in the classroom,

from the viewpoint and experience of practitioners, helped me to link the theoretical part to future practice' (Social Science, experimental group). The practitioners also commented on making practical connections. As P1 stated, "I brought them a more real classroom experience in relation to the content of their module, and we tried together to link it with the TPACK theory… It perfectly complemented theory and practice together.' However, the pre-service teachers in the control group claimed to struggle to make this practical connection. For example, ST11 said, 'Sometimes I struggled to understand how specific types of knowledge can work effectively in practice… None of my peers had encountered real teaching experience' (Science, control group).

Category 2: Depth and breadth of the discussion

'Deepening and expanding knowledge'. All pre-service teachers in the experimental group acknowledged that the online discussion helped them not only to expand their existing knowledge but also to gain new knowledge. ST6 mentioned that 'We discussed the issues that are covered in the module but from different angles that are not considered in the classroom… It helped to establish my knowledge and the discussion was expanded by involving these different viewpoints' (Science, experimental group). ST1 said:

> Our discussion with a practitioner just opened my eyes to different opportunities offered by the use of technologies in collaborative learning … As this issue was not considered in our module… it helped me to focus on our discussion of a new area that had not been considered before. (Social Science, experimental group)

The practitioners also mentioned the methods used to deepen existing knowledge. For example, P1 said:

> I worked on deepening the knowledge that they build in the module by providing some real examples, more in-depth questions and up-to-date resources… It helped them to understand the element of their module and to keep the discussion going.

Five pre-service teachers in the control group were of the view that the discussion did not contribute significantly to expanding or deepening their existing knowledge. On this point, ST12 stated:

> I was tired of seeing the same information in the articles and book that are discussed in the classroom and which appeared again and again in the online discussion without them adding their voice or a new perspective on it… What is the benefits of this repetition? (Social Science, control group)

Three pre-service teachers from the control group mentioned that the lack of responses one reason did not enhance the discussion. ST10 added, 'Me and a few of my peers attempted to discuss new things about technology, but I feel disappointment without seeing a response from other peers… I know it is not easy to discuss something that we do not have any experience of (Science, control group). Three of the pre-service teachers in the control group expressed the reason behind not adding new knowledge. For example, ST14 asked, 'How we can discuss new things when we do not really know how to work in teaching?' (Social Science, control group). Four of them also mentioned the difficulty that prevented them from adding new knowledge. For example, ST13 stated, 'To be honest, I do not know how to find the new resource and even if I did… I want some help in order to discuss it in the group' (Science, control group).

'The no-spoon-feeding method'. Both practitioners mentioned how their contributions did not follow a 'spoon-feeding' method and how this, in their view, contributed to the depth of discussion. P1 said:

> I know we came to share our knowledge, but we do not use any spoon-feeding method in our discussion… We make the discussion more like a sharing experience between us as practitioners and pre-service teachers. I want pre-service teachers to construct their knowledge with the help of our expertise… I think this can enhance the depth of our discussion.

P2 set out the implications if she were to use a spoon-feeding method:

> I do not let the discussion rely only on the approach of pre-service teachers asking me questions and I answering them… because this can reduce active participation and deep and critical discussion. Also, this can lead to a decrease in the effort to learn of the students. It is not my role to only give answers but to hear pre-service teachers' voice and perspective.

It seems that the techniques used by practitioners may play role in enhance the discussion and encourage pre-service teachers to add their voice.

'Practitioners as role models'. The presence of practitioners helped pre-service teachers learn to be critical to direct the discussion for it to be more in-depth. ST7 explained, 'We tried to do what the practitioners do with us. We asked for more clarifications… We attempted to evaluate and critique the website they suggested for us… and we gave our points of view' (Social Science, experimental group). ST6 described how the practitioners influenced their peers' contributions, 'I

felt my peers sometimes tried to resemble the practitioners by making the discussion in-depth, asking challenging questions and providing useful and critical feedback on my comments' (Science, experimental group). It appears that the method used by practitioners influence pre-service teachers facilitating techniques.

Concept 2: The development of social interaction and group dynamics

This second main concept focused on the social engagement. This concept included two main categories.

Category 1: Network development and connection

This section examines pre-service teachers' opinions of whether the presence of practitioners affected the development of ties among pre-service teachers.

'Strengthening confidence'. Confidence and trust were considered important elements that affected pre-service teachers developing ties with other members of an online learning community, in both groups. All pre-service teachers in the experimental group emphasised that self-confidence had a positive effect on helping them to interact with other people in the group, and they explained how the practitioners played a role in increasing their confidence in interacting with others. For example, ST1 explained:

> Before engaging the practitioners, I was hesitant to interact with others… I don't know really whether I was right or not... but the practitioners usually asked me to justify my answer and sometimes she appreciated my comment… This increased my confidence in my ability to interact with others and provide some suggestions. (Social Science, experimental group)

The pre-service teachers in the experimental group also indicated that trust in their peers' ability played a role in increasing their interactions and network size. ST3 described how the involvement of practitioners affected her view about trust in peers' ability: 'I felt my peers are becoming aware of issues in teaching and learning and also sharing resources… so I can trust them and I can take their knowledge more seriously than before.' (Science, experimental group)

The practitioners also commented that they tried not only to strengthen pre-service teachers' self-confidence but also the confidence between them. For example, P1 said:

> I tried to increase the pre-service teachers' confidence to participate... in the first week of my participation in the online community… I felt that the pre-service teachers were cautious about participating... I told them how they can become teachers and how you they can act in their school community. If you are too shy to provide your opinions now… how can you engage in your school community or how can you deal with your students? I found later that they became more engaged in the discussion. I think this will help them later.

The practitioners reported that they generated trust among pre-service teachers by recognising the value of peer comments through direct feedback to the individual person who was posting and by the encouragement they offered to the network more generally. As P2 mentioned:

> I worked also on strengthening confidence in each other… I tried to show appreciation for some comments that I found very interesting or creative and asked other pre-service teachers to provide some comments on these contributions… So, I think when I recognised the value of the peers' contribution, it helped them to trust each other.

Although three pre-service teachers found their self-confidence encouraged them to participate, four of the participants in the control group expressed a lack of self-confidence, which in their view prevented them from interacting with others and developing more ties. For example, ST10 expressed:

> Sometimes, I am afraid to interact with members in the online community… especially if I am not very sure about my opinions... Not everyone is open to interact with you. Sometimes they do not like my opinion… because I don't want to lose face… I hesitate sometimes to interact with them. (Science, control group)

Four out of seven mentioned that the lack of trust in their peers' ability might hinder them from interacting with them. For example, ST13 mentioned, 'I do not like to ask or interact very much in the online group... Honestly, how I can discuss with people who don't know much more than us?' (Science, control group).

'Practitioners as relationship-makers'. Another factor that positively affected the development of the network size was the role of practitioners in making links between pre-service teachers. The pre-service teachers appreciated the role of practitioners in helping them to build relationships with others. They noted that the practitioners tried to find some relationship between them. For example, ST4 said:

> The professionals usually tried to catch our unique knowledge or skills and to help us to recognise these benefits and help others to benefit from these unique things in us. For example, she asked me to help one of my peers to solve some difficulty in understanding some issues using collaborative learning, because she saw that I was active in this area. (Science, experimental group).

ST7 described the role of the practitioners in helping to build relationships with others:

> I feel the practitioners played the role of relationship makers. They stand as mediators to help us to build relationships with other members of the community. They asked us to help each other... to provide some suggestions to other people. (Social Science, experimental group).

'Is my own family network enough?' All pre-service teachers in both groups appreciated the value of their existing external networks, which meant links with other people beyond the pre-service teachers. Pre-service teachers in the experimental group found that external networks were resources that could help them to use their knowledge to interact with others in the group. For example, ST3 related, 'I usually interact with one teacher on Twitter about some issues regarding teaching and learning… but I usually share this knowledge with my friend to find something to interact about… as a professional recommended to me' (Science, experimental group). Pre-service teachers in the experimental group also explained how practitioners helped them to exploit their external networks to enhance their interactions. As stated by ST1:

> The most interesting thing in our discussion was when the practitioners asked us to share what we have from our family networks. To be honest, it helps me to know how I can exploit my supporters to expand my knowledge and share it with my peers (Social Science, experimental group).

ST6 added:

> I usually ask myself, is my own family network enough… but the practitioners opened my eyes to how I can use this resource to enhance our discussion, because sharing my own experiences that I take from my family [external support] can help me to get a lot of different perspectives from my peers in the network and benefit them as well. (Science, experimental group)

It was evident that practitioners attempt to encourage pre-service teachers to use their external supports as resources for enhancing the interaction in the online PLC. The practitioners also discussed how their suggestions played a role in their realising the benefits of external resources.

As mentioned by P2, 'You can share with us any interesting examples of the use of technologies… You can show us your family teaching plan… I told them there is a valuable resource in all of us that we can share.' It appears that practitioners can help pre-service teachers to recognise the benefit of their external support and use them as resource in the discussion.

Only two pre-service teachers in the control group mentioned that they used their external network as a resource to help others. For example, ST1 said, 'Sometimes I share some resources that I get from my brother, who is a teacher, with my friend… It's very nice to support others with the knowledge that I have' (Social Science, experimental group). However, some of the pre-service teachers in the control group saw their existing network(s) as sufficient for their needs. 'I do not think I need to build other relationships; I have a large network outside this group that satisfies me. All my family members are teachers' (ST14, Social Science, control group).

'Deepening the ethic of collaborative work with Islamic cultural perspectives'. Another issue that played a role in increasing the development of ties among pre-service teachers was the strength of the ethic of collaborative work with Islamic cultural perspectives. Both groups mentioned that shared Islamic cultural values among the participants encouraged them to support each other and build relationships with each other. They referred to some of the values in relation to the ethics of collaborative work, such as altruism, care, and sharing. ST5 explained, 'Our Islamic culture calls us to care about each other… so I was very keen to help others… The professionals do not stop *reminding* us of the value of collaboration in our religion' (Social Science, experimental group). ST12, from the control group, expressed, 'Even if I can find the knowledge without the help of other members, we should collaborate with each other for better outcomes and for establishing Islamic transactions' (Social Science, control group).

The practitioners took the lead in deepening the ethic of collaborative work with Islamic cultural perspectives. They mentioned that one of their roles was to build an online learning community driven by the ethics of Islamic cultural transactions. For example, P1 said:

> I tried to make our professional community feel inspired by the Islamic cultural perspective of communication and collaboration… I tried to increase their communication with each other by the strength of the ethics of altruism in our Islam culture… I usually reminded them of the value of helping each other by saying, "Love for the people what you love for yourself [quotation from Prophet Mohammad].

P2 also added that 'I worked also on reminding them of the value of caring about each other from our Islamic culture… because I think our professional community should be for the people and I said to them what the Prophet Mohammad said, 'The best people are those who are most beneficial to other people'. It appears that both group influence by Islamic believes and the practitioners played extra role to deepen this believes.

'A sense of belonging and loyalty to the group'. A sense of belonging to the community was considered to be one factor that increased the ties between members in an online community. The participants in the experimental group felt some sense of membership. For example, ST3 said, 'I feel always welcomed by my peers and experts… I feel some emotional connection to each other… We care about each other. We are like a family' (Science, experimental group). PS5 added, 'I think the experts' participation makes the atmosphere more harmonious… They care about each member… and encourage us to care about other members... [The name of practitioner] said that we are in the same boat' (Social Science, experimental group).

Although three of the pre-service teachers in the control group felt that there was some sense of belonging to the group, not all of them interacted with or helped other members. For example, ST12 explained how the lack of care about others in the group reduced her participation:

> I was active in the beginning of the online discussion, but then I just focused on communicating with some active pre-service teachers and I reduced my discussion in activity three [end of three weeks]… No one helps you if they do not have any benefit from you. (Social Science, control group)

Another participant expressed their sense of belonging to the online learning community and revealed that the lack of response from some played a role in decreasing the sense of belonging. ST10 said:

> I consider myself to be very loyal to my groups, but the problem is that not all members care about other… Sometimes you ask a question but you do not find any response. I think we should all of us create a more cohesive environment that encourages each other to care and interact in this learning environment. (Science, control group)

'Pre-existing relationship'. Both groups mentioned that a friend was a factor that affected how the group formed. Although the experimental group said that they tried to interact with diverse members, they sometimes found interactions with a friend easier than interacting with new members. In this regard, ST5 stated, 'I know the interaction with my peers who have studied with me for four years better than new ones… but the practitioner told us to try to see other opinions and we will be impressed and surprised… So, I attempted to balance the two' (Social Science, experimental group).

The participants in the control group expressed the same feeling, but they found it difficult to interact with people who were not their friends. ST11 added:

> I prefer to work and discuss with my close friends who I know very well because they understand me and know my abilities and what I prefer and it is too difficult to engage with someone else because it takes time to understand each other and I am worried they cannot understand my opinion very well. So, I only focus on my discussion with my peers. (Science, control group)

At times, the practitioners also expressed some ambiguity in their understanding of the group formation, and referred to friendships as one factor affecting this. For example, P1 explained:

> It was clear to me that pre-service teachers usually attempted to interact with similar peers from the same department but there was some ambiguity for me in the way that the group was forming, especially in the first two weeks… I usually asked myself why they interacted with specific participants... It could be their friends or because they had a specific goal... but I tried to keep encouraging them to see other perspectives.

Category 2: interaction with peers inside and outside the department

This category focuses on the factors that affected the interaction among participants outside their department.

'Interdisciplinary activity'. This section explains how the practitioners established interdisciplinary collaboration between the social science and science pre-service teachers and enabled the pre-

service teachers from the different departments to interact with each other. Pre-service teachers in the experimental group found that the interdisciplinary activity was very useful for them for two reasons. Firstly, interaction with diverse members helped them to gather new ideas and perspectives; and secondly, they recognised the value of interaction with other members from other departments in helping them in their future teaching as way of enhancing pupils' learning and interest. Pre-service teachers in the experimental group explained how the practitioners encouraged interactions with members outside the department. In this regard, ST3 state:

> The practitioners usually attempted to find the relationship between our subjects [science and social science]… They asked me for examples to give some suggestions from social science pre-service teachers… It was exciting for me to see how I can make links between my subject [biology] and history… I think this will be an interesting contribution to my teaching and the students will engage more… I think the practitioners see the hidden relationship between our subjects. (Science, experimental group)

Another pre-service teacher from the social science department (her minor was geography) explained how the interdisciplinary activity encouraged her to interact with science pre-service teachers. ST7 said:

> To be honest, I recognise the benefit of interaction with other members from our department. I like practitioners making some interesting links between my subject and science. It helps me to find new ways of teaching and engaging the students. I was very surprised how I can find links between the lessons that focus on the weather and climate of countries and connect this with water recycling and temperature measuring from a biology perspective. It was a very interesting activity and I was very keen to interact with science pre-service teachers to find more creative ways and ideas for my teaching. (Social Science, experimental group).

The practitioners also explained their role in terms of encouraging interactions among pre-service teachers with members outside the department. They had a positive view of the effect of the interdisciplinary activity on pre-service teachers' interactions and enjoyment. Practitioners also encouraged pre-service teachers to work on interdisciplinary activities by explaining the benefits to their future practice: P1 said:

> One of my aims is to strengthen the connection between different subjects and discipline areas. As teachers, you should be aware of the links between your subject and other disciplines… So, I attempted to direct the discussion to make it more interdisciplinary. I found pre-service teachers enjoyed seeing the connection and tried to interact with other people from different departments.

Practitioners also encouraged pre-service teachers to work in interdisciplinary activities by explaining the benefits for their future practice. As P2 state that 'I told the pre-service teachers about the importance of collaborating with other teachers from different departments… I told them that some of the teaching and learning objectives in a school community cannot be achieved without working with teachers in different subject areas.'

Although the practitioners explained their role in establishing interdisciplinary activity, both of them believed that the nature of the current activity might not help them engage the pre-service teachers in interacting with others outside the department. For example, P1 commented, 'But I do not think that I can completely make the discussion as interdisciplinary as I would like… So, I think the type of activity should be changed next time in order to make it a more interdisciplinary activity.' P2 added:

> The structure of online discussion should be designed to encourage the establishing of the relationship between the different disciplines… The activity can be some sort of learning design. So, the pre-service teachers can work collaboratively in designing activities for students that include different subject areas. I think if we do something like this, the interdisciplinary interaction between groups will be increased.

Although there were small numbers (three out of seven) of pre-service teachers from the control group who believed that there was some relationship between the two subject areas, they did not see the major benefits of these interactions, and therefore preferred to interact with pre-service teachers from the same department. As expressed by ST9, 'I think interaction with the science group may provide new perspectives, but I think there is no big relationship with other subject areas. So, I think my peers from the same department can help me more' (Social Science, control group). PS10 commented, 'Interaction with social science can help me to find some ideas, but it is too difficult to find the solid link… It is not like the interaction with my peers from the same area' (Science, control group). Some pre-service teachers in the control group did not find benefits from interaction with other members from the different department and felt it might distract them. For example, ST8 stated:

> I usually ask myself why social science pre-service teachers are with us in the group… There is no relationship with our subjects…When I interact with them, I feel some distraction and confusion... I think the online group should include only science pre-service teachers, and there should be another group for them [social science pre-service teachers]. (Science, control group).

'Common knowledge'. Both groups recognised that there was common knowledge that could be shared with individuals from different departments. From example, ST3 from the experimental group stated, She [the practitioner] encouraged us to discuss sharing knowledge with other pre-service teachers from the science department, like knowledge about general teaching methods' (Science, experimental group). And ST11 from the control group said, 'I interacted with pre-service teachers from the social science department only in one situation… I contacted them when we discussed some issues around class management and teaching methods' (Science, control group). The practitioners also attempted to encourage them to discuss common knowledge between each other. P2 commented, 'I just keep them at least discussing common knowledge that they can share with each other such as PK and TK*'.* Although pre-service teachers from the control group recognised the benefits of interacting with participants from outside the department in sharing common knowledge, three of them were still confused about engaging with them. For example, ST14 admitted, 'I know there is some similarity in terms of teaching method but usually they use it in a different way… So it is better to interact and discuss with my colleagues' (Social Science, control group).

'Academic language'. Both groups encountered some barriers to interacting with members outside the department. Although pre-service teachers in the experimental group found the interaction with pre-service teachers outside the department enjoyable, they found it difficult to engage in a high level of cognitive discourse. For example, ST2 said: 'I can provide pre-service teachers who are not in science with some suggestions or solutions for their teaching, but sometimes I cannot go deeply into the issues of social science' (Science, experimental group). However, three pre-service teachers from experimental group found that engaging in this way was a challenging task for them and they should engage with it. ST1 stated:

> I really enjoyed discussion with science pre-service teachers, especially as there are some common issues between us… All of us are teachers, and there are common thinks like how to manage the classroom and how to use collaboration groups… I usually take

> care when making comments about the content of science… It is very hard to understand their language... I mean the terminologies they use… I know this presents a challenging task for us and I have tried to engage with it, but it is still difficult sometimes to interact with them. (Social Science, experimental group)

Pre-service teachers from the control group explained their negative feelings about interacting with members outside the department:

> Interaction with social science pre-service teachers sometimes gives me a headache… I feel sometimes that they speak another language… There is a lot of academic knowledge and language they use that I cannot understand …so how can I engage with them? (ST8, Science, control group)

Practitioners also expressed difficulties with engaging pre-service teachers in deep issues from other areas, but they considered it useful for them. They encouraged the pre-service teachers to explain some of their terminology. P2 commented:

> Engaging the pre-service teachers in deep issues from other subject area, is not easy… especially the use of terminologies and language from other disciplines. I usually asked them to please explain these terminologies and to try to considered others in the online community as students or beginners in your field because this will help you to explain these terminologies to your students and help your peers in the online community to have some opinions.

It appears that practitioners encouraged pre-service teachers to clarify the terminologies in order to encourage them to participate with peers from different department.

Concept 3: Recommendations for enhancing the practitioner's participation in an online PLC

Category 1: Role of the lecturer

Both groups mentioned the importance of the role of the course lecturer in enhancing the pre-service teachers' learning experience. The experimental group believed that a lecturer could further enhance the discussion by making appropriate links with practitioners. For example, ST2 stated, 'I know the practitioners make the discussion more interesting and productive but I think if

teachers existing alongside practitioners, they can make it deeper… as teachers can collaborate with practitioners to improve our understanding about the use of technology*'.* Pre-service teachers in the experimental group also mentioned the importance of lecturer presence in making links to the classroom activity. For example, ST3 said, 'I think we need the teachers… Because we want the teachers to be aware of something, we discuss it in the online community and link it with examples in the classroom and evaluate the activities that are done online together in the classroom' (Science, experimental group). The control group also believed that the presence of teachers could enhance their learning experience. They believed that the teachers could facilitate interaction and enhance the depth of the discussion. For example, ST11 stated, 'I think teachers should participate with us in order to direct our discussion to be deeper and more productive' (Science, experimental group). It appears that both group believe that teacher's role is very important in enhance the engagement in an online PLC.

Category 2: The selection of practitioner's activities

Pre-service teachers provided suggestions for the activities that might enhance engagement in an online PLC with practitioners. They mentioned that if the activities included some sort of design-based learning, they could engage more. For example, ST4 said, 'I think we want to design lesson plans with practitioners and not just discuss how we can use technology in the classroom without making a concrete lesson plan' (Science, experimental group). Furthermore, pre-service teachers suggested visiting the practitioner's classroom to see how the practitioner worked in the classroom. For example, ST7 said, 'I hope that there might be an opportunity to visit the practitioner's classroom and reflect on this experience in an online group with practitioners… I believe we can engage more in the discussion' (Social Science, experimental group). Pre-service teachers also recommended inviting more than two practitioners and changing the practitioners after each activity in order to gain a different perspective. For example, PS2 suggested, 'Actually, we engage with these two practitioners… but I wonder if there is the possibility of inviting other practitioners or changing the practitioners from time to time... because we want to see how different teachers work in the classroom' (Science, experimental group).

7.4.2 Research Question 8: The Practitioners' Experience

This section presents the findings from the interviews that focused on practitioners' views and experiences of participation with pre-service teachers in the online learning community. Table 7-1

represents the categories and codes that relate to the concept '**Enhancement of the experience of practitioners'.**

Category 1: Learning about their practice

This category focuses on the practitioners' views on how their participation in an online PLC played a role in helping them to learn about their practice.

'Role reflection'. The practitioners found that their participation with pre-service teachers in an online PLC helped them to be reflective practitioners as they tried to reflect on their role in teaching and the different decisions they made in the classroom. For example, P2 stated:

> I believe this experience provided learning opportunities for pre-service teachers and me… It helped me to reflect on my role and experience of teaching practice… I discussed with them many decisions that I had made when I used the technologies in my teaching, and I analysed the impact on students.

The practitioners explained how they reflected on their experience in teaching in general. For example, P1 mentioned, 'I also reflect about the new practices that I observed in my colleagues in schools.' In addition, they referred to other benefits of being reflective practitioners. For example, P1 revealed, 'It helped me obtain a deeper understanding of myself, an understanding of how I teach and of my students' response to my teaching.'

'Critical incident reflection'. The practitioners also found that the online discussion with the pre-service teachers resembled a critical incident analysis. They noticed that the pre-service teachers tried to challenge the practitioners in order to understand the difficulties that teachers might face in the classroom. For example, P1 pointed out:

> Pre-service teachers attempted to understand our abilities and how we can deal with different problem that may face us in teaching, and they tried to ask some challenging questions. For example, they provided some scenarios of how we might deal with disadvantaged students in the classroom or how I manage students' behaviour when they use technology.

Another practitioner explained the benefits of a critical incident analysis discussion. P2 said, 'It is like the critical incident reflection and analysis sessions… It provided me with other views on my work… It helped me to develop myself professionally and increase my awareness of professional judgements in practice.' Furthermore, the practitioners saw the discussion in the training

programme as a critical incident. 'The discussion with [the name of practitioner] during the training programme developed awareness about different issues of teaching and learning'. Both training program that was provided to the practitioners as well as engaging them in an online PLC helped practitioners to learn.

Category 2: Learning about engaging learners

This category focused on understanding practitioners' experience of studying how they can engage learners in the learning process and in an online learning community.

'Enhancing the facilitator role'. The practitioners acknowledged that their participation enhanced their facilitator role in engaging the learners in an online learning community and more specifically novice teachers. As P2 phrased it, 'I learned about engaging novice teachers in the process of learning to teach'. P1 added:

> I learned a lot about group dynamics and how to facilitate the learning experience... and the different ways to enhance my facilitator role… I learned how to ask questions to encourage participation and how to enhance collaboration among learners from different backgrounds.

'Understanding the group interaction'. The practitioners identified the benefits of engaging in an online learning community, which made them aware of the group dynamics and how this inspired them to design online activities for their students. For example, P1 commented,

> It was a nice experience… It was quite different from interaction with my students in the classroom. Each context was different… I learned how the group members interact and collaborate… I think it will help me when I design the online activity for my students.

Furthermore, P2 said,

> It helped me to understand a great deal about the effective interaction in online learning… It made me recognise what online activities I should design for my students and how to form groups.

Category 3: Learning from pre-service teachers

This category focused on understanding how the practitioners learned from the pre-service teachers and their awareness of the pre-service teachers' university programme.

'Learning new ideas'. The practitioners acknowledged that the online community was a space for them in which to learn new ideas in teaching practice from pre-service teachers. P2 said,

> It was, I think, two-way learning… It was also a good opportunity for my professional growth. Sometimes, I ask questions to learn what I can do better with the use of technology in my teaching practice and to acquire new ideas… especially as pre-service teachers are considered as girls who were born in the digital generation, so they can help me to understand the thinking of new generation… to acquire different outlooks that will help me with making better decisions.

'Learning about pre-service teachers and the teachers' education programme'. Practitioners talked about some benefits from their participation with pre-service teachers. It helped them to understand the current change in the teacher education programme. For instance, P1 stated, 'It has given me a chance to understand the up-to-date changes in the teacher education programme… As you know, I graduated 15 years ago, and there has been a substantial change in the teacher education programme'. Practitioners said that they understood the issues relating to pre-service teachers in the university context. 'It helped me to understand the difficulties that pre-service teachers faced during their time at university… and how these difficulties can affect them in their placement.'

7.5 Discussion

7.5.1 Research Question 7: The Experiences of Pre-service Teachers

The first research question in this Phase (RQ7) focused on understanding the experiences and perspectives of pre-service teachers of the impact of practitioners on their engagement with an online PLC. These views were compared with those of a control group, who did not benefit from the stimulus provided by these practitioners. The findings from examining the interview responses of pre-service teachers and practitioners indicated that pre-service teachers found that practitioners played a role in enhancing cognitive and social engagement.

7.5.1.1 Cognitive Engagement

This section showed the findings related to pre-service teachers' cognitive engagement. The findings from this study revealed that the practitioners in the experimental group made discussions more authentic and productive than the discussions experienced by the control group. The methods used by the practitioners, such as providing real examples and using problem-

solving techniques, played a role in the discussions being perceived as more real and productive. This result supports the findings of McGrath (2009), who found that inviting experts to interact with learners can lead to real-life examples. The method of imagination used by practitioners also made discussions more real. This is consistent with the concept of 'furnished imagination' proposed by Kiely and Askham (2012), who examined how pre-service teachers learned to be ready for teaching practice and developed a new understanding of it based on sociocultural theory. The concept of imagination in Kiely and Askham's (2012) study was derived from Wenger's conceptualisation of learning, which views identity as a method of perceiving the way in which learning can alter identity and shows how it produces individual stories of being contextualised in society. Kiely and Askham (2012) found that this method made pre-service teachers ready for teaching practice. It seems that practitioners can enhance pre-service teachers' imagination which play role in engage them deeply in the discussion.

The experimental group found that the presence of practitioners made the discussion more relevant to the objectives of the module. Zhang et al. (2017) stated that some teachers found online discussion irrelevant to their classroom problems and objectives. One of the obstacles in the study of Zhang et al. (2017) was the lack of chief teachers' experience (more experienced teachers), who act as moderators and have experience in teaching, in organising the group, so they recommended that chief teachers need to generate a focused and deep discussion and create norms. It seems that the training programme provided to practitioners helped them to create discussions that were focused on module objectives.

Although both groups engaged in the sharing of resources, the degree of sharing was different. The results of this study suggest that the practitioners encouraged pre-service teachers to engage in the sharing of resources. Previous studies of online discussion in the context of teacher education revealed a lack of sharing knowledge, as the posts focused on confirming each other's points of view without further clarification, leading to decreased collaboration and engagement (Zhang, Liu, Chen, Wang & Huang, 2017; Pavo & Rodrigo, 2015; Tsiotakis & Jimoyiannis, 2016). It seemed that the involvement of practitioners acted as a way to encourage the norm of sharing resources among pre-service teachers.

The results also revealed that practitioners played a role in linking TPACK knowledge with practice and increasing their awareness of knowledge application. This finding supports previous research

in the areas of invited experts and guest speakers in the classroom, as they found these experts matched theory with practice (Agha-Jaffar, 2000; Metrejean, Pittman & Zarzeski, 2002). Moreover, this finding aligns with that of Alebaikan (2016), who indicated that discussion between Saudi computer science teachers and experts made the teachers more aware of new practical ideas. The finding of the current study corroborates the ideas of Zeichner (2010), who suggested that creating a hybrid space in pre-service teacher education programmes that links the university-based learning experience with the knowledge and experience of experienced practitioners who work in schools can minimise the disconnection between theory and practice. It seems that the study created a productive 'hybrid cultural space' (Zeichner, 2010) by merging the two different discourses – theory and knowledge of the pre-service teacher curriculum with the practice and experience of practitioners.

The study also found that practitioners enhanced the depth and breadth of discussions by not only deepening existing knowledge but also adding new knowledge. Further, the methods used by the practitioners enhanced the depth of the discussion, as they focused on asking questions and challenging the thinking of the pre-service teachers. Garrison & Cleveland-Innes (2005) and Zhang et al. (2017) argued that in order to engage learners in deep learning and discussion, it is critical to offer challenging questions and focused discussion. The practitioners also acted as role models whose interactions with the pre-service teachers attempted to simulate real classroom practice in order to make the discussions deeper and more critical. Several researchers (e.g. Brunt, 2005; Walsh & Seldomridge, 2006) have argued that educators who engage with students should apply different techniques that show how to be critical in order to improve students' critical thinking skills and techniques.

7.5.1.2 Social Engagement

This section presented the findings related to pre-service teachers' social engagement. The pre-service teachers in the experimental group appreciated the role of the practitioners in enhancing network connections and development. The practitioners tried to strengthen the self-confidence and trust among the pre-service teachers. In contrast, the control group reported a lack of self-confidence and trust in their peers due to issues of face saving and conflict avoidance. This finding is similar to that of Yuan & Zhang (2016), who found that one of the challenges to collaboration among Chinese teachers was related to the need to avoid losing face, which leads to teachers being unwilling to collaborate with each other. The current study found that the practitioners appreciated the comments of the pre-service teachers and played a role in enhancing their trust and self-confidence. Swan (2002) found that offering some sort of praise and encouragement can

enhance collaboration in online learning communities. The practitioners also tried to make a connection with the pre-service teachers. Yang and Zehng (2016) found a lack of collaboration among teachers in their study, so recommended the engagement of expert teachers in order to facilitate communication.

Both groups mentioned the value of a collaborative work ethic from an Islamic perspective, encouraging them to make a connection. The experimental group appreciated the role of practitioners in strengthening the collaborative work ethic within an Islamic cultural perspective. Elhoshi et al. (2017) argued that the teaching and deepening of the ethics of Islamic culture, such as care, love and altruism, can create individuals who support people in society. Dorner and Kumar (2016) suggested that expert teachers can play a role in developing shared norms among learners. In the current study, the practitioners tried to create the norm of collaboration from an Islamic perspective by encourage caring and altruism.

The pre-service teachers in both groups appreciated the value of their existing external networks – that is, their links with people outside the pre-service teachers' teacher education community. The practitioners attempted to use the external support that the pre-service teachers had to enhance their interactions in the online learning community. Sharing resources from those outside pre-service teacher education programmes can provide new ideas and perspectives that are not encountered in the campus-based experience and can enhance their learning (Fox & Wilson, 2015). However, limited numbers of the control group mentioned that they shared external resources with others, and the majority of them saw their existing network(s) as sufficient for their needs. Similarly, Rienties and Kinchin (2014) conducted studies investigating teachers' networks inside and outside of professional development programmes and found that some teachers developed more external ties (to people outside the programme) than internal ties. The reason for this is that they might have had external support that could help them to discuss issues around teaching and learning (Rienties & Kinchin, 2014).

The pre-service teachers appreciated the role of practitioners in establishing a sense of community among the group and within the profession. This finding is consistent with that of several studies (e.g. Fox & Wilson, 2015; Le Cornu, 2013; Rippon & Martin, 2006) that found that providing support for beginning teachers can enhance their sense of belonging in the teaching profession and community. It seems that practitioners supported a sense of belonging among pre-

service teachers. Both groups and the practitioners noticed that pre-existing friendships can affect group connections. This is consistent with the findings of Rienties and Kinchin (2014), that friendships affected learning ties among teachers' professional development programmes. Therefore, pre-existing relationships should be taken into account in the design of online learning activities.

The current study found that practitioners enhanced interactions between pre-service teachers and other departments. The practitioners tried to create interdisciplinary activities that allowed the pre-service teachers to collaborate with those in other departments. Berlin and White (2012) argued that a specific strategy should be used to enhance the interdisciplinary collaboration among teachers. It can be argued that the practitioners enacted such a strategy that engaged the pre-service teachers in interdisciplinary activities. Brown, Hartwell and Thomas (2018) recommended that in order to enhance engagement with interdisciplinary activity, experts with experience of working in interdisciplinary activities should be invited, which was indeed the case with both practitioners in this study. The pre-service teachers in the experimental group saw the value of interaction with other pre-service teachers outside the department, as they felt that this would help them gain new ideas. This is consistent with the findings of Coburn, Russell, Kaufman and Stein (2012), that teachers can acquire new ideas of practice through interaction with colleagues from different disciplines. Although the practitioners attempted to create space for enhanced interdisciplinary activity, they found that the current online activity might not support such activity. On that point, Brown et al. (2018) argued that the design activity should have a common focus and encourage interdisciplinary activity. Therefore, this current study recommended that the online activity should be designed to enhance interdisciplinary activity in order to support the interaction between pre-service teachers from different departments.

Both groups reported that they experienced some challenges in engaging with peers from different departments due to the academic language of the specific fields. Similarly, Oncu and Ozdiek (2013) found that pre-service teachers from a computer science department had difficulty working with chemistry pre-service teachers in interdisciplinary activities because of the chemistry terminology. The results of the current study suggest that practitioners felt that pre-service teachers needed to gain some skills in order to help each other understand the different terminology used. DuRussel and Derry (1996) argued that collaboration between interprofessional members first needed to define the terminologies that they wanted to use and how these terminologies can be seen from the perspectives of different professions. Oncu and

Ozdiek (2013) suggested that a reason for the lack of engagement in interdisciplinary activity was that pre-service teachers did not feel able to express their ideas and perspectives for other pre-service teachers outside of their department. Therefore, pre-service teachers may need to develop negotiation skills in order to help others understand their terminology. This can be done through training them before the engage in an online PLC how they can express the terminologies for people outside their department.

7.5.1.3 Recommendation to enhance pre-service teachers experience

This section showed the recommendations that provided by participants to enhance the experience of participating in an online PLC. Pre-service teachers suggested that the involvement of the course lecturer with practitioners in the pre-service teachers' community could benefit pre-service teacher engagement. Both parties have advantages and the course lecturer can make the discussion more relevant and link the practitioners' activities with classroom activities. This concurs with Alebakean (2016) who revealed that the course lecturer played a critical role in enhancing the experience of practitioners as the lecturer usually discussed with practitioners a suitable activity for students.

Further, the pre-service teachers suggested including design-based learning activity as learning methods by allowing them to collaborate with practitioners in designing lesson plans. The value of design-based learning has been argued in several studies. This type of learning method allows pre-service teachers to engage in issues of learning and teaching and provide more authentic experience (Aydin-Gunbatar, Tarkin-Celikkiran, Kutucu & Ekiz-Kiran, 2018; Cameron & Campbell, 2011). Moreover, the pre-service teachers talked about the importance of inviting different practitioners in order to gain different learning experience and perspectives. Indeed, Yuan and Zhang (2016) found that teachers did not gain new ideas from the discussion because they were working together intensively, and they recommended inviting different expert teachers from time to time to add new perspectives.

7.5.2 Research Question 8: The Experience of Practitioners

The practitioners discussed some benefits they gained from this experience. One of the main benefits was related to becoming a reflective practitioner. They learned more about their teaching practice and how they could improve it. According to Mathew, Mathew and Peechattu

(2017), becoming reflective practitioners can enhance teachers' learning, teaching and understanding of themselves, which can enhance professional growth.

Another benefit was related to understanding how they could engage novice teachers in the process of learning to teach. This can allow practitioners to understand how they coach other in online professional learning communities. According to Rhodes and Beneicke (2002), peer mentoring and coaching is a complex professional development activity that requires teachers to have coaching and mentoring skills, such as facilitating interaction and the ability to provide effective feedback. Therefore, the involvement of practitioners provides an opportunity for them to learn peer coaching techniques.

A further benefit was related to learning new teaching techniques from pre-service teachers. It appears that both the pre-service teachers and practitioners learned from this experience, with the pre-service teachers serving as a resource for the practitioners. The practitioners also gained information related to the pre-service teacher education programme. Zeichner (2010) found that the teachers whom pre-service teachers often work with during school placement usually have little knowledge about the modules of pre-service teacher education programmes and the courses they have taken. This experience allowed practitioners to understand the current issues in pre-service teacher education programmes, which might allow them to enhance their experience with the pre-service teachers with whom they will work in the future.

7.6 Conclusion

The purpose of the current study was to investigate the perceptions and experiences of pre-service teachers and practitioners regarding their participation in an online PLC. One of the major findings was that practitioners enhanced the quality of the discussion by making it real and focused, engaging the pre-service teachers in sharing resources and linking theory with practice. The practitioners also played a role in enhancing the depth and breadth of the discussion by expanding and deepening pre-service teacher knowledge and acting as role models, allowing the pre-service teachers to imitate their techniques to make the discussion more critical. Another significant finding was that the practitioners enhanced social interaction among pre-service teachers by strengthening their self-confidence, deepening the ethics of collaborative work within an Islamic cultural perspective, strengthening the sense of community, linking pre-service teachers with each other and encouraging them to use their external support resources to

interact with other teachers. The practitioners also attempted to enhance the interactions of pre-service teachers with others from outside the department by enhancing the interdisciplinary activity and discussing common knowledge between departments, such as general pedagogical issues.

However, both groups experienced difficulties with understanding the terminologies of other disciplines. There were some suggestions regarding the enhancement of preservice teachers' experience during the event of inviting practitioners. These suggestions related to designing online activity that would enhance interdisciplinary activity and using design-based learning techniques as a learning approach. This current study also recommended that allowing pre-service teachers visit practitioners' classrooms and reflect on this experience in the online group. It also recommended inviting more than two practitioners and changing the practitioners from time to time in order that pre-service teachers can gain wider experiences.

This study also investigated the experience of practitioners regarding their participation with pre-service teachers in an online PLC. The practitioners found that this experience helped them become more reflective practitioners, enhanced their facilitation techniques and allowed them to learn new ideas from pre-service teachers as well as more about the context of pre-service teachers and their university-based programme. Although this study provided insight into the perceptions of pre-service teachers and practitioners of participation in this online PLC, it did not investigate their perspectives of the impact of this experience on classroom practice or their participation in other PLCs. It is therefore recommended that a follow-up study is conducted to investigate this impact.

Chapter 8 Conclusion

8.1 Introduction

This chapter concludes the thesis by presenting an overview of the main findings. It discusses the study's contribution to knowledge and methodological contributions. It also illustrates the study's implications for course designers of teacher education programmes, university lecturers and policy makers. It provides an overview of the study's limitations and potential research directions.

8.2 Summary of the Research Findings

8.2.1 TPACK Development (Phase 1)

Chapter 5 presents Phase 1: an examination of the role of experienced practitioners in developing pre-service teachers' TPACK knowledge through participation in an online PLC. This phase was achieved using a mixed-methods approach, with data collected by employing a TPACK questionnaire to measure pre-service teachers' knowledge and semi-structured interviews with pre-service teachers in both groups and with practitioners. The first research question (To what extent does introducing the practitioners lead to developing the pre-service teachers' TPACK knowledge?) used the TPACK questionnaire to examine the impact of the involvement of practitioners on developing pre-service teachers' TPACK knowledge. The results showed that pre-service teachers in both groups increased their TPACK knowledge after they participated in an online PLC. However, the gains in mean scores of TPK and TPACK in the experimental group were significantly greater than those of the control group. It seems possible that the practitioners provided additional support, scaffolding, and guidance, and acted as role models, which made pre-service teachers more aware of the importance of the pedagogy of technology integration.

The second research question (What is the pre-service teachers' experience and perspective of engaging with practitioners in developing their TPACK knowledge?) used semi-structured interviews with pre-service teachers in both groups and the practitioners. Pre-service teachers' experiences and perspectives of the effect of practitioners on their TPACK development were investigated and compared with those of the control group members, who did not experience any interaction with a practitioner. The interview findings showed that practitioners increased pre-service teachers' awareness of up-to-date technology, technologies designed for specific subjects,

the pedagogical affordance of technology and factors that need to be considered during the use of a particular technological tool. More importantly, practitioners can enhance pre-service teachers' ability to link technology with PK and PCK. Both pre-service teachers and practitioners provided some suggestions regarding a change of structure of the teacher education programme and the content of the module, in order to enhance the development of pre-service teachers' TPACK experience. This study recommends that pre-service teachers take a pedagogy course before taking an ICT course in order to enhance their TPACK development. Further, the content of the module should be updated to include some new trends in technology such as augmented reality and mobile learning.

8.2.2 Cognitive and Network Development (Phase 2)

Chapter 6 presents Phase 2: an investigation of the involvement of practitioners in enhancing pre-service teachers' knowledge building and network development. This was achieved using multiple methods, by employing CA, SNA and TPACK questionnaires. The first research question in this Phase (RQ3) (To what extent does the involvement of practitioners increase the level of cognitive discourse in online pre-service teachers' PLC?) used CA as an approach to analyse the data. Cognitive presence, developed by Garrison et al. (2000), was used as a coding schema. The results showed that the experimental group posted on average more cognitive messages than the control group after the involvement of practitioners in the experimental group. Both groups posted a similar volume of Trigger and Explanation messages in each of the three time bands. The experimental group had a steeper increase over time in Exploration and Resolution than the control group. Unlike the experimental group, the control group focused on exchange information (Explanation) more than connecting and testing ideas (Exploration and Resolution. The experimental group underwent growth over time, in terms of the high level of cognitive discourse, while the control group remained constant.

The second research question in this phase (RQ4) (To what extent does introducing the practitioners lead to developing pre-service teachers' professional interaction?) used SNA and more specifically: ego network size measurement. The findings showed that the experimental group had steeper growth over time both in the size of knowledge-sharing and knowledge-building networks than the control group. Although the control group saw an increase in links with peers in knowledge-sharing, it did not sustain this growth to the end of the online activity or develop ties with peers over time in the knowledge-building network.

The third research question in this Phase (RQ5) (To what extent does the involvement of practitioners lead to developing knowledge ties across the boundary between subject disciplines?) used two SNA approaches: network homophily, known as the E-I index and MRQAP. In terms of developing ties with pre-service teachers from within and outside their department, in the knowledge-sharing network the control group developed more internal ties than the experimental group, while the experimental group developed more external ties, over time, after the involvement of practitioners in the experimental group. Regarding the high knowledge-building, the results of this study indicated that pre-service teachers in the experimental group increased their external and internal ties over time, whereas the control group did not change over time. Although the experimental group developed internal and external ties, the pre-service teachers interacted more with peers from similar departments, as indicated by the negative sign value of the E-I index and shown in MRQAP.

The fourth research question in this Phase (RQ6) (To what extent does the involvement of practitioners enhance collaboration between pre-service teachers with different levels of knowledge?) used the MRQAP analytical approach in combination with seven items from the TPACK questionnaire to investigate collaboration between pre-service teachers with contrasting TPACK levels. The results showed that after the engagement of the practitioners in the knowledge-building and knowledge-sharing networks, the experimental group supported collaboration between pre-service teachers with a high level of TPACK knowledge and others with a low level of TPACK knowledge, compared to the control group.

8.2.3 Pre-service Teachers and Practitioners' Experience and Perspective of Participation in an Online PLC (Phase 3)

Chapter 7 presents Phase 3: an investigation into pre-service teachers' and practitioners' experiences and perspectives of their participation in an online PLC. This was achieved by using a qualitative approach. Semi-structured interviews were used with pre-service teachers in both groups and with practitioners. The first research question in this Phase (RQ7) was: How does the introduction of practitioners affect the pre-service experience in the online PLC? To answer this research question, the researcher undertook triangulation of semi-structured interviews with pre-service teachers in both groups and with practitioners. The findings showed that practitioners enhanced the focus, quality and meaningfulness of the discussion, engaging the pre-service teachers in sharing resources and linking theory with practice. The practitioners enhanced the depth and breadth of discussion by expanding and deepening pre-service teacher knowledge and acting as role models. Another significant finding was that the practitioners enhanced the social

interaction among pre-service teachers by strengthening their self-confidence, deepening the ethics of collaborative work within an Islamic cultural perspective, strengthening the sense of community, linking pre-service teachers with each other and encouraging them to use their external support resources to interact with other teachers. Although the practitioners attempted to enhance the interactions of pre-service teachers with others from outside the department by enhancing the interdisciplinary activity and discussing common knowledge between departments, pre-service teachers faced difficulties in understanding the terminologies of other disciplines. A number of suggestions were provided by participants to further enhance the pre-service teachers' experience. These included inviting practitioners to design online activities that promote interdisciplinary interaction, allowing pre-service teachers to visit the practitioners' classrooms and reflect on that experience online, inviting more than two practitioners to contribute to the PLC, and changing the complement of practitioners from time to time in order to help broaden the pre-service teacher experiences.

The second research question in this Phase (RQ8) was: What is the practitioners' experience of engaging with pre-service teachers in an online PLC? Semi-structured interviews were undertaken with the two practitioners to explore their perspectives of participation in an online PLC. The findings showed that this experience helped practitioners to become more reflective practitioners, enhanced their facilitation techniques and allowed them to learn new ideas from pre-service teachers as well as more about the context of pre-service teachers.

8.2.4 Further Discussion: Link between the Main Theoretical Concepts and Outcomes of the Three Phases

This section attempts to establish connections between and synthesise the three phases and to make connection between the theoretical aspects of this study, such as social capital and online PLC, and the outcomes of this study. The proposed model in Figure 8-1 shows the connection between the main theoretical concepts and outcomes of the three phases of this study.

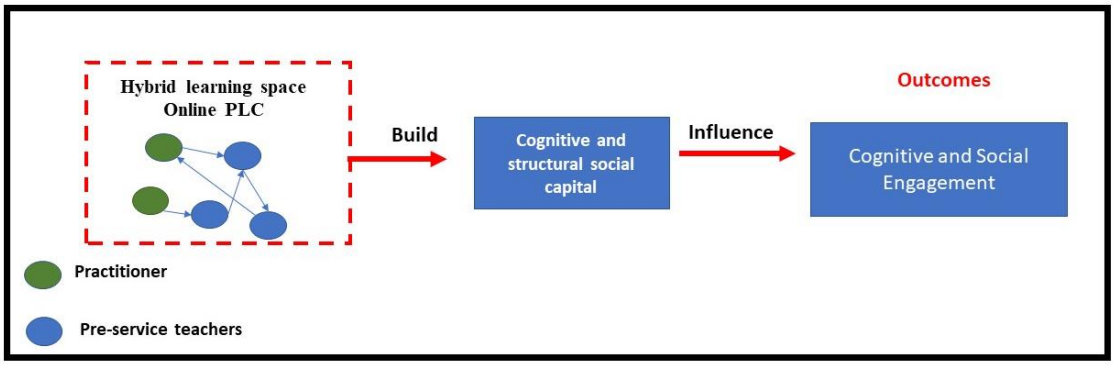


Figure 8-1: The connection between the main theoretical concepts and outcomes of this study

This study shows that the interaction between practitioners and pre-service teachers can play a role in enhancing both cognitive and structural social capital among pre-service teachers. Phase 1 and 3 have shown that practitioners bring discourses and practice methods from their working experience to the online PLC that play a role in enhancing the shared repertoire of this community. This plays a role in building cognitive social capital among the members of these communities and enhances the learning experience. The design of this study enhances the structure of social capital as the online PLC group consists of diverse members (practitioners and pre-service teachers) who are from diverse subject disciplines. Furthermore, some aspects of the training programme that was provided by practitioners, such as facilitating collaboration and support among pre-service teachers, played a role in enhancing structural social capital. These two concepts of social capital affect both cognitive and social development as will be discussed here.

One of the themes that emerged in this study is the pre-service teachers' cognitive development. Phase 1 has shown that pre-service teachers increased their level of TPACK and there were significant differences in TPK and TPACK between the experimental and control groups, in favour of the experimental group. The qualitative findings from both Phase 1 and 3 provide clarification on this development and illustrated how the discussion with practitioners can play a role in building cognitive capital, as practitioners bring their experience to the pre-service teachers. The findings showed that practitioners enhance and expand pre-service teachers' knowledge and understanding about practice in school, the use of technology in learning and teaching, and links between theory and practice. Several scholars found that a lack of awareness of technology exists in schools as well as the limited opportunity to link theory with practice, which can hinder TPACK development. Phase 3 also found that the practitioners encouraged collaboration among pre-service teachers related to common knowledge between different departments, which may explain why the experimental group had higher levels of knowledge related to technology and

pedagogy as found in Phase 1. Heo (2016) found that the majority of pre-service teachers focus on their discussion on issues surrounding TK and TCK. It seems that encouraging discussion on pedagogy issues related to technology with diverse people can enhance TPK and TPACK. This study increased structural social capital by including members from different disciplines, which enhanced pre-service teachers' understanding of pedagogical aspect of technology integration.

Another theme that emerged from this study is collaboration development. Phase 2 has shown that pre-service teachers in the experimental group increased their level of knowledge construction and higher-cognitive discourse in an online PLC. The findings of Phase 3 explain the reasons behind the engagement in knowledge construction. As shown in the interview findings in Phase 3, the practitioners enhanced the quality of the discussion by making the discussion rich and relevant and engaging in the sharing of recourses, and also attempted to make the discussion deeper by using techniques such as asking questions, thereby expanding the discussion. Garrison and Cleveland-Innes (2005) recommend engaging learners in online activities that promote challenging questions and deep discussion to generate an environment that supports high levels of knowledge construction. It appears that the factors related to enhancing the quality of online discussion that are referred to in Phase 3 played role in increasing cognitive engagement and the level of knowledge construction. Phase 2 also showed that the pre-service teachers in the experimental group developed their network size due to several reasons detailed in Phase 3. It appears that facilitating the techniques referred to in Phase 3 used by practitioners helped to build structural capital. Phase 3 of this study revealed some of the roles that the practitioners played in enhancing the network size and collaboration between pre-service teachers, such as attempting to build relationships among pre-service teachers, fostering a sense of community and strengthening confidence and trust. These factors are referred to in several studies as playing a role in enhancing collaboration. For example, Dorner and Kumar (2016) found that a sense of community and facilitating interaction plays a role in enhancing collaboration in an online PLC. Voogt, Pieters and Handelzalts (2016) found that trust is one factor that engages pre-service teachers in the collaboration process. These factors not only increase social interaction but also knowledge construction in an online PLC, as reported by Swan (2002). This indicates that in order to enhance knowledge construction and social interaction in an online PLC, these previous factors need to be reinforced. Further, building cognitive social capital can play a role in enhancing social interaction. The qualitative findings in Phase 3 indicated that the practitioners played a role in enhancing the discussion and sharing of information surrounding common knowledge between departments. This may explain the results in Phase 2, which show that the pre-service teachers in

the experimental group developed interaction with members outside their departments in a knowledge sharing network.

Altogether, the engagement of pre-service teachers with practitioners in an online PLC can build cognitive and structural social capital, which plays a role in enhancing pre-service teachers' TPACK development, knowledge building, and social and collaboration development.

8.3 Contributions to the Existing Knowledge

This section discusses the ways in which this thesis contributes to the existing knowledge related to three main areas of research. First, it explores how the presence of practitioners contributes to enhancing the quality of pre-service teachers' cognitive and social engagement. Secondly, it shows how this study serves as a contribution to the understanding of some current issues related to Saudi pre-service teachers' learning and interaction. Finally, it illustrates how this study enhances the experience and ability of practitioners.

8.3.1 Enhancing the Quality of Cognitive and Social Engagement among of Pre-service Teachers in Learning to Teach with Technology

This thesis has explored how the involvement of practitioners affected pre-service teachers' cognitive engagement (TPACK development and knowledge building) and social engagement (network development) in online PLCs. Previous work outlined that pre-service teachers face challenges engaging in the process of learning to teach and in how to integrate technology during their university-based learning context (Section 3.1.3). Further, previous research found that the lack of engagement with experienced practitioners can disconnect pre-service teachers from practice in school. While several studies suggest that creating a learning space that engages both pre-service teachers and experienced in-service teachers can support pre-service teachers' engagement in the learning process (Zeichner, 2010; Dorner & Kumar, 2017; Hus, 2012), there is currently a paucity of empirical studies that design 'hybrid cultural space' in pre-service teachers' education. Therefore, this current study adds to the literature on how to create 'hybrid cultural space' in an initial teacher education programme in order to enhance the quality of pre-service teachers' learning process. This study demonstrates how a hybrid cultural space may be created through the design of an online PLC that includes both pre-service teachers and experienced practitioners with the aim of supporting pre-service teachers' TPACK development, knowledge construction, social interaction and collaboration. It provides some criteria by which to select experienced practitioners in teacher education in general and in the Saudi context in particular, as

well as to prepare both practitioners and pre-service teachers for engagement in this learning activity.

This thesis also adds to the literature on understanding the multiple dimensions of pre-service teachers' engagement in the process of learning to teach and how they can incorporate technology in their teaching. Previous studies have focused on the cognitive aspects of TPACK development, in order to understand the influence of the intervention on pre-service teachers' engagement in learning (Al-Abdullatif, 2019). Although TPACK development is very important, previous research overlooked other aspects of cognitive engagement, such as knowledge building and social engagement (social ties and relation) in the process of learning to teach with technology, as these two elements are very important in helping pre-service teachers to construct their understanding of TPACK knowledge. Previous work shows that research related to the presence of an online expert has yet to demonstrate the impact of experts on the community's group activity, the enhancement of the learning experience or active engagement (Costello, 2012; Li et al., 2014). As a contribution to knowledge, this study adopted a mixed-method approach, using both qualitative and quantitative data to provide evidence of the effect of the involvement of practitioners on pre-service teachers' TPACK development and engagement in online PLCs. It has shown how practitioners enhance TPACK development, a high level of knowledge building and social interaction through employing different methods and analytical techniques.

Previous research has noted the benefits of interaction with peers from different departments (see Section 6.2.2). However, few evaluations have been made of how pre-service teachers work collaboratively with peers outside of their department to enhance their knowledge of technology integration and how they collaboratively build their knowledge through an online PLC. The current study therefore contributes to the existing literature through providing empirical verification of how pre-service teachers from different departments in Saudi Arabia share and build their knowledge through an online PLC. While it has been shown that the presence of practitioners enhances knowledge sharing among pre-service teachers from different departments, certain challenges remain in terms of pre-service teachers' engagement in building their knowledge and collaboratively discussing cognitive discourse with peers outside the department. Therefore, this current study suggests that effective support should be provided to pre-service teachers such that they can enhance their interaction across the boundaries that mark the various disciplines. This can be done through training practitioners in how to support

collaboration between pre-service teachers from different departments as well as designing online learning activities that support interdisciplinary collaboration.

Another contribution of this thesis lies in its examination of how the level of pre-service teachers' TPACK knowledge affects group forming and network structures. The existing research outlines that collaboration between high- and low-performing pre-service teachers can enhance both the collaborative environment and the flow of knowledge (Liou et al., 2017). However, no study has examined how the level of TPACK knowledge can affect the pre-service teachers' collaboration during their learning of how to integrate technology in their teaching. This study contributes to the existing knowledge of the role of practitioners in providing an inclusive environment that supports the interaction between pre-service teachers with a high level of TPACK knowledge and those with a low level of knowledge, by incorporating the items of a TPACK questionnaire within SNA through the use of MRQAP.

8.3.2 The Interaction and Learning Process in the Context of Saudi Arabia

This study further adds to existing knowledge about the understanding of learning and interaction culture in a country that is considered as a homogeneous society in terms of sharing the same religion and social norms. The majority of previous studies that have focused on online learning in general and the use of practitioners as pedagogical tools with pre-service teachers have been conducted in Western countries. Only one study undertaken in the Gulf region could be located (Alebaikan, 2016). Alebaikan (2016) stated that the involvement of online experts was not a commonly used teaching approach in the Gulf region, and recommended that future studies should focus on how experts can influence the engagement of learners in the Saudi context, since many different social and cultural factors exist that influence their participation. As discussed in Section 2.2, religious and social norms can shape pre-service teacher practice and interaction. This current study shows how religious beliefs that pre-service teachers and practitioners hold can influence their engagement in online PLCs. In Phase 3, practitioners emphasised their role in strengthening the ethic of collaborative work with attention to Islamic cultural perspectives. They attempted to engage pre-service teachers in the online PLC by acknowledging Islamic ethics such as altruism, care, and sharing. The pre-service teachers also referred to the importance of religious norms in motivating them to establish relationships with other members in the group. This current study adds to the existing literature on how religious beliefs act as a factor that can enhance engagement in the learning process. So, this factor needs to be considered during the

learning process by course designers and teachers not only in Saudi context but also in the international context. Universities around the world that receive people from different cultures need to understand international students' cultural norms in order to know how to engage pre-service teachers in the process of learning. These factors should be considered and reinforced among learners to engage people in the learning process.

This study is set within the wider context of ongoing social and cultural change in Saudi Arabia, particularly in relation to enhancing women's education and enabling women to recognise their educational abilities and talents. Saudi Vision 2030 places emphasis on empowerment and greater educational opportunities for women in KSA, (Naseem & Dhruva, 2017) and the expansion of women's roles (Khan, 2016). Historically, the government of Saudi Arabia has relied on men rather than women to achieve its development objectives (Naseem & Dhruva, 2017). Saudi women now hold many administration and leadership positions and roles at the top of the hierarchy in both public and private sectors (Naseem & Dhruva, 2017). This means that Saudi women are increasingly having the opportunity to lead and meet the development objectives of KSA. The Saudi government seeks to provide greater educational opportunities in order for more women to gain skills that enable them to participate in decision-making over the future of KSA and contribute to achieving the objectives of Vision 2030 (Naseem & Dhruva, 2017). This study, within an educational context, illustrates one approach that can enhance Saudi women's cognitive and social engagement. As indicated, one objective of the Saudi government involves empowering women to realise their abilities and contribute to the country's development (Khan, 2016). It could be argued that this study has in part attempted to empower female pre-service teachers and practitioners to both recognise and benefit from the cognitive and social skills earned from this experience, which could potentially contribute to enhancing the education system in KSA.

This study also adds to the current literature on how to enhance a learning culture in teachers' education around the world in general and in the Saudi education system in particular. In Saudi Arabia, a didactic teacher-centred model operating in lecture-based teaching space has been recognised as the main pedagogical approach used in Saudi universities (Alebaikan, 2010). Previous work found that Saudi pre-service teachers find difficulties in both using an online environment for professional development and establishing connections with others in the field through the use of this environment. These issues not only related to the Saudi Arabia context but also several other countries as mentioned in Section 3.1.3. This study contributes to the teacher

education literature around the word in general and Saudi literature in particular on how to successfully use practitioners as an approach that can enhance the quality of learning. This study showed that employing practitioners in an online learning environment as a pedagogical approach in the Saudi Arabian context played a role in engaging the pre-service teachers in the process of learning to teach and facilitating the development of relationships with their peers and with experts in the field.

8.3.3 Enhancing the Practitioner's Ability and Experience

Previous research has suggested that preparation and training programmes must be provided to practitioners prior to their interaction with pre-service teachers, in order to enhance the latter's engagement in the learning process (Redmond & Mander, 2006; Dorner & Kumar, 2017). In fact, several studies have found that the lack of fully prepared practitioners hinders the engagement of pre-service teachers in online PLCs (Redmond & Mander, 2006; Hemphill & Hemphill, 2007). Thus, the current study sought to fill this gap by providing a training programme for the practitioners that enabled them to provide effective support for pre-service teachers. The content of the programme included several areas of knowledge and skills that practitioners need to have in order to enhance the pre-service teachers' engagement. The content of the programme provided some knowledge of the pre-service education programme context, such as the objectives, structure and content of the module. It also provides practitioners with knowledge about how to enhance their facilitation skills and provide effective scaffolding for pre-service teachers.

Another gap that the current study attempted to fill relates to examining the experience of the practitioners. Previous research has generally focused on how the practitioners' involvement affects pre-service teachers' experience from the pre-service teachers' perspective rather than the practitioners' perspective. This study, it is argued, has addressed this gap in order to add depth to the study and to increase the insights of the findings by not only interviewing the pre-service teachers but also the practitioners. The practitioners' perspective added depth to this study in their explanations of how their role enhances the pre-service teachers' engagement, and this data was triangulated with the pre-service teachers' interviews. In addition, this study further contributes to the existing knowledge by investigating the impact of the engagement of practitioners with pre-service teachers in an online PLC on the practitioners' experience. Previous studies have not attempted to explore this area. Therefore, this thesis adds to current literature

on how practitioners' participation not only enhances the pre-service teachers' learning process but also the practitioners' professional growth and professional experience.

8.4 Methodological Contributions

In addition to contributing to the existing knowledge on the value of the involvement of practitioners in online PLCs, this thesis makes certain methodological contributions. One relates to the use of an experimental design with repeated measurements. This design permitted comparisons between two different situations (the participation of practitioners in the experimental group versus the absence of practitioners in the control group), which ensured that any influence of practitioner participation could be determined. In addition, it also allowed the prior level of the pre-service teachers' TPACK knowledge and engagement in both the control and the experimental groups to be taken into account, such that any between-group differences before the intervention could be determined. The advantage of repeated measurements is that this allows for the effect of the intervention to be observed at different time points and after controlling for the prior level of knowledge building and network development. Previous research has generally used case studies (e.g. Redmond & Mander, 2006; Dorner & Kumar, 2016; 2017; Alebakan, 2016) or a quasi-experimental design with one group (e.g. Hemphill & Hemphill, 2007) and has not used repeated measurements to trace the pre-service teachers' development. This research provides insights into the role of practitioners by tracing the development and engagement of pre-service teachers at different time points and comparing this with the control group. The benefit of this design is that it allows confidence in the interpretation of the differences between the presence of practitioners in the experimental group and the absence in the control group.

A further methodological contribution relates to using a mixed-method design to understand pre-service teachers' engagement in online PLCs. In fact, previous studies have generally focused on using a single-method approach, including a self-reporting method involving interviews (Alebakan, 2016) or questionnaires (Dorner & Kumar, 2016, 2017) and limited use of content analysis (Redmond & Mander, 2006; Hemphill & Hemphill, 2007). However, previous research has not considered the use of SNA. Moreover, some studies only count the numbers of the contributions in an online PLC. Risser (2014) has argued that the quantified number of messages may not be useful for measuring the level of social engagement. The benefit of SNA was allowing and understanding of the collaboration process and how the practitioners affect it. The number of

posts can show how the pre-service teachers increase their interaction but cannot provide insights into the group formation, development and interaction with members outside the department.

No single study has incorporated a combination of more powerful methods, such as SNA and CA, and used these alongside qualitative data such as that gathered from interviews. In fact, prior computational and social science research has suggested that in order to understand the complexity of the online learning process, a combination of methodological techniques should be used to provide a more holistic view of the learning process within online environments (Wesler et al., 2008; Eynon et al., 2016). The mixed-method design of this study was adopted with the aim of providing multifaceted insights into pre-service teachers' engagement with practitioners in online PLCs. It has shown the complexity of the engagement in an online PLC and the benefit of each method in tracing the engagement.

8.5 Practical Implications for Course Designers, Instructors and Policy Makers

The design of the activities for the modules had an influence on pre-service teachers' learning and engagement. The findings of this thesis have several significant implications for course designers, instructors and policy makers. Although the work outlined in this thesis relates to an online PLC context, it is recognised that many of the suggestions are also applicable to a face-to-face context.

The findings of this study suggest that engaging practitioners with pre-service teachers without the provision of preparation and training cannot enhance the pre-service teachers' engagement. In fact, several studies found some lack of engagement with practitioners due to the limited opportunity to fully prepare them (Redmond & Mander, 2006; Hemphill & Hemphill, 2007; Dorner & Kumar, 2017). It should not be presumed that experienced teachers who are experts in their subject area have sufficient knowledge to play the role of facilitator. Therefore, it is important to prepare practitioners prior to their engagement with pre-service teachers in terms of, for example, providing general information on pre-service teacher education programmes and the various modules, and outlining how to facilitate interaction and build knowledge and how to engage learners in collaborative work with peers from different departments.

The findings also reveal the importance of the involvement of university instructors (module instructors) in online PLCs that involve practitioners and pre-service teachers. In fact, both pre-service teachers and practitioners have noted that the experience can be enhanced if the university lecturers become involved in the online PLC. According to Hulshof and Verloop (1994), the basic triad that affects pre-service teachers' experience consists of pre-service teacher, cooperative teacher, and university instructor. Several studies (e.g. Zeichner, 2010; Clark, Triggs & Nielsen, 2014) argue for the importance of collaboration between the university lecturer and the practitioners (expert in-service teachers) to enhance pre-service teachers' experience. The involvement of university instructors can enhance and strengthen the classroom activities and can consolidate the strong connection between online and classroom activities. Meanwhile, the involvement of the instructors can help enhance their knowledge about current school practice and can, in turn, enhance the practitioners' understanding of the university instructors' practice.

The evidence from this study suggests that engaging pre-service teachers from different departments cannot automatically enhance collaboration across the various disciplines. In fact, the results of this study indicate that the pre-service teachers found it difficult to engage in highly cognitive discourse with peers from different departments. The practitioners also reported that the current design of the online activities did not effectively support collaboration among participants from different departments or enhance the interdisciplinary activities. Although the current design of the online activities may support the collaboration of the potential commonalities across departments – pedagogical approaches, use of ICT, assessment, the online activities did not engage pre-service teachers in supporting collaboration in discussion related to the content of other subject areas. It is clear, then, that the online activities should be designed to support interdisciplinary activities and that the practitioners should be trained in how to facilitate the interaction and how to scaffold pre-service teachers' work in interdisciplinary teams. Here, Rienties and Heliot (2018) suggest providing effective support and coaching to enhance the collaborative work in interdisciplinary activities.

Meanwhile, the findings also suggest that pre-service teachers should be given the opportunity to engage in designing the lesson plans with the practitioners. In fact, this study recommends that using a design-based learning approach that involves the practitioners could enhance the pre-service teachers' understanding of technology integration and encourage them to engage more in the online PLCs and the process of learning to teach. The study also suggests making the online PLCs broader, with the involvement of more than the usual two practitioners. This may well help

to enhance the diversity of the ideas and the experiences that pre-service teachers can have through engaging with a greater number of expert in-service teachers.

In addition to having practical implications for course designers and university lecturers, this research also provides valuable suggestions for policy makers in terms of teacher education programmes for both in-service teachers and pre-service teachers. The key finding here suggests that inviting practitioners to work alongside pre-service teachers can be an approach that could enhance the pre-service teachers' professional development in terms of cognitive and social engagement and aid connections between theory and practice. Meanwhile, the indication is that this can also give practitioners the opportunity to enhance their own professional development, helping them to reflect on their practice and share their experiences with pre-service teachers. This finding is in line with the Saudi Vision 2030. One of the key objectives of this vision is to enhance the Saudi education system as a whole, but particularly in terms of teacher training (Saudi Vision 2030, 2016). In fact, the Saudi Vision 2030 pays close attention to issues related to the development of cognitive and social skills, high-quality education, training teachers and training young men and women so they are prepared for the jobs of the future and providing the opportunity for each member of the community to learn (Vision 2030, 2016). With this in mind, the current research included an attempt to achieve these objectives by enhancing the social and cognitive development of pre-service teachers, enhancing the quality of teacher training, providing equal opportunities for both practitioners and pre-service teachers to engage in professional development learning and preparing pre-service teachers for their future teaching practice. Here, it can be argued that in order to improve the professional learning opportunities for both in-service and pre-service teachers, it is recommended that policy makers need to work on strengthening the partnerships between universities and schools. While such partnerships do exist, they are limited to pre-service teachers' field experience and are generally only related to pre-service teachers' professional learning as mentioned in several studies around the world (Al-Zahrani , 2015; Zeichner, 2010; Dorner & Kumar, 2016). Therefore, some rethinking of the management of partnerships and, in particular, their organisation is recommended. More explicit explanation of the role of key stakeholders including university lecturers, in-service teachers and pre-service teachers in this partnership is needed. The lack of partnerships and the lack of clarity in terms of the attendant strategies do not currently allow effective support and guidance for pre-service teachers, which could negatively affect their learning experience.

The evidence from this study (Phase 1) suggests that pre-service teachers faced some obstacles in developing their TPACK knowledge due to the structure of teacher education programmes and the content of the modules. The lack of taking pedagogy course before taking an ICT course and the out-of-date course content can act as obstacles to developing pre-service teachers' TPACK knowledge. Therefore, this study recommends that policy makers restructure teacher education programmes and update the content of the modules. This recommendation is aligned with Saudi Vision 2030 as one of the aims to reform the curriculum so that it is suitable for work of the future.

8.6 Research Limitations

This study utilised a rigorous mixed-method approach and an experimental design to examine pre-service teachers' engagement in the process of learning to teach with technology and to evaluate the role of experienced practitioners in supporting pre-service teachers during their participation in online PLCs. Although this approach provided valuable insights and perspectives, some limitations should be acknowledged.

One of these limitations is related to the small number and the homogeneity of the study participants, which limited the generalisability of the findings. In terms of homogeneity, the pre-service teachers were all from one public university in the western region of Saudi Arabia, while all the pre-service teachers and practitioners who participated in this study were female, meaning that the influence of gender on online PLC participation could not be investigated. Having a larger sample that encompassed participants from different universities and included a gender balance would have broadened the research's scope and would have ensured that the analysis and discussion were more convincing, while more insights into socio-cultural factors related to gender could have been gained. In fact, Al-Ghamdi, Samarji and Watt (2016) found that the learners' gender can affect their participation and interaction within an online learning space.

A further limitation is that the current study only conducted in-depth analyses of the interactions and discussions that took place in online PLCs and did not investigate those that took place in a face-to-face context (university), specifically in terms of the extent of the impact of online discussions, interactions and activities on a university context in general and on classroom interaction in particular. Having an understanding of the discussions that take place within a university and classroom context would provide more insights into the factors that may affect

TPACK and cognitive and network development, the factors that may affect the participation in online PLCs and the impact of online PLCs on the university context and vice versa. Although this study found that the pre-service teachers discussed with peers some resources and information that take it from their external support in online PLC, this study did not involve an examination of the external network of support (outside of the online PLCs) that pre-service teachers develop to enhance their learning. In fact, several researchers (e.g. Rienties & Kinchin, 2014; Van Waes et al., 2018) found that teachers developed external ties with people outside of the professional development programme in order to develop their learning and teaching, while Bokhove and Downey (2018) observed that pre-service teachers developed supportive ties with family and friends outside of the university community. Therefore, future research should consider these issues during the design of the study.

Another limitation is that this study does not provide insight into the extent of the impact of the intervention on pre-service teachers' classroom practices and student learning when they progress to school placements and become teachers. Moreover, it does not provide insight into the pre-service teachers' online discussions and network development after they engage in school placements and the impact of practitioners in this area. Thus, one suggestion for future research is to investigate the impact of practitioners on pre-service teachers' engagement in learning about technology in longitudinal terms, covering the whole of their teacher education programme (both university and school context). In fact, Bokhove and Downey (2018) found that pre-service teachers' networks were different in the university and school contexts.

8.7 Future Research Directions

Throughout Phases 2 and 3 of this study, the pre-service teachers encountered some difficulties in developing social relationships with peers outside of their department in terms of the interaction surrounding higher-level cognitive discourse. This is in line with a number of existing studies (e.g. Brown et al., 2018; Rienties & Heliot, 2018) that concluded that learners find it difficult to develop ties outside of their own discipline. The suggestion here, then, is that future research should address how the online collaboration among pre-service teachers from different departments could be improved when higher-level cognitive knowledge is involved. This would involve exploring the design of interventions and activities that could support the collaboration among pre-service teachers from different departments and enhance the interdisciplinary activities. This could be done by asking the pre-service teachers to design a lesson that involves making connections between science and social science subject in a specific topic.

A further recommendation for future research relates to examining the impact of the intervention on pre-service teachers' and practitioners' participation in other PLCs and school communities. The current study found that practitioners enhanced sharing and collaboration among pre-service teachers and provided some details of the practitioners' experience of engaging novice teachers in the process of learning to teach. However, it is recommended that a follow-up study is conducted to investigate the impact and the benefits of this experience on other PLCs. The study could adopt a case study approach and a combination of methods, such as SNA, CA and interview.

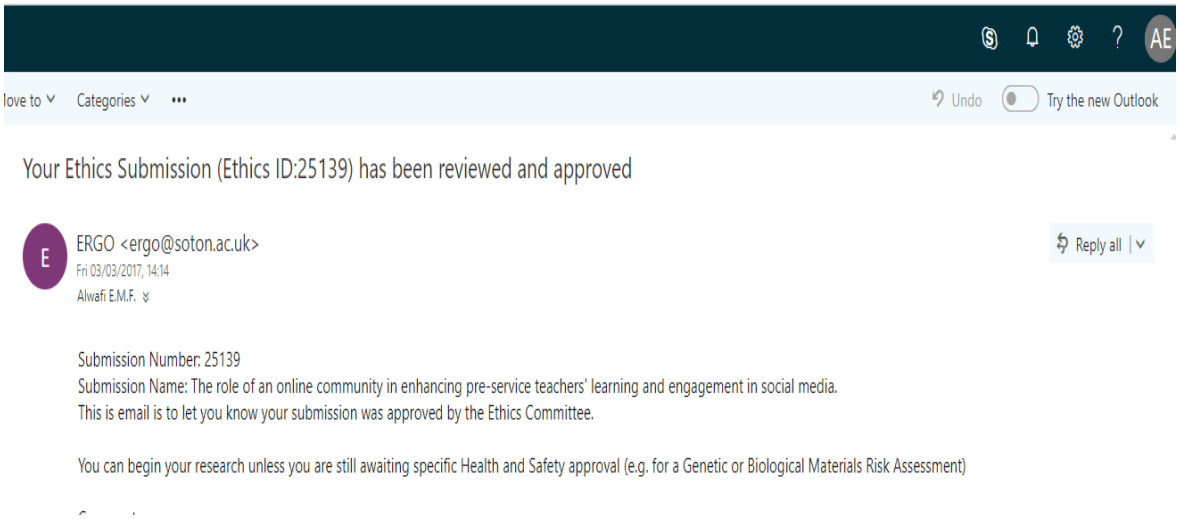
Throughout Phase 3, there was evidence that the presence of practitioners made the discussion more 'real' and helped pre-service teachers to understand the reality of the classroom. Future research could focus on how this experience affects the 'reality shock' (Veenman, 1984) that pre-service teachers might face during their first year in the profession. Therefore, this study recommends that a follow-up study is conducted to examine the influence of the experience of participation with practitioners in an online PLC on reducing any 'reality shock' among pre-service teachers.

A final recommendation relates to designing online PLCs that include some heterogenic participants in terms of gender in the Saudi context. Here, Al-Zahrani (2015) stated that technological breakthroughs play a significant role in disturbing the traditional culture of Saudi Arabia, while Al-Saggaf (2004) interviewed Saudi women in relation to the use of the internet and found that the digital space allowed them to discuss certain learning issues with their male counterparts, which may have been more difficult within a face-to-face context. Abokhodair and Vieweg (2016) found that some Saudi female participants used pseudonyms when they made their accounts public. So, it would be interesting to investigate the social interaction among males and females in online PLCs. Indeed, this could lead to different results, especially within the Saudi context, where gender segregation exists at all levels of education. As mentioned in Section 8.3.2, the Saudi Arabia government has adapted a new vision for further increasing the empowerment of women in society as reflected in Saudi Vision 2030 (Naseem & Dhruva, 2017). The Ministry of Education in Saudi Arabia has very recently established an online platform for teacher development called 'IEN INMA' (Tatweer for Education, 2017). This platform is designed for both male and female Saudi teachers. The platform allows teachers and professionals from, irrespective of gender, in the field of education to deliver training programmes for other teachers.

This can be considered as a major change in the Saudi system, as traditionally men and women had separate training programmes and women did not deliver-training for men. Therefore, it would be interesting to explore social interaction and engagement between males and females in online PLCs.

Appendix A Ethical Approval

A.1 Ethical Approval: University of Southampton



love to Categories ••• Undo Try the new Outlook

Your Ethics Submission (Ethics ID:25139) has been reviewed and approved

E ERGO <ergo@soton.ac.uk> Reply all

Fri 03/03/2017, 14:14

Alwafi E.M.F.

Submission Number: 25139

Submission Name: The role of an online community in enhancing pre-service teachers' learning and engagement in social media.

This is email is to let you know your submission was approved by the Ethics Committee.

You can begin your research unless you are still awaiting specific Health and Safety approval (e.g. for a Genetic or Biological Materials Risk Assessment)

A.2 Ethical approval: Umm Alqura University

إدارة البعثات والعلاقات الجامعية	الموظف المختص بجامعة ام القرى	قبول	01-08-2017

رسالة هاتفية عاجلة رقم الملف UMU531 سعادة الملحق الثقافي ببريطانيا سلمه الله السلام عليكم ورحمة الله وبركاته إشارة إلى رقم الطلب المقدم من المبتعثة/ إيناس محمد فرج الوافي، (17023345) (وسجل مدني) بشأن طلب القيام برحلة علمية إلى المملكة في مرحلة الدكتوراه لمدة 90 يوماً اعتباراً من 20/09/2017م الموافق 29/12/1438هـ. أود إفادتكم أنه وبعرض الموضوع على كلية التربية فقد تمت الموافقة على طلبها بخطابهم رقم 4380152522 وتاريخ 07/11/1438 هـ، وجاري استكمال الإجراءات المطلوبة. أمل التكرم باعتماد موافقة الجامعة على طلب المبتعثة الموضح اسمها أعلاه. وتقبلوا خالص تحياتي ،،،،، المشرف العام على إدارة البعثات د. أحمد بن يوسف أحمد برقاوي

A.3 Complet Fieldwork

Kingdom of Saudi Arabia
Ministry of Education
Umm Al-Qura University
(031)

المملكة العربية السعودية
وزارة التعليم
جامعة أم القرى
(٠٣١)

الى من يهمه الأمر

يفيد قسم المناهج وطرق التدريس بجامعة أم القرى بأن المبتعثة الأستاذة / ايناس محمد الوافي ، قامت بعمل رحلة علمية بجامعة أم القرى لتجميع البيانات المتعلقة ببحث الدكتوراه الخاص بها في الفترة من تاريخ ١٤٣٨/١٢/٢٩هـ الى ١٤٣٩/٣/٢٥هـ .

للإحاطة

وتفضلوا بقبول عاطر التحية ؛

وكيلة رئيس قسم المناهج وطرق التدريس

د . نيفين بنت حمزة البركاتي

Appendix B Ethical documents

B.1 Participants information sheet for pre-service teachers in an experimental group

English Version

UNIVERSITY OF Southampton

Pre-service teachers Participant Information Sheet

Study Title: The role of an online community in enhancing pre-service teachers' learning and engagement in social media.

Researcher: Enas Alwafi **Ethics number: 25139**

Please read this information carefully before deciding to take part in this research. If you are happy to participate you will be asked to sign a consent form.

What is the research about?

I am a PhD research student at the University of Southampton in the UK. This research project is a part of my PhD degree. The focus of this project is on the role of online learning community play in enhancing the learning process. As pre-service teachers, you can use this online platform to ask, contact, exchange information with other participants in the group which include other pre-service teachers and it may include some practitioners (in-service teachers). As a researcher, I am interested in investigating the value of online interaction in social media to underpin study and learning.

Why have I been chosen?
You have been chosen because you are a current pre-service teacher and can give the researcher an insight into the learning process and exchange take place in social media.

What will happen to me if I take part?
You will be invited by the researcher with other pre-service teachers to use selected social media to support your learning and study of the module of Educational means and technology. First, some videos and guidelines of the use of selected social media will send to your email. In the online activity, some practitioners may participate in the online group. The private group in social media will be created for this study. When you create your account in social media, you have right to use pseudonym name rather than your real name. I will use your contribution as well as your peers' contribution regarding the extent to which using social media in education can help to improve learning process. Your identity will be anonymised for the purposes of reporting the result. After the online learning activities, the interview will be conducted. If you are willing to do the interview, you will ask to sign a consent form for your participation in the interview. In the interview, you will be asked about your perceptions of the use of social media for learning process. There are no right or wrong answers. If you do not mind, the interview will be audio recorded to be analysed later with your permission. Also, you will be asked to fill a questionnaire (approximately 10 minutes) regarding the level of your knowledge about technology. The questionnaire will be distributed two times during the study.

Are there any benefits in my taking part?

It is hoped that it will support your learning as a pre-service teacher. Your participation in this research is highly valued and I believe it can make a significant contribution to research on using technology such as social media in learning.

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Are there any risks involved?

The project is relatively free of risks beyond that of attending school as normal. The online activities will be conducted in private group with your peers and two practitioners. The topic of the online activities will focus on the use of technology in your future teaching. The topic is not of a sensitive nature, therefore it is also unlikely to cause you any stress. Also, the questions that are posed to you during the interviews and through the questionnaire will not contain any sensitive questions.

Will my participation be confidential?

All information and data collected during the research will be strictly confidential. The research will be aligned with the Data Protection Act and University of Southampton policy. Your data will be kept on a password protected University computer until the researcher's graduation, after which it will be deleted. In any report, the researcher will describe the results anonymously. When reporting the results, your real name will not be used and a pseudonym will be used to hide your identity.

What happens if I change my mind?

You can withdraw from participation in the research at any time and without any disadvantage to yourself of any kind. You have full rights to withdraw your data until 30 November 2018 where the researcher begins her study's writing up stage. If you choose to withdraw your data from the study before 30 November 2018, data relating to all your responses will be destroyed and will not be used in the research.

What happens if something goes wrong?
If you have any concerns about the research please contact. Head of Research Governance, University of Southampton, rgoinfo@soton.ac.uk +44 (0) 2380 595058

Where can I get more information?
If you would like more information about this project including on how the data you provide will be used, please contact me:
Enas Alwafi, Southampton Education School, University of Southampton.
Email: emfa1d15@soton.ac.uk
Phone: +447462427486

Or you can contact with my supervisor
Dr Chris Downey, Southampton Education School, University of Southampton
Email: c.j.downey@soton.ac.uk
Phone: (023) 8059 3707

1st February 2017. Version 1

Arabic Version

UNIVERSITY OF Southampton

ورقة معلومات للمشاركين لمعلمات ما قبل الخدمة

عنوان الدراسة: دور مجتمع عبر الإنترنت في تعزيز تعلم ومشاركة معلمي ما قبل الخدمة في وسائل التواصل الاجتماعي.

الباحثة: إيناس الوافي رقم ملف الأخلاقيات**25139** :

يرجى قراءة هذه المعلومات بعناية قبل اتخاذ قرار بالمشاركة في هذا البحث. إذا كنت سعيدة بالمشاركة ، فسيُطلب منك التوقيع على نموذج الموافقة.

ما هو البحث عنه؟

أنا طالبة دكتوراه في جامعة ساوثامبتون في المملكة المتحدة. هذا المشروع البحثي هو جزء من درجة الدكتوراه. ينصب تركيز هذا المشروع على دور مجتمع التعلم عبر الإنترنت في تعزيز عملية التعلم. كمدرسه قبل الخدمة ، يمكنك استخدام هذا المنصة عبر الإنترنت للسؤال والاتصال وتبادل المعلومات مع المشاركات الأخريات في المجموعة والتي تشمل معلمات ما قبل الخدمة وقد تشمل بعض المهنيات (معلمات أثناء الخدمة). كباحثة، أنا مهتمة بالتحقيق في قيمة التفاعل عبر الإنترنت في وسائل التواصل الاجتماعي لدعم الدراسة والتعلم.

لماذا تم اختياري؟
لقد تم اختيارك لأنك معلمة حالي لما قبل الخدمة ، ويمكنك منح الباحثة نظرة ثاقبة على عملية التعلم و التبادل في وسائل التواصل الاجتماعي.

ماذا سيحدث لي إذا شاركت؟
ستتم دعوتك مع معلمات ما قبل الخدمة لاستخدام وسائل التواصل الاجتماعي المختارة لدعم تعلمك ودراسة وحدة الوسائل التعليمية والتكنولوجيا. في البداية سوف يرسل على بريدك معلومات عن كيفيه استخدام موقع تواصل اجتماعي المختار لهذة الدراسة. في النشاط عبر الإنترنت ، قد يشارك بعض المهنيات (معلمات أثناء الخدمة) في المجموعة عبر الإنترنت. سيتم إنشاء مجموعة خاصة في وسائل التواصل الاجتماعي لهذه الدراسة. عندما تنشئ حسابك في وسائل التواصل الاجتماعي ، يحق لك استخدام اسم مستعار بدلاً من اسمك الحقيقي. سأستخدم مساهمتك وكذلك مساهمة زميلاتك فيما يتعلق بمدى استخدام وسائل التواصل الاجتماعي في التعليم في تحسين عملية التعلم. سيتم إخفاء هويتك لأغراض الإبلاغ عن النتيجة. بعد أنشطة التعلم عبر الإنترنت ، سيتم إجراء المقابلة. إذا كنت على استعداد لإجراء المقابلة ، فسوف يطلب منك التوقيع على نموذج الموافقة على مشاركتك في المقابلة. في المقابلة ، سيتم سؤالك عن تصوراتك حول استخدام وسائل التواصل الاجتماعي لعملية التعلم. لا توجد إجابات صحيحة أو خاطئة. إذا كنت لا تمانعي ، فسيتم تسجيل المقابلة الصوتية ليتم تحليلها في وقت لاحق بإذن منك. أيضًا ، سيُطلب منك تعبئة استبيان (يستغرق حوالي 10 دقائق) بشأن مستوى معرفتك بالتكنولوجيا. سيتم توزيع الاستبيان مرتين خلال الدراسة.

هل هناك أي فوائد في مشاركتي؟

من المأمول أن مشاركتك سوف تدعمك في تعلمك كمدرسة ما قبل الخدمة. إن مشاركتك في هذا البحث تحظى بتقدير كبير وأعتقد أنها يمكن أن تقدم مساهمة كبيرة في البحث عن استخدام التكنولوجيا مثل وسائل التواصل الاجتماعية في التعلم.

هل هناك أي مخاطر التي تنطوي عليها؟

المشروع خالي نسبياً من المخاطر التي لن تتجاوز الذهاب إلى المدرسة كالمعتاد. سيتم إجراء الأنشطة عبر الإنترنت في مجموعة خاصة وفقط مع زميلاتك و معلمات أثناء الخدمة. مواضيع الأنشطة عبر الإنترنت ستركز على استخدام التكنولوجيا في تدريسك في المستقبل. الموضوع ليس ذا طبيعة حساسة ، لذلك من غير المرجح أن يسبب لك أي ضغوط. أيضًا ، لن تحتوي الأسئلة التي يتم طرحها عليك خلال المقابلات ومن خلال الاستبيان على أي أسئلة حساسة.

هل ستكون مشاركتي سرية؟

1 الإصدار 1 فبراير 2017.

UNIVERSITY OF Southampton

ستكون جميع المعلومات والبيانات التي تم جمعها خلال البحث سرية للغاية. البحث يتماشى مع قانون حماية البيانات وسياسة جامعة ساوثهامبتون. سيتم الاحتفاظ ببياناتك على كمبيوتر الجامعة وهو محمي بكلمة مرور حتى تخرج الباحث ، وبعد ذلك سيتم حذفها. في أي تقرير ، سوف يصف الباحث النتائج بشكل مجهول. عند الإبلاغ عن النتائج ، لن يتم استخدام اسمك الحقيقي وسيتم استخدام اسم مستعار لإخفاء هويتك.

ماذا يحدث إذا غيرت رأيي؟

يمكنك الانسحاب من المشاركة في البحث في أي وقت ودون أي ضرر عليك من أي نوع .لديك الحق الكامل في سحب بياناتك حتى 30 نوفمبر 2018 ، حيث تبدأ الباحثة مرحلة كتابة دراستها. إذا اخترت سحب بياناتك من الدراسة قبل 30نوفمبر 2018 ، فسيتم إتلاف البيانات المتعلقة بجميع إجاباتك ولن يتم استخدامها في البحث.

ماذا يحدث إذا حدث خطأ ما؟
إذا كان لديك أي مخاوف بشأن البحث يرجى الاتصال. رئيس حوكمة الأبحاث ، جامعة ساوثهامبتون ، 44+ rgoinfo@soton.ac.uk (0) 2380 595058

أين يمكنني الحصول على مزيد من المعلومات؟
إذا كنت ترغب في الحصول على مزيد من المعلومات حول هذا المشروع بما في ذلك كيفية استخدام البيانات التي تقدمها ، يرجى الاتصال بي:
إيناس الوافي ، مدرسة التربية، جامعة ساوثهامبتون.
البريد الإلكتروني: emfa1d15@soton.ac.uk
الهاتف: +447462427486

أو يمكنك الاتصال مع مشرفي
الدكتور كريس داوني، كلية التربية ، جامعة ساوثهامبتون
البريد الإلكتروني: cjdowney@soton.ac.uk
الهاتف: 02380593707

B.2 Participants information sheet for pre-service teachers in a control group

English Version

UNIVERSITY OF Southampton

Pre-service teachers Participant Information Sheet

Study Title: The role of an online community in enhancing pre-service teachers' learning and engagement in social media.

Researcher: Enas Alwafi **Ethics number**: 25139

Please read this information carefully before deciding to take part in this research. If you are happy to participate you will be asked to sign a consent form.

What is the research about?

I am a PhD research student at the University of Southampton in the UK. This research project is a part of my PhD degree. The focus of this project is on the role of online learning community play in enhancing the learning process. As pre-service teachers, you can use this online platform to ask, contact, exchange information with other participants in the group which include other pre-service teachers. As a researcher, I am interested in investigating the value of online interaction in social media to underpin study and learning.

Why have I been chosen?
You have been chosen because you are a current pre-service teacher and can give the researcher an insight into the learning process and exchange take place in social media.

What will happen to me if I take part?
You will be invited by the researcher with other pre-service teachers to use selected social media to support your learning and study of the module of Educational means and technology. First, some videos and guidelines of the use of selected social media will send to your email. The private group in social media will be created for this study. When you create your account in social media, you have right to use pseudonym name rather than your real name. I will use your contribution as well as your peers' contribution regarding the extent to which using social media in education can help to improve learning process. Your identity will be anonymised for the purposes of reporting the result. After the online learning activities, the interview will be conducted. If you are willing to do the interview, you will ask to sign a consent form for your participation in the interview. In the interview, you will be asked about your perceptions of the use of social media for learning process. There are no right or wrong answers. If you do not mind, the interview will be audio recorded to be analysed later with your permission. Also, you will be asked to fill a questionnaire (approximately 10 minutes) regarding the level of your knowledge about technology. The questionnaire will be distributed two times during the study.

Are there any benefits in my taking part?

It is hoped that it will support your learning as a pre-service teacher. Your participation in this research is highly valued and I believe it can make a significant contribution to research on using technology such as social media in learning.

1st February 2017. Version 1

UNIVERSITY OF Southampton

Are there any risks involved?

The project is relatively free of risks beyond that of attending school as normal. The online activities will be conducted in private group with your peers. The topic of the online activities will focus on the use of technology in your future teaching. The topic is not of a sensitive nature, therefore it is also unlikely to cause you any stress. Also, the questions that are posed to you during the interviews and through the questionnaire will not contain any sensitive questions.

Will my participation be confidential?

All information and data collected during the research will be strictly confidential. The research will be aligned with the Data Protection Act and University of Southampton policy. Your data will be kept on a password protected University computer until the researcher's graduation, after which it will be deleted. In any report, the researcher will describe the results anonymously. When reporting the results, your real name will not be used and a pseudonym will be used to hide your identity.

What happens if I change my mind?

You can withdraw from participation in the research at any time and without any disadvantage to yourself of any kind. You have full rights to withdraw your data until 30 November 2018 where the researcher begins her study's writing up stage. If you choose to withdraw your data from the study before 30 November 2018, data relating to all your responses will be destroyed and will not be used in the research.

What happens if something goes wrong?
If you have any concerns about the research please contact. Head of Research Governance, University of Southampton, rgoinfo@soton.ac.uk +44 (0) 2380 595058

Where can I get more information?
If you would like more information about this project including on how the data you provide will be used, please contact me:
Enas Alwafi, Southampton Education School, University of Southampton.
Email: emfa1d15@soton.ac.uk
Phone: +447462427486

Or you can contact with my supervisor
Dr Chris Downey, Southampton Education School, University of Southampton
Email: c.j.downey@soton.ac.uk
Phone: (023) 8059 3707

1st February 2017. Version 1

Arabic Version

UNIVERSITY OF Southampton

ورقة معلومات للمشاركين لمعلمات ما قبل الخدمة

عنوان الدراسة: دور مجتمع عبر الإنترنت في تعزيز تعلم ومشاركة معلمي ما قبل الخدمة في وسائل التواصل الاجتماعي.

الباحثة: إيناس الوافي رقم ملف الأخلاقيات**25139** :

يرجى قراءة هذه المعلومات بعناية قبل اتخاذ قرار بالمشاركة في هذا البحث. إذا كنت سعيدة بالمشاركة ، فسيُطلب منك التوقيع على نموذج الموافقة.

ما هو البحث عنه؟

أنا طالبة دكتوراه في جامعة ساوثامبتون في المملكة المتحدة. هذا المشروع البحثي هو جزء من درجة الدكتوراه. ينصب تركيز هذا المشروع على دور مجتمع التعلم عبر الإنترنت في تعزيز عملية التعلم. كمدرسه قبل الخدمة ، يمكنك استخدام هذا المنصة عبر الإنترنت للسؤال والاتصال وتبادل المعلومات مع المشاركات الأخريات في المجموعة والتي تشمل معلمات ما قبل الخدمة. كباحثة، أنا مهتمة بالتحقيق في قيمة التفاعل عبر الإنترنت في وسائل التواصل الاجتماعي لدعم الدراسة والتعلم.

لماذا تم اختياري؟
لقد تم اختيارك لأنك معلمة حالي لما قبل الخدمة ، ويمكنك منح الباحثة نظرة ثاقبة على عملية التعلم و التبادل في وسائل التواصل الاجتماعي.

ماذا سيحدث لي إذا شاركت؟
ستتم دعوتك مع معلمات ما قبل الخدمة لاستخدام وسائل التواصل الاجتماعي المختارة لدعم تعلمك ودراسة وحدة الوسائل التعليمية والتكنولوجيا. في البداية سوف يرسل على بريدك معلومات عن كيفيه استخدام موقع تواصل اجتماعي المختار لهذة الدراسة. سيتم إنشاء مجموعة خاصة في وسائل التواصل الاجتماعي لهذه الدراسة. عندما تنشئ حسابك في وسائل التواصل الاجتماعي ، يحق لك استخدام اسم مستعار بدلاً من اسمك الحقيقي. سأستخدم مساهمتك وكذلك مساهمة زميلاتك فيما يتعلق بمدى استخدام وسائل التواصل الاجتماعي في التعليم في تحسين عملية التعلم. سيتم إخفاء هويتك لأغراض الإبلاغ عن النتيجة. بعد أنشطة التعلم عبر الإنترنت ، سيتم إجراء المقابلة. إذا كنت على استعداد لإجراء المقابلة ، فسوف يطلب منك التوقيع على نموذج الموافقة على مشاركتك في المقابلة. في المقابلة ، سيتم سؤالك عن تصوراتك حول استخدام وسائل التواصل الاجتماعي لعملية التعلم. لا توجد إجابات صحيحة أو خاطئة. إذا كنت لا تمانعي ، فسيتم تسجيل المقابلة الصوتية ليتم تحليلها في وقت لاحق بإذن منك. أيضًا ، سيُطلب منك تعبئة استبيان (يستغرق حوالي 10 دقائق) بشأن مستوى معرفتك بالتكنولوجيا. سيتم توزيع الاستبيان مرتين خلال الدراسة.

هل هناك أي فوائد في مشاركتي؟

من المأمول أن مشاركتك سوف تدعمك في تعلمك كمدرسة ما قبل الخدمة. إن مشاركتك في هذا البحث تحظى بتقدير كبير وأعتقد أنها يمكن أن تقدم مساهمة كبيرة في البحث عن استخدام التكنولوجيا مثل وسائل التواصل الاجتماعية في التعلم.

هل هناك أي مخاطر التي تنطوي عليها؟

المشروع خالي نسبياً من المخاطر التي لن تتجاوز الذهاب إلى المدرسة كالمعتاد. سيتم إجراء الأنشطة عبر الإنترنت في مجموعة خاصة وفقط مع زميلاتك. مواضيع الأنشطة عبر الإنترنت ستركز على استخدام التكنولوجيا في تدريسك في المستقبل. الموضوع ليس ذا طبيعة حساسة ، لذلك من غير المرجح أن يسبب لك أي ضغوط. أيضًا ، لن تحتوي الأسئلة التي يتم طرحها عليك خلال المقابلات ومن خلال الاستبيان على أي أسئلة حساسة.

هل ستكون مشاركتي سرية؟

1 الإصدار 1 فبراير 2017.

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ستكون جميع المعلومات والبيانات التي تم جمعها خلال البحث سرية للغاية. البحث يتماشى مع قانون حماية البيانات وسياسة جامعة ساوثهامبتون. سيتم الاحتفاظ ببياناتك على كمبيوتر الجامعة وهو محمي بكلمة مرور حتى تخرج الباحث ، وبعد ذلك سيتم حذفها. في أي تقرير ، سوف يصف الباحث النتائج بشكل مجهول. عند الإبلاغ عن النتائج ، لن يتم استخدام اسمك الحقيقي وسيتم استخدام اسم مستعار لإخفاء هويتك.

ماذا يحدث إذا غيرت رأيي؟

يمكنك الانسحاب من المشاركة في البحث في أي وقت ودون أي ضرر عليك من أي نوع .لديك الحق الكامل في سحب بياناتك حتى 30 نوفمبر 2018 ، حيث تبدأ الباحثة مرحلة كتابة دراستها. إذا اخترت سحب بياناتك من الدراسة قبل 30نوفمبر 2018 ، فسيتم إتلاف البيانات المتعلقة بجميع إجاباتك ولن يتم استخدامها في البحث.

ماذا يحدث إذا حدث خطأ ما؟
إذا كان لديك أي مخاوف بشأن البحث يرجى الاتصال. رئيس حوكمة الأبحاث ، جامعة ساوثهامبتون ، rgoinfo@soton.ac.uk
+44 (0) 2380 595058

أين يمكنني الحصول على مزيد من المعلومات؟
إذا كنت ترغب في الحصول على مزيد من المعلومات حول هذا المشروع بما في ذلك كيفية استخدام البيانات التي تقدمها ، يرجى الاتصال بي:
إيناس الوافي ، مدرسة التربية، جامعة ساوثهامبتون.
البريد الإلكتروني: emfa1d15@soton.ac.uk
الهاتف: +447462427486

أو يمكنك الاتصال مع مشرفي
الدكتور كريس داوني، كلية التربية ، جامعة ساوثهامبتون
البريد الإلكتروني: cjdowney@soton.ac.uk
الهاتف: 02380593707

1 الإصدار 1 فبراير 2017.

B.3 Participants information sheet for practitioners

English Version

UNIVERSITY OF Southampton

Practitioners Participant Information Sheet

Study Title: The role of online community in supporting pre-service teachers' professional learning and engagement in social media.

Researcher: Enas Alwafi **Ethics number**: 30249

Please read this information carefully before deciding to take part in this research. If you are happy to participate you will be asked to sign a consent form.

What is the research about?

I am a PhD research student at the University of Southampton in the UK. This research project is a part of my PhD degree. The focus of this project is on the role of online learning community play in enhancing the learning process. As you are considered as one who have experience in using technology in education, you can use this online platform to provide feedback to the pre-service teachers. As a researcher, I am interested in investigating the value of online interaction in social media to underpin study and learning.

Why have I been chosen?
You have been chosen because you have experience in technology and you can provide feedback into pre-service teacher regarding the use of technology in their future teaching. Also, you can give the researcher an insight into the learning process and exchange take place in social media.

What will happen to me if I take part?

There are two phases for your participation. In the first phase, you will invite in training course with other experts who also have experience in technology. This training course will provide you information regarding the useful way of enhancing pre-service teacher engagement in their learning. The training course will take around two weeks. The training course will be conducted in social media. The private group in social media will be created for this study. When you create your account in social media, you have right to use pseudonym name rather than your real name. In the first week, you will have online sessions focus on the how you can help pre-service teachers in engaging in learning process. The second week will focus on practical part. This part will apply what you learn in this sessions.

In the second phase, you will be invited with other practitioners and the pre-service teachers to use selected social media (Facebook) to support the pre-service teachers' learning and study of the module of educational means and technology. The private group in social media will be created for this study. When you create your account in social media, you have right to use pseudonym name rather than your real name. Your identity will be anonymised for the purposes of reporting the result. I will use your contribution as well as pre-service teachers' contribution regarding the extent to which using social media in education can help to improve learning process. After the online learning activities, the interview will be conducted. If you are willing to do the interview, you will ask to sign a consent form for your participation in the interview. In the interview, you will be asked about your perceptions of the use of social media for learning process and how to support pre-service teachers. There are no right or wrong answers. If you do not mind, the interview will be audio recorded to be analysed later with your permission.

26 August 2017 Version 2

UNIVERSITY OF Southampton

Are there any benefits in my taking part?

Your participation in this research is highly valued and I believe it can make a significant contribution to research on using technology such as social media in learning.

Are there any risks involved?

The project is relatively free of risks. The online activities will be conducted in private group and only with selected pre-service teachers and another practitioner. The topic of the online activities will focus on the use of technology in your future teaching. The topic is not of a sensitive nature, therefore it is also unlikely to cause you any stress. Also, the questions that are posed to you during the interviews and through the questionnaire will not contain any sensitive questions.

Will my participation be confidential?

All information and data collected during the research will be strictly confidential. The research will be aligned with the Data Protection Act and University of Southampton policy. Your data will be kept on a password protected University computer until the researcher's graduation, after which it will be deleted. In any report, the researcher will describe the results anonymously. When reporting the results, your real name will not be used and a pseudonym will be used to hide your identity.

What happens if I change my mind?

You have full rights to withdraw and your data and your participation from the study until 30 November 2018 without any disadvantage where the researcher begins her study's writing up stage. If you choose to withdraw your data from the study before 30 November 2018, data relating to all your responses will be destroyed and will not be used in the research.

What happens if something goes wrong?
If you have any concerns about the research please contact. Head of Research Governance, University of Southampton, rgoinfo@soton.ac.uk +44 (0) 2380 595058

Where can I get more information?
If you would like more information about this project including on how the data you provide will be used, please contact:

Researcher
Enas Alwafi, Southampton Education School, University of Southampton. Email:
emfa1d15@soton.ac.uk
Phone: +447462427486

Or you can contact with my supervisor
Dr Chris Downey, Southampton Education School, University of Southampton
Email: c.j.downey@soton.ac.uk
Phone: (023) 8059 3707

26 August 2017 Version 2

Arabic Version

UNIVERSITY OF Southampton

صفحة معلومات المشاركين الممارسين

عنوان الدراسة: دور المجتمع عبر الإنترنت في دعم التعلم المهني للمعلمين قبل الخدمة ومشاركتهم في وسائل التواصل الاجتماعي.

الباحث: ايناس الوافي رقم الأخلاقيات30249 :

يرجى قراءة هذه المعلومات بعناية قبل اتخاذ قرار بالمشاركة في هذا البحث. إذا كنت سعيدًا بالمشاركة ، فسيُطلب منك التوقيع على نموذج الموافقة.

ما هو هذا البحث

أنا طالبة دكتوراه في جامعة ساوثامبتون في المملكة المتحدة. هذا المشروع البحثي هو جزء من درجة الدكتوراه. يركز هذا المشروع على دور مجتمع التعلم عبر الإنترنت في تعزيز عملية التعلم. نظرًا لأنك تعتبر من ذوي الخبرة في استخدام التكنولوجيا في التعليم ، يمكنك استخدام هذه المنصة عبر الإنترنت لتقديم ملاحظات إلى معلمات ما قبل الخدمة. كباحث ، أنا مهتم بالتحقيق في قيمة التفاعل عبر الإنترنت في وسائل التواصل الاجتماعي لدعم الدراسة والتعلم.

لماذا تم اختياري؟
لقد تم اختيارك لأن لديك خبرة في التكنولوجيا ويمكنك تقديم ملاحظات إلى معلمات ما قبل الخدمة فيما يتعلق باستخدام التكنولوجيا في التدريس في المستقبل. أيضا ، يمكنك إعطاء الباحثة نظرة ثاقبة على عملية التعلم والتبادل الذي يحدث في وسائل التواصل الاجتماعية.

ماذا سيحدث لي إذا شاركت؟

هناك مرحلتان لمشاركتك. في المرحلة الأولى ، ستدعى الى دورة تدريبية مع مدرسات لديهم أيضًا خبرة في التكنولوجيا. ستوفر لك هذه الدورة التدريبية معلومات تتعلق بالطريقة المفيدة لتعزيز مشاركة المعلمات ما قبل الخدمة في تعلمهم. سوف تستغرق الدورة التدريبية حوالي أسبوعين. سيتم إجراء الدورة التدريبية في وسائل التواصل الاجتماعي. سيتم إنشاء مجموعة خاصة في وسائل التواصل الاجتماعي لهذه الدراسة. عندما تنشئ حسابك في وسائل التواصل الاجتماعي ، يحق لك استخدام اسم مستعار بدلاً من اسمك الحقيقي. في الأسبوع الأول ، سيكون لديك جلسات عبر الإنترنت تركز على كيفية مساعدة معلمات ما قبل الخدمة في الانخراط في عملية التعلم. سيركز الأسبوع الثاني على الجزء العملي. في هذا الجزء سوف تطبق ما تعلمته في هذه الدورة.

في المرحلة الثانية ، ستتم دعوتك مع المهنيين و معلمات ما قبل الخدمة لاستخدام وسائل التواصل الاجتماعي المختارة (فيس بوك) لدعم تعلم المعلمين قبل الخدمة ودراسة وحدة الوسائل التعليمية والتقنية. سيتم إنشاء مجموعة خاصة في وسائل التواصل الاجتماعي لهذه الدراسة. عندما تنشئ حسابك في وسائل التواصل الاجتماعي ، يحق لك استخدام اسم مستعار بدلاً من اسمك الحقيقي. سيتم إخفاء هويتك لغرض إعلان عن النتيجة. سأستخدم مساهمتك بالإضافة إلى مساهمة معلمات قبل الخدمة فيما يتعلق بمدى استخدام وسائل التواصل الاجتماعي في التعليم والذي يمكن أن يساعد في تحسين عملية التعلم. بعد أنشطة التعلم عبر الإنترنت ، سيتم إجراء المقابلة. إذا كنت على استعداد لإجراء المقابلة ، فسوف يطلب منك التوقيع على نموذج الموافقة لمشاركتك في المقابلة. في المقابلة ، سيتم سؤالك عن تصوراتك حول استخدام وسائل التواصل الاجتماعية في عملية التعلم وكيفية دعم معلمات ما قبل الخدمة. لا توجد إجابات صحيحة أو خاطئة. إذا كنت لا تمانع ، فسيتم تسجيل المقابلة الصوتية ليتم تحليلها في وقت لاحق بإذن منك.

هل هناك أي فوائد في مشاركتي؟

إن مشاركتك في هذا البحث تحظى بتقدير كبير وأعتقد أنها يمكن أن تقدم مساهمة كبيرة في البحث عن استخدام التكنولوجيا مثل وسائل التواصل الاجتماعي في التعلم.

هل هناك أي مخاطر التي تنطوي عليها؟

المشروع خالي نسبياً من المخاطر. سيتم إجراء الأنشطة عبر الإنترنت في مجموعة خاصة وفقط مع معلمات ما قبل الخدمة و معلمة اثناء الخدمة. سيركز موضوع الأنشطة عبر الإنترنت على استخدام التكنولوجيا في تدريسك في المستقبل. الموضوع ليس ذا طبيعة حساسة ،

2 الإصدار 2017 أغسطس 26

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لذلك من غير المرجح أن يسبب لك أي ضغوط. أيضًا ، لن تحتوي الأسئلة التي سيتم طرحها عليك خلال المقابلات ومن خلال الاستبيان على أي أسئلة حساسة.

هل ستكون مشاركتي سرية؟

ستكون جميع المعلومات والبيانات التي تم جمعها خلال البحث سرية للغاية. البحث يتماشى مع قانون حماية البيانات وسياسة جامعة ساوثهامبتون. سيتم الاحتفاظ ببياناتك على كمبيوتر الجامعة و هو محمي بكلمة مرور حتى تخرج الباحث ، وبعد ذلك سيتم حذفها. في أي تقرير ، سوف يصف الباحث النتائج بشكل مجهول. عند الإبلاغ عن النتائج ، لن يتم استخدام اسمك الحقيقي وسيتم استخدام اسم مستعار لإخفاء هويتك.

ماذا يحدث إذا غيرت رأيي؟

لديك الحق الكامل في الانسحاب وسحب بياناتك ومشاركتك من الدراسة حتى 30 نوفمبر 2018 دون أي مشاكل , حيث تبدأ الباحثة مرحلة كتابة دراستها. إذا اخترت سحب بياناتك من الدراسة قبل 30 نوفمبر 2018 ، فسيتم إتلاف البيانات المتعلقة بجميع إجاباتك ولن يتم استخدامها في البحث.

ماذا يحدث إذا حدث خطأ ما؟
إذا كان لديك أي مخاوف بشأن البحث يرجى الاتصال. رئيس حوكمة الأبحاث ، جامعة ساوثهامبتون ، rgoinfo@soton.ac.uk +44 (0) 2380 595058

أين يمكنني الحصول على مزيد من المعلومات؟
إذا كنت ترغب في مزيد من المعلومات حول هذا المشروع بما في ذلك كيفية استخدام البيانات التي تقدمها ، فيرجى الاتصال بـ:

الباحثة
إيناس الوافي ، كلية التربية، جامعة ساوثامبتون. البريد الإلكتروني: emfa1d15@soton.ac.uk
الهاتف: +447462427486

أو يمكنك الاتصال مع لمشرفي
الدكتور كريس داوني ، كلية التربية ، جامعة ساوثهامبتون
البريد الإلكتروني: cjdowney@soton.ac.uk
الهاتف: 02380593707

B.4 Consent form for the interview

English Version

UNIVERSITY OF Southampton

Consent Form to participate in interview

Study title: The role of online learning community in supporting pre-service teachers' learning and engagement in social media

Researcher name: Enas Alwafi **Ethics reference**: **25139**

Please initial the box(es) if you agree with the statement(s):

I have read and understood the information sheet (1st February 2017, version 1) and have had the opportunity to ask questions about the study. ☐

I agree to take part in this research project and agree for my data to be recorded and used for the purpose of this study ☐

I understand that my responses will be anonymised in reports of the research ☐

I understand my participation is voluntary and I can withdraw from participation in the research at any time and without my legal rights being affected. I have full rights to withdraw my data until 30 November 2018 where the researcher begins her study's writing up stage. ☐

I agree to the audio recording of the interview ☐

Data Protection

I understand that information collected about me during my participation in this study will be stored on a password protected computer and that this information will only be used for the purpose of this study.

Name of participant (print name).....

Signature of participant.....

Date.....

Appendix B

Arabic Version

UNIVERSITY OF Southampton
School of Social Sciences

نموذج الموافقة على المشاركة في المقابلة

عنوان الدراسة: دور مجتمع التعلم عبر الإنترنت في دعم تعلم المعلمين قبل الخدمة "والمشاركة في وسائل التواصل الاجتماعي

اسم الباحثة: إيناس الوافي رقم ملف الأخلاقيات**25139** :

أرجو وضع علامة صح أمام كل مربع (الخانات) إذا كنت تتفق مع الجملة:

لقد قرأت وفهمت ورقة المعلومات (1 فبراير 2017 ، الإصدار 1) و أتيحت لي الفرصة لطرح أسئلة حول الدراسة.	
أوافق على المشاركة في هذا المشروع البحثي وأوافق على تسجيل بياناتي واستخدامها لغرض هذه الدراسة	
أدرك أن استجابات ستكون مجهولة الهوية في تقارير البحث	
أدرك أن مشاركتي تطوعية و يمكنني الانسحاب من المشاركة في البحث في أي وقت ودون أن تتأثر حقوقي القانونية. لدي الحقوق الكاملة لسحب بياناتي حتى 30 نوفمبر 2018 حيث تبدأ الباحثة مرحلة كتابة دراستها.	
أوافق على التسجيل الصوتي للمقابلة	
حماية البيانات :أفهم أن المعلومات التي يتم جمعها عني أثناء مشاركتي في هذه الدراسة سيتم تخزينها على جهاز كمبيوتر محمي بكلمة مرور وأن هذه المعلومات سوف تستخدم فقط لغرض هذه الدراسة.	

اسم المشاركة: .....

توقيع المشاركة : .....

التاريخ .....

1- فبراير - 2017 الإصدار 1

B.5 Consent form for participation in an online learning activity

English Version

UNIVERSITY OF Southampton

Consent Form to participate in online activities

Study title: The role of online learning in supporting pre-service teachers' learning and engagement in social media

Researcher name: Enas Alwafi **Ethics reference**: 25139

Please initial the box (es) if you agree with the statement(s):

I have read and understood the information sheet (1st February 2017, version 1) and have had the opportunity to ask questions about the study. ☐

I agree to take part in this research project and agree for my data to be recorded and used for the purpose of this study ☐

I understand that my responses will be anonymised in reports of the research ☐

I understand my participation is voluntary and I can withdraw from participation in the research at any time and without my legal rights being affected. I have full rights to withdraw my data until 30 November 2018 where the researcher begins her study's writing up stage. ☐

Data Protection

I understand that information collected about me during my participation in this study will be stored on a password protected computer and that this information will only be used for the purpose of this study.

Name of participant (print name).....

Signature of participant.....

Date.....

Arabic version

UNIVERSITY OF Southampton
School of Social Sciences

نموذج الموافقة على المشاركة في الأنشطة عبر الإنترنت

عنوان الدراسة:دور التعلم عبر الإنترنت في دعم تعلم المعلمين قبل الخدمة "والمشاركة في وسائل التواصل الاجتماعي

اسم الباحثة:إيناس الوافي رقم ملف الأخلاقيات25139 :

أرجو وضع علامة صح أمام كل مربع (الخانات) إذا كنت تتفق مع الجملة

لقد قرأت وفهمت ورقة المعلومات (1 فبراير 2017، الإصدار 1)، و أتيحت لى الفرصة لطرح الأسئلة حول الدراسة.	
أوافق على المشاركة في هذا المشروع البحثي وأوافق على تسجيل بياناتي واستخدامها في هذه الدراسة	
أدرك أن إجاباتي ستكون مجهولة الهوية في تقارير البحث	
أدرك أن مشاركتي تطوعية و يمكنني الانسحاب من المشاركة في البحث في أي وقت ودون أن تتأثر حقوقي القانونية. لديّ الحقوق الكاملة لسحب بياناتي حتى 30 نوفمبر 2018 حيث تبدأ الباحثة مرحلة كتابة دراستها.	
حماية البيانات أفهم أن المعلومات التي يتم جمعها عني أثناء مشاركتي في هذه الدراسة سيتم تخزينها على جهاز كمبيوتر محمي بكلمة مرور وأن هذه المعلومات سيتم استخدامها فقط لغرض هذه الدراسة.	

اسم المشارك: .....

توقيع المشارك : .....

التاريخ .....

Appendix C Questionnaire

C.1 English Version

A) Demographic Information:

Name:…….

Department:……..

Email:…….

B) Technological Pedagogical Content Knowledge:

Please read the following statement and tick (√) to the answer which best describe your status.

SD = strongly disagree D = disagree N = neither agree or disagree A = agree SA = strongly agree

		SA	A	N	D	SD
Content knowledge	I have sufficient knowledge about my teaching subject.					
	I can think about the content of my teaching subject like a subject matter expert.					
	I am able to gain deeper understanding about the content of my teaching subject on my own.					
	I am confident to teach the subject matter.					
Pedagogical Knowledge	I am able to stretch my students' thinking by creating challenging tasks for them.					
	I am able to guide my students to adopt appropriate learning strategies.					
	I am able to help my students to monitor their own learning.					

	I am able to help my students to reflect on their learning strategies.					
	I am able to guide my students to discuss effectively during group work.					
Technological Knowledge	I have the technical skills to use computers effectively					
	I can learn technology easily					
	I know how to solve my own technical problems when using technology.					
	I keep up with important new technologies					
Pedagogical Content Knowledge	Without using technology, I can help my students to understand the content knowledge of my teaching subject through various ways.					
	Without using technology, I can address the common learning difficulties my students have for my teaching subject.					
	Without using technology, I can facilitate meaningful discussion about the content students are learning in my teaching subject.					
	Without using technology, I can engage students in solving real world problem related to my teaching subject					
	Without using technology, I can support students to manage their learning of content for my teaching subject					
Technological Content Knowledge	I can use the software that are created specifically for my teaching subject					
	I know about the technologies that I have to use for the research of content of my teaching subject					

	I can use appropriate technologies (e.g., multimedia resources, simulation) to represent the content of my teaching subject					
	I can use specialized software to perform inquiry about my teaching subject.					
Technological Pedagogical Knowledge	I am able to use technology to introduce my students to real world scenarios.					
	I am able to facilitate my students to use technology to plan and monitor their own learning.					
	I am able to facilitate my students to use technology to construct different forms of knowledge representation.					
	I am able to facilitate my students to collaborate with each other using technology.					
Technological Pedagogical Content Knowledge	I can structure activities to help students to construct different representations of the content knowledge using appropriate ICT tools					
	I can create self-directed learning activities of the content knowledge with appropriate ICT tools					
	I can design inquiry activities to guide students to make sense of the content knowledge with appropriate ICT tools					
	I can formulate in-depth discussion topics about the content knowledge and facilitate students' online collaboration with appropriate tools					
	I can design lessons that appropriately integrate content, technology and pedagogy for student-centred learning					

C.2 Arabic Version

أ) المعلومات الديموغرافية:

الاسم: .....

القسم: .....

البريد الإلكتروني: ....

ب) معرفة المحتوى التربوي التكنولوجي:

يرجى قراءة البيان التالي ووضع علامة (√) على الإجابة التي تصف حالتك .

		أوافق بشدة	أوافق	لا اعلم	لا أوافق	لا أوافق بشدة
المعرفة بالمحتوى	لدي معرفة كافية حول موضوع التدريس الخاص بي.					
	يمكنني التفكير في محتوى موضوع التدريس الخاص بي كخبير في الموضوع.					
	أنا قادرة على اكتساب فهم أعمق لمحتوى موضوع التدريس الخاص بي بمفردي.					
	أنا واثقة من تدريس الموضوع.					
المعرفة التربوية	أنا قادرة على توسيع تفكير طالباتي من خلال إنشاء مهام صعبة لهم.					
	أنا قادرة على توجيه طالباتي لتبني استراتيجيات التعلم المناسبة.					
	أنا قادرة على مساعدة طالباتي على مراقبة تعلمهم.					
	أنا قادرة على مساعدة طالباتي للتفكير في استراتيجيات التعلم الخاصة بهم.					
	أنا قادرة على توجيه طالباتي للمناقشة الفعالة خلال العمل الجماعي.					
المعرفة التكنولوجية	لدي المهارات التقنية لاستخدام أجهزة الكمبيوتر بفعالية					
	يمكنني تعلم التكنولوجيا بسهولة					
	أنا أعلم كيفية حل مشاكلي التقنية عند استخدام التكنولوجيا.					
	أنا مواكبة مع التقنيات الجديدة الهامة					
معرفة المحتوى التربوي	بدون استخدام التكنولوجيا ، يمكنني مساعدة طالباتي على فهم معرفة محتوى الموضوع الذي أقوم بتدريسه من خلال طرق مختلفة.					
	بدون استخدام التكنولوجيا ، يمكنني معالجة صعوبات التعلم الشائعة التي يواجهها طالباتي في مادة التي أقوم بتدريسها.					
	بدون استخدام التكنولوجيا ، يمكنني تسهيل مناقشة هادفة حول المحتوى الذي يتعلمه الطالبات في مادة التي أقوم بتدريسها.					
	بدون استخدام التكنولوجيا ، يمكنني إشراك الطالبات في حل مشكلة من العالم الحقيقي متعلقة بالموضوع الذي أقوم بتدريسه					
	دون استخدام التكنولوجيا ، يمكنني دعم الطالبات لإدارة تعلمهم للمحتوى الخاص بالموضوع الذي أقوم بتدريسه.					
المعرفة بالمحتوى التكنولوجي.	يمكنني استخدام البرنامج الذي تم إنشاؤه خصيصًا لموضوع التدريس الذي أقوم بتدريسه					
	أعرف عن التقنيات التي يجب على استخدامها للبحث في محتوى الموضوع الذي أقوم بتدريسه					
	يمكنني استخدام التقنيات المناسبة (على سبيل المثال ، موارد الوسائط المتعددة ، والمحاكاة) لتمثيل محتوى الموضوع الذي أقوم بتدريسه					
	يمكنني استخدام برنامج متخصص لإجراء استفسار عن الموضوع الذي أقوم بتدريسه					

المعرفة التربوية التكنولوجية	إنني قادرة على استخدام التكنولوجيا لتعريف طالباتي على سيناريوهات العالم الحقيقي.					
	أنا قادرة على التسهيل لطالباتي لاستخدام التكنولوجيا لتخطيط ومراقبة التعلم الخاص بهم.					
	أنا قادرة على التسهيل ل طالباتي لاستخدام التكنولوجيا لبناء أشكال مختلفة من تمثيل المعرفة.					
	أنا قادرة على التسهيل لطالباتي للتعاون مع بعضهم البعض باستخدام التكنولوجيا.					
المعرفة التكنولوجية التربوية للمحتوى:	يمكنني هيكلة الأنشطة لمساعدة الطالبات على إنشاء تمثيلات مختلفة لمعرفة المحتوى باستخدام أدوات تكنولوجيا المعلومات والاتصالات المناسبة.					
	يمكنني إنشاء أنشطة تعليمية موجهة ذاتيًا لمعرفة المحتوى باستخدام أدوات تكنولوجيا المعلومات والاتصالات المناسبة					
	يمكنني تصميم أنشطة الاستقصاء لتوجيه الطالبات لفهم معرفة المحتوى باستخدام أدوات تكنولوجيا المعلومات والاتصالات المناسبة					
	يمكنني صياغة موضوعات لمناقشة متعمقة حول معرفة المحتوى وتسهيل تعاون الطالبات عبر الإنترنت مع الأدوات المناسبة					
	يمكنني تصميم الدروس التي تدمج بشكل مناسب المحتوى والتكنولوجيا والتربية في التعليم المتمركز حول الطالبة					

Appendix D Interview questions (Phase 1)

D.1 English version

Pre-service teachers' interview

1. How do you evaluate the development of your understanding regarding the use of technology in teaching and learning after your participation in an online PLC?
2. What role did the online PLC play in supporting your development and understanding in terms of the integration of technology?
3. How did the online PLC affect your awareness concerning your understanding of the use of technology in practice?
4. Can you explain what you discussed in the online PLC when it comes to issues relating to technology integration?
5. How did the practitioners affect the development of your understanding regarding the integration of technology? (only experimental group)
6. What was the role that practitioners play to enhance your understanding regarding technology integration? (only experimental group)
7. How do you evaluate your contribution to the online PLC in terms of supporting others' awareness and development regarding the use of technology in teaching and learning?
8. How do you evaluate your peers' contribution to the online PLC in terms of supporting your and others' awareness and development regarding the use of technology in teaching and learning?
9. How do you evaluate practitioners' contribution to the online PLC in terms of supporting your and others' awareness and development regarding the use of technology in teaching and learning? (only experimental group)
10. Do you have any recommendations or suggestions on how to improve the learning experience in terms of technology integration?

Practitioners' interview

1. How do you evaluate the development of the pre-service teachers understanding regarding the use of technology in teaching and learning throughout their participation in the online PLC?
2. How do you think the discussion in the online PLC supported pre-service teachers' understanding of technology integration?
3. What was your role in supporting the pre-service teachers' learning about technology integration?
4. How do you evaluate the pre-service teachers' contribution to the online PLC in terms of supporting their awareness of and development in the use of technology in teaching and learning?

5. Do you have any recommendations or suggestions on how to improve pre-service teachers' learning experience when it comes to technology integration?

D.2 Arabic version

مقابلة معلمات ما قبل الخدمة

- كيف تقيمين تطور فهمك فيما يتعلق باستخدام التكنولوجيا في التدريس والتعلم بعد مشاركتك في مجتمع التعلم المهني عبر الإنترنت؟
- ما هو الدور الذي لعبته مجتمع التعلم المهني عبر الإنترنت في دعم تطورك وفهمك من حيث دمج التكنولوجيا؟
- كيف أثرت مجتمع التعلم المهني عبر الإنترنت على إدراكك لفهمك لاستخدام التكنولوجيا في التدريس؟
- هل يمكنك شرح المواضيع التي تمت مناقشتها في مجتمع التعلم المهني عبر الإنترنت عندما يتعلق الأمر بالقضايا المتعلقة بدمج التكنولوجيا ؟
- كيف أثرت الممارسات على تطوير فهمك فيما يتعلق بدمج التكنولوجيا؟ (المجموعة التجريبية فقط)
- ما هو الدور الذي لعبته الممارسات لتعزيز فهمك فيما يتعلق بالدمج التكنولوجي؟ (المجموعة التجريبية فقط)
- كيف تقيمين مساهمتك في مجتمعات التعلم المهني عبر الإنترنت من حيث دعم وعي الآخرين وتطويرهم فيما يتعلق باستخدام التكنولوجيا في التعليم والتعلم؟
- كيف تقيم مساهمة زميلاتك في مجتمع التعلم المهني عبر الإنترنت من حيث دعم وعي الآخرين وتطورهم فيما يتعلق باستخدام التكنولوجيا في التعليم والتعلم؟
- كيف يمكنك تقييم مساهمة الممارسات في مجتمع التعلم المهني عبر الإنترنت من حيث دعم وعي وتنمية الآخرين فيما يتعلق باستخدام التكنولوجيا في التعليم والتعلم؟ (المجموعة التجريبية فقط)
- هل لديك أي توصيات أو اقتراحات حول كيفية تحسين تجربة التعلم من حيث دمج التكنولوجيا؟

مقابلة المهنيات

- كيف تقيمين تطور فهم معلمات ما قبل الخدمة فيما يتعلق باستخدام التكنولوجيا في التدريس والتعلم من خلال مشاركتهم في مجتمع التعلم المهني عبر الإنترنت؟
- كيف تعتقد أن المناقشة في مجتمعات التعلم المهني عبر الإنترنت تدعم فهم المعلمين قبل الخدمة لدمج التكنولوجيا ؟
- ما هو دورك في دعم تعلم معلمات ما قبل الخدمة حول دمج التكنولوجيا؟
- كيف تقيمون مساهمة معلمات ما قبل الخدمة في مجتمع التعلم المهني عبر الإنترنت من حيث دعم وعيهم وتطويرهم في استخدام التكنولوجيا في التعليم والتعلم؟
- هل لديك أي توصيات أو اقتراحات حول كيفية تحسين تجربة تعلم معلمات ما قبل الخدمة عندما يتعلق الأمر بدمج التكنولوجيا ؟

Appendix E Interview questions (Phase 2)

E.1 English Version

Interview questions for pre-service teachers

1. How did you find the experience of participating in this online PLC?
2. How did you find the experience of the presence of the practitioners in this online learning community? (For experimental group only)
3. What has that experience been like for you?
4. How did each person play a role in contributing to the sustainment of learning in this community?
    a. You b. Other pre-service teachers c. Practitioners (For experimental group only)
5. How did the practitioners impact this community (online learning group)?
6. What did you gain from the *experience* of participating in this online PLC?
7. What did you gain from the *experience* of the practitioners' presence as a pre-service teacher? (For experimental group only)
    a. On a personal level?
    b. On a professional level?
8. Can working with practitioners like this provide you with any benefits or satisfaction? (For experimental group only)
9. How would you describe your participation in the online activities (actively participated, sometimes participated, reluctant to participate, or observer)?
10. What was your role?
11. What did you think about your level of interaction with other pre-service teachers during the online activities?
12. What did you think about your level of interaction with other pre-service teachers from your department during the online activities?
13. What did you think about your level of interaction with other pre-service teachers from outside your department during the online activities?
14. How did the engagement of practitioners affect your interaction with the online learning community? (For experimental group only)
15. How did you find the level of discussion in the online PLC?
16. How did the practitioners contribute to the discussion? (For experimental group only)
17. How did your peers contribute to the discussion?

18. How did the practitioners contribute to your learning? Can you give me an example? (For experimental group only)
19. What did the professionals do to increase your interest in what they had to say? (For experimental group only)
20. Do you think the practitioners played a part in enhancing your learning and knowledge development? (For experimental group only)
    a. If yes, what method did the practitioners use that helped to improve your activity?
    b. What method did you find best for improving your knowledge development?
21. Who do you think helped you improve your knowledge development process the most: the practitioners, your peers, or other resources?
    a. Please provide an example of the type of support they provided
22. Do you have any recommendations regarding how learning in online PLC could be enhanced?
23. Do you have any recommendations for how to enhance the experience of the participation of practitioners in pre-service teachers' community in the future? (For experimental group only)
24. Do you have any comments or suggestions? Feel free to list them.

Interview questions for practitioners

1. Please describe your experience of participating in the online activity.
2. How do you feel about the level of discussion and interaction among pre-service teachers?
3. What do you feel you brought to the pre-service teachers' learning?
4. What was your role in engaging pre-service teachers in the discussion?
5. Describe your role in facilitating interaction during the online PLC?
6. How did you feel about the collaboration among pre-service teachers during this online PLC?
7. How did you feel about the collaboration among pre-service teachers from outside the department?
8. Did you play a role in facilitating interaction among the pre-service teachers from outside the department?
    a. If yes, please explain further; if no, what hindered your facilitation of this interaction?
9. What are the main advantages that you took from the experience?

10. Can you provide any recommendations on how to enhance this experience in the future?

E.2 Arabic Version

أسئلة المقابلة لمعلمات ما قبل الخدمة

1. كيف وجدت تجربة المشاركة في هذا البرنامج التعليمي عبر الإنترنت؟
2. كيف وجدت تجربة وجود الممارسات في مجتمع التعلم عبر الإنترنت هذا؟ (للمجموعة التجريبية فقط)
3. كيف كانت هذه التجربة بالنسبة لك؟
4. كيف لعب كل شخص دورًا في المساهمة في استدامة التعلم في هذا المجتمع؟
   أ.أنت ب. مدرسات ما قبل الخدمة ج. الممارسات (للمجموعة التجريبية فقط)
5. كيف أثر الممارسات على هذا المجتمع (مجموعة التعلم عبر الإنترنت)؟
6. ماذا اكتسبت من التجربة من المشاركات في هذه المجموعة على الانترنت؟
7. ماذا اكتسبت من التجربة عن وجود الممارسات كمدرسة قبل الخدمة؟ (للمجموعة التجريبية فقط)
   a. على المستوى الشخصي؟
   b. على المستوى المهني؟
8. كيف يمكن لهذا النوع من العمل مع المهنيين أن يوفر لك أي فوائد أو رضا؟ (للمجموعة التجريبية فقط)
9. كيف تصف مشاركتك في الأنشطة عبر الإنترنت؟ (شارك بنشاط ، شارك في بعض الأحيان ، أحجم عن المشاركة أو مراقب)
10. ماذا كان دورك؟
11. ما رأيك في مستوى تفاعلك في الأنشطة عبر الإنترنت مع معلمات ما قبل الخدمة؟
12. ما رأيك بمستوى تفاعلك في الأنشطة عبر الإنترنت مع معلمات ما قبل الخدمة من قسمك؟
13. ما رأيك في مستوى تفاعلك في الأنشطة عبر الإنترنت مع معلمات ما قبل الخدمة من خارج إدارتك؟
14. كيف تؤثر مشاركة الممارسين في تفاعلك في مجتمع التعلم عبر الإنترنت؟ (للمجموعة التجريبية فقط)
15. كيف وجدت مستوى المناقشة في مجتمع التعلم عبر الإنترنت ؟
16. كيف ساهم المهنيات في المناقشة؟ (للمجموعة التجريبية فقط)
17. كيف ساهم زملائك في المناقشة؟
18. كيف ساهم المهنيات في تعلمك؟ هل تستطيع أن تعطيني مثالا؟ (للمجموعة التجريبية فقط)
19. ما الذي فعله المهنيات لزيادة اهتمامك بما قالته؟ (للمجموعة التجريبية فقط)
20. هل تعتقد أن المهنيات لعبوا دورًا في تحسين التعلم وتطوير المعرفة؟
   a. إذا كانت الإجابة بنعم ، ما الطريقة التي استخدمها المهنيات للمساعدة في تحسين نشاطك
   b. ما هي الطريقة التي تجد أفضل ما يمكن أن تلعبه في تحسين تطوير معرفتك؟
21. من برأيك ، ساعدك أكثر شيئ في تحسين عملية تطوير المعرفة الخاصة بك (المهنيات ، الأقران ، أو غيرها من الموارد؟ من
   a. فضلك ، هل يمكن أن تقدم مثالاً على نوع الدعم الذي قدموه.
22. هل لديك أي توصية لتعزيز التعلم في مجتمع التعلم عبر الإنترنت ؟
23. هل لديك أي توصية لتعزيز تجربة مشاركة الممارسات مع مجتمع المعلمات قبل الخدمة في المستقبل؟ (للمجموعة التجريبية فقط)
24. هل لديك أي تعليقات أو اقتراحات؟ لا تتردد في سرد

أسئلة المقابلة للممارسين

1. وصف تجربتك على المشاركة في النشاط عبر الإنترنت؟
2. ما هو شعورك حيال مستوى المناقشة والتفاعل بين معلمات ما قبل الخدمة؟
3. ما هو شعورك أنك جلبت إلى والتفاعل بين معلمات ما قبل الخدمة ؟
4. ماما هو دورك في إثراك معلمات ما قبل الخدمة في المناقشة ؟
5. وصف لك دور في تسهيل التفاعل في مجتمع التعلم عبر الانترنت؟
6. كيف كان شعورك حول التعاون بين المعلمين قبل الخدمة في هذا في مجتمع التعلم عبر الانترنت
7. كيف تشعر حيال التعاون بين المعلمات ما قبل الخدمة مع الاقسام الاخرى؟
8. هل لعبت دورًا في تسهيل التفاعل بين معلمات ما قبل الخدمة من مع الاقسام الاخرى ؟
   a. إذا كانت الإجابة بنعم، رجاء التوضيح. إذا كنت لا ، ما هي الأسباب التي تعيقك لتسهيل التفاعل
9. ما هي المزايا الرئيسية التي تأخذها من التجربة؟
10. هل يمكنك تقديم أي توصيات لتعزيز هذه التجربة في المستقبل؟

Appendix F Coding Schema and Example

Cognitive presence coding schema adapted from Garrison et al. (2001) based examples from this current study

Category	Description	Indictors	Example
Trigger	Messages involving some sort of identification of the problem, such as asking a question or messages that take discussion in a new direction.	Asking questions Messages that take discussion in a new direction	To be honest, the project-based learning can be used with collaborative learning by using social network tools. How do you think we can effectively apply these tools with project-based learning? I think the most issue that we should focus on is the process of decision-making by the teacher when she tries to incorporate the iPad in the classroom.
Explanation	Messages on sharing information such as providing opinions, exchanging experience without defending, justifying or developing additional ideas. Also, messages involving unsupported ideas or unconnecting messages.	Opinion Experience	From my opinion, I think using many images and sounds in the presentation may not help students to focus on the content. I think from my experience, when I was student in the secondary schools, I really liked how to work collaboratively in our assignments in biology using Moodle. I think good ideas using online tools for collaboration.

		Share information Brainstorming	Try to see this website (URL provided). I think it may be helpful for you. Many types of activities that teachers do can use clicker (classroom response system). Teachers can use at the beginning of class in order to collect students' response about what they think about the topic or at the end of the class to examine students' understanding.
Exploration	Connecting ideas with previous messages. For example, messages point out to previous contributions followed by agreements or justification. Messages provide solution for specific problem.	Agreement with developing ideas and provide justification Disagreement with creating solution	I definitely agree with S1's (pre-service teacher name) comment about the importance of the teachers in providing scaffolding for the first time of using technology in the classroom, because the students may have different ICT skills and teachers should be aware of these issues before they start using it with students. The article of Dr Alamr clarifies this point clearly. She found that the students may not use technology effectively, because they did not have support from teachers. Hi E4 (pre-service teacher name), I may not completely agree with you that the teachers cannot mentor students' progress in the online activity. There are a number of tools which enable teachers to observe

			the students, and teachers can post and edit some contributions, such as Edmodo. You can also ask students to write a report about their progress and also assess each other during online activity. Do not worry, there is a solution for everything, you will become a teacher☺.
Resolution	Messages involving some sort of testing and defending the solution or idea.	Tested solution Defended the solution	I think the solution for using animation and electronic story rather than image alone that proposed by E8 (pre-service teacher's name) is a perfect one for helping students to understand a concept such as the water cycle. I did this yesterday when I teach my little sisters and it was working well with her. She enjoyed and she described the water cycle for me after the end of video very well, with good language and fluency. I was impressed, actually. She told me I want to share this link with my teacher and peers. Hi, P1 (name of practitioner), I think I understand what you mean but my solution regarding using inquiry-based learning (IBL) with augmented reality application in science can help students to engage in their learning more than only using augmented reality without incorporating it with any pedagogical

			strategy. There are two reasons that make me confident about using these tools with my students in future. First, both augmented reality digital tool and IBL can increase students' interest in science. According to Dr Hamd, he conducted a study to investigate the impact of IBL on students' learning and he found that the IBL played a role in increasing students' curiosity about the science concept. Second, IBL not only develops students' knowledge but also students' skills. For example, Dr Majed conducted experiments on science students to find the impact of IBL on students' achievement in critical thinking and found that students increase their grade, collaboration and problem-solving skills. So, the technology itself cannot help students to improve their skills in science without focusing on other aspects, such as pedagogical strategy.

Appendix G Post-hoc Tests

This Appendix presents the Post-hoc tests of the variables that show significant difference through the time in Section 6.4.1, 6.4.3 and 6.4.4.

Table G-1 Pairwise comparison of cognitive message

Group	Category	Time		Mean Differences	Sig
Experimental Group	Explanation	1	2	-0.92	.002*
		2	3	-1.21	.000*
		1	3	-2.13	.000*
	Exploration	1	2	-2.66	.000*
		2	3	-2.95	.000*
		1	3	-5.60	.000*
	Resolution	1	2	-0.97	.000*
		2	3	-1.08	.000*
		1	3	-2.05	.000*
	Total	1	2	-4.87	.000*
		2	3	-5.24	.000*
		1	3	-10.11	.000*
Control Group	Explanation	1	2	-0.79	0.000*
		2	3	-0.44	0.04
		1	3	-1.23	0.000*
	Total	1	2	-1.29	.000*
		2	3	-1.05	.000*
		1	3	-2.34	.000*

* p< 0.003

Table G-2: Pairwise comparison of network size

		Time		Mean Differences	Sig
Experimental Group	**Knowledge Sharing**	1	2	-2.73	.000*
		2	3	-2.13	.000*
		1	3	-4.86	.000*
	Knowledge Building	1	2	-5.55	.000*
		2	3	-5.81	.000*
		1	3	-11.36	.000*
Control Group	**Knowledge Sharing**	1	2	-2.05	0.000*
		2	3	-0.10	1.00
		1	3	-2.15	0.000*

* p< 0.003

Appendix G

Table G-3 Pairwise comparison for internal, external and E-I index for knowledge sharing network

		Time		Mean Differences	Sig
Experimental Group	**External**	1	2	-1.76	0.000*
		2	3	-2.36	0.000*
		1	3	-4.13	0.000*
	E-I	1	2	-0.31	0.000*
		2	3	-0.25	0.000*
		1	3	-0.56	0.000*
Control Group	**Internal**	1	2	-2.73	0.000*
		2	3	0.26	1.00
		1	3	-2.47	0.000*
	E-I	1	2	0.25	0.000*
		2	3	0.10	0.11
		1	3	0.15	0.05

* p< 0.003

Table G-4: Pairwise comparison for internal, external and E-I index for knowledge building network

		Time		Mean Differences	Sig
Experimental Group	Internal	1	2	-3.07	0.000*
		2	3	-3.47	0.000*
		1	3	-6.55	0.000*
	External	1	2	-2.47	0.000*
		2	3	-2.34	0.000*
		1	3	-4.81	0.000*
	E-I	1	2	-0.35	0.000*
		2	3	-0.07	0.46
		1	3	-0.42	0.000*

* p< 0.003

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