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Preparedness to teach: The perceptions of Saudi female pre-service mathematics teachers

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Abstract

Being well prepared and experiencing a sense of preparedness for teaching is a key learning outcome of any initial teacher education (ITE) program. In order to understand more about the nature, development, and sufficiency of mathematics teacher readiness to teach, this study explores the phenomenon of preparedness. The aim of this study was to investigate how well Saudi pre-service teachers (PSTs) feel prepared to teach mathematics at secondary or middle schools (i.e. to explore their sense of preparedness to teach), delving into the nature and origins of that sense.

The participants in the study were a sample of female mathematics PSTs (N=105), who were near the end of their teaching methods course in the final year of their 4-year education degree. The construct of preparedness was operationalized through a survey of PSTs' efficacy to teach mathematics and an interview-based exploration of the factors influencing these perceptions. The data were collected over 4 months from 2015 to 2016. The quantitative data were analysed in SPSS and thematic analysis was used to analyse the qualitative data.

The key findings of this study indicated that for the PSTs, being prepared to teach means having teaching efficacy, good knowledge for teaching, a sense of preparedness, and professionalism. However, PSTs are not fully aware of all the kinds of knowledge needed for being prepared. The study showed that PSTs were generally confident that they were sufficiently prepared to teach. They felt most confident in the areas of content knowledge (CK) and pedagogical knowledge (PK) rather than pedagogical content knowledge (PCK). The findings showed that the PSTs felt inadequately prepared in some aspects of their teaching roles, and needed more support and guidance from their university-school communities. The majority felt that classroom and behaviour management was the aspect in which they felt least prepared. They also expressed only a moderate level of general teaching efficacy (GTE), expressing a lower sense of efficacy relating directly to supporting students as learners. These were related to the disjunction between theory and practice that resulted from the two most influential factors shaping PSTs' sense of preparedness and feelings of efficacy: the practicum experience and the ITE. Although these factors had positive impacts on their perceptions, they also expressed how the classroom environment, challenges, and school culture encountered during the practicum had lowered the PSTs' sense of preparedness and teaching efficacy. Indeed, half of

the PSTs felt that the school was neither sufficiently prepared nor sufficiently resourced to support PSTs learning the work of teaching. The challenge of closing the gap between theory and practice has led to PSTs' desire to have more time in the mathematics methods course, as well as extra time in the practicum.

It is hoped that the findings from this study concerning PSTs' current perceptions about preparedness, combined with the suggestions for improving their levels of preparedness, will contribute to improvements in ITE and teaching quality in Saudi Arabia.

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1. Introduction

1.1 Background context for the research

Being well prepared and experiencing a sense of preparedness for teaching are key learning outcomes of initial teacher education (ITE). We know that there is a positive connection between teachers' subject matter preparation and teacher/ing quality and student achievement in the classroom. There has been increasing agreement among educational researchers that teaching quality may be the most significant factor contributing to student academic achievement in schools (Darling-Hammond, 2000; Harris & McCaffrey, 2010; Hattie, 2012). For mathematics, the connection between the quality of preparation and the quality of the teaching has been affirmed by several studies (e.g., Goldhaber & Brewer, 2000; National Council for Accreditation of Teacher Education (NCATE), 2006; Wilson, Floden, & Ferrini-Mundy, 2001). In many countries, the emphasis on teacher quality and accountability related to student learning outcomes has prompted the restructuring of ITE (Evers & Walberg, 2002; Lim, 2011).

In 2007, Saudi Arabia took part in the Trend in International Mathematics and Science Studies (TIMSS) Y4 and Y8 survey for the first time. Saudi students in the eighth grade performed poorly in the area of mathematics. The score of 329 (2.9), being 152 points below the international average, was among the lowest in the study. Whilst this low level of achievement can be attributed to a range of socio-political factors, unsurprisingly, within Saudi Arabia this low standing fuelled a heated debate on educational issues related to the quality of teaching and the learning process that continues today.

In response to public demand to improve education, there is currently a move to improve the quality of education and ITE (Albalawi & Ghaleb, 2011; Al Shannag, Tairab, Dodeen, & Abdel-Fattah, 2013). One outcome is that the National Commission for Academic Accreditation and Assessment (NCAAA, 2013) has designed a national assurance framework focused on accountability and improving educational quality (Al-Musallam, 2007; Darandari et al., 2009). This framework distinguishes four learning outcomes domains for graduate and beginning teachers: (1) Professional Knowledge, (2) Promoting Learning, (3) Supporting Learning, and (4) Professional Responsibilities.

Alongside the increased focus on improving ITE provisions, emphasis has also been given to professional development for practising teachers in Saudi Arabia (Obikan for Research and Development, 2010). However, in spite of these efforts, Sabah, Fayez, Alshamrani, and Mansou (2014) claim that these measures have not yet been effective enough to alter teachers' attitudes or general perspectives on pedagogy. There remain concerns that opportunities for continuing professional development are limited and that beginning teachers do not have adequate mentoring support needed as they transition to the classroom (Sywelem & Witte, 2013). Despite recent efforts to prioritise professional development for science and mathematics education (Alshamrani, 2012; Obeikan for Research and Development, 2010), access to professional development programs by mathematics teachers in Saudi Arabia remains limited. In particular, teachers receive little or no professional training support in new areas such as digital technologies and working with diverse students (Almazroa, Aloraini, & Alshaye, 2015; Alshehri, 2012).

Limited access to professional development of teachers no doubt impacts on beginning teachers' ability to meet the challenges of reforms in the mathematics classroom (Alharbi, 2011). More recently, studies into teacher quality and its relationship to mathematical and/or scientific achievement in Saudi schools (e.g., Al-bursan & Tighezza, 2013; Dodeen, Abdelfattah, Shumrani, & Abu Hilal, 2012) have suggested that as well as looking at current teaching practice, researchers need to look at teacher-related factors, including how well beginning and/or pre-service teachers (PSTs) are prepared, including their feelings of preparedness and their previous level of education.

1.2 Rationale

Ongoing reviews of the student learning outcomes and performance within the education system in Saudi Arabia have raised several areas of concern. In arguing that the education system does not equip students with the appropriate critical thinking skills, critics (e.g., Al-Essa, 2009; Allamnakhrah, 2013; Al-Miziny, 2010; Elyas, 2008; Kafa, 2009) point to a tendency to produce passive students who have been taught to think rigidly rather than creatively when solving problems. In response to the perceived lack of critical thinking among Saudi students, these researchers argue that any reforms of the Saudi education system must incorporate critical thinking. Internationally and within Saudi Arabia, mathematicians and educators also argue for changes to address the concerning number of underachieving and

disengaged students (Atweh & Brady, 2009). Naturally, these are worrying trends, particularly in the light of an acknowledgement that mathematics is an important subject across the curriculum, and in the current and future lives of students (Anthony & Walshaw, 2009).

Suggestions in the research literature about possibilities for improving mathematics education outcomes reflect concerns that focussing simply on issues related to the learner, neglect the crucial role of the teacher and teaching quality (Alsharif, 2011; Goe & Stickler, 2008; Knight et al., 2015). This concern is valid in the Saudi Arabian context where in seeking to make improvements, educational reforms have focused on specific parts of the education system without consideration of the overall system (Alghamdi, 2013). In particular, curriculum reforms focused on establishing contemporary and important goals and learning resources have failed to address styles and theories of classroom instruction (Alghamdi, 2013) and their impact on student learning.

What students learn relates to what and how teachers teach. In my Master's dissertation (Alsaleh, 2013), I found that mathematics teachers were a crucial factor in shaping students' attitudes towards mathematics. Saudi students expressed mixed views about the effectiveness of their mathematics teachers, with secondary school students being more likely than younger students to have a negative perception of their teachers. Many students stated that the teacher's effectiveness was one of the most influential factors in determining why they felt the way that they did about mathematics. This is significant, as numerous studies, both in Saudi Arabia and internationally, have found strong correlation between student attitudes and achievement (Clarke, Thomas, & Vidakovic, 2009; Hemmings, Grootenboer, & Kay, 2010; Mohd, Mahmood, & Ismail, 2011). In particular, studies note strong links between disengagement and poor performance in mathematics (Alsaleh, 2013; Özgün Koca & Şen, 2011). Understanding the different facets that influence teacher quality has promoted research on teacher knowledge (Ball, Thames, & Phelp, 2008), professional skills (Burghes, 2008; Day & Sachs, 2004) including implementation of high-leverage practices (Ball & Forzani, 2011), and adaptive expertise (Anthony, Hunter, & Hunter, 2015a).

Going forward, ITE provides an ideal opportunity for improving teacher quality (Alsharif, 2011). In Saudi Arabia, attention on ITE (Al Shannag et al., 2013) mirrors a global move prompted by an "unprecedented and politicized attention to teacher preparation/certification and the policies and accountability systems that govern them and measure their effectiveness" (Cochran-Smith & Villegas, 2015, p. 10). For beginning teachers, what and how they will teach

is dependent on the knowledge, skills, vision, and level of commitment engendered through their ITE experience. This skill set is typically assessed, in a formal sense, in terms of readiness to teach against a number of graduating standards aligned to the accreditation of a program of study.

In this thesis, however, I take a different stance. In order to understand more about the nature, development, and sufficiency of mathematics teacher readiness to teach, this study explores the phenomenon of preparedness. Experienced in both informal and personal ways by each PST, preparedness to transition into the classroom will be influenced by their personal biographies, their opportunities to learn within their period of study, and their experiences within the practicum period. Determination of their level of preparedness will be influenced by their sense of teacher efficacy formed in part by their assessment of sufficiency in knowledge and professional skills aligned to beliefs about good mathematics teaching.

Given the considerable number of ITE nationwide in Saudi Arabia and the current urgency of ITE reforms, it is surprising that a literature search revealed only a limited number of studies related to ITE within Saudi Arabia (Almoathm, 2008; Alsharif, 2011), with very few focused on the area of mathematics education. Moreover, it is also noted that PSTs' voices are rarely represented within teacher education literature, especially in Saudi Arabia (Alghamdi, 2013). In examining the perceptions of PSTs, regarding their preparedness to teach mathematics, this study will address this need and contribute to informing our understanding about improvements and changes needed to ensure quality teaching in mathematics in middle and secondary classrooms.

1.3 The purpose of the study

This study will contribute to the current initiatives to improve teacher and teaching quality, inclusive of ITE within Saudi Arabia, through an exploration of the phenomenon of preparedness in the context of mathematics education. The construct of preparedness will be operationalized through a survey examination of PSTs' efficacy to teach mathematics and an interview-based exploration of the factors influencing PSTs' perceptions of preparedness. Teacher efficacy has been identified as the strongest predictor of teachers' perceptions of preparedness, with several studies indicating a relationship between feelings of preparedness and an increased sense of teaching efficacy (Anderson & Stillman, 2013; Brown, Lee, & Collins, 2015; Caires, Almeida, & Vieira, 2012; Darling-Hammond, Chung, & Frelow, 2002).

In the classroom context, other studies have also demonstrated links between teacher efficacy and student achievement and teacher behaviour (Darling-Hammond, 2006; NCATE, 2006).

The aim of this study is to investigate how well Saudi PSTs feel that they are prepared to teach mathematics at secondary or middle schools—that is, to explore their ‘sense’ of preparedness to teach, delving into the nature and origins of that ‘sense’.

To gain insight into the phenomenon of preparedness, this thesis addresses the following research questions:

1. What beliefs do PSTs hold about ‘preparedness to teach’?
 - Their definition of preparedness
 - Kinds of knowledge and skill PSTs regard as necessary to be an effective mathematics teacher
 - Perceptions of a ‘good’ mathematics teacher
2. What perceptions do PSTs have about their levels of preparedness?
 - Efficacy beliefs about teaching
3. What are the factors influencing the formation of mathematics PSTs’ perceptions?
 - a. Prior experience,
 - b. ITE, and
 - c. Practicum experience.

The participants in the study are a sample of mathematics PSTs who are near the end of their teaching methods course in the final year of their four-year education degree.

1.4 Definition of terms

As with any study, it is important to clarify and define the important terms. Key terms used in this study are defined below:

Initial teacher education (ITE): A college or university program whose intent and purpose is to provide prepare teachers to teach in classrooms. This may also be known as a teacher preparation program (Clark, 2009).

Pre-service teachers (PSTs): PSTs are students enrolled in a college or university ITE prior to being certified to teach in primary, middle or secondary school (Rice, 2003). In the international literature, PSTs are also referred to as prospective teachers, novice teachers, initial teachers, teacher candidates, or student teachers.

Practicum: Opportunities for PSTs to spend time in the classroom/field where they are expected to use and test the theories that they have studied during their teaching method course work (Feiman-Nemser, 2001). It is also known as internship, placement, student teaching experience, fieldwork, or being on section.

A qualified teacher: A qualified Saudi teacher must have a 4-year Bachelor of Education degree (BED) and a teaching license/registration as defined by the standards mandated by an Educational Authority body. They must know how to use and apply computers in education in manner that is appropriate for their specialisation and their stage of study. They must also prove their knowledge of the duties of the teaching profession (Wiseman & Bakr, 2013). For middle and secondary mathematics teachers, their Bachelor degree should include significant course work in the discipline of mathematics. A full discussion of the context of education in Saudi Arabia, where these terms are used within is provided in the following chapter.

2. Background context of education in Saudi Arabia

2.1 The education system in Saudi Arabia

The Ministry of Education of Saudi Arabia was established in 1953 to make education and the school system (for boys only at that stage) comparable to Western educational systems. Later, in the late 1950s and early 1960s, the education system was amended to include education for girls. By the mid-1970s, approximately 50% of Saudi girls were enrolled in school. By the early 1980s, all Saudi girls had access to education, although attendance and enrolment were not compulsory. As a flow-on effect, universities were seeing young women enrol and graduate with degrees and diplomas.

There are three basic levels in the Saudi school system: 6 years of primary school (Grade 1–6), 3 years of intermediate school (Grade 7–9), and 3 years of secondary school (Grade 10–12). All levels of education are free. The Saudi Arabian Ministry of Education is responsible for all aspects of the system: the curricula, teacher education, teacher appointments, and school evaluations (Marsh et al., 2014).

One area that is notably different between Saudi and Western educational systems is complete gender segregation in all schools (and universities). Unlike single-sex schools in the Western context, teachers are also subject to this segregation so that only female teachers teach girls and only male teachers teach boys.

In Saudi schools, mathematics is a compulsory subject through to Grade 10. Grade 1 has two classes per week, Grades 2 and 3 have four classes per week, Grades 4 to 6 have five classes per week, and Grades 7 to 10 (middle school and first year of secondary school) have four classes per week. After Grade 10, students can opt either for the literature/religious or for the scientific stream. The scientific stream includes advanced mathematics as an option, whereas the literature/religious stream has much less emphasis on mathematics. Boys and girls have the same options in secondary school, except that only boys take physical education and only girls take home economics. Beyond high school, girls do not have the same opportunities as boys regarding university and employment, especially in areas such as science, technology, engineering, and agriculture. Consequently, teaching is a highly regarded career option for girls. In recent years, however, researchers have noted that the gender imbalance for career opportunities has lessened (Marsh et al., 2014).

As the system of ITE in Saudi Arabia is likely to differ from that used in other countries, a brief overview of the system is presented. The process of becoming a licensed teacher in Saudi Arabia has two main stages. Firstly, those wishing to enter teaching obtain a degree in teaching education at bachelor level (either at a local Saudi university or a recognised foreign institution), with a specialisation in one subject area. Alternatively, a PST can obtain a Diploma of Education as a non-specialist educator after obtaining a bachelor-level degree in any area (Alshumrani, 2008). On completion of the teacher education degree, teacher candidates have to pass a vetting process—involving a personal interview and testing of professional and specialised skills. Candidates must also demonstrate that they know how to use and apply computers in education in a manner that is appropriate for their specialisation and their stage of study. Additionally, they have to pass a full medical examination to confirm their fitness, health (including mental health) and freedom from drug addiction, and prove their knowledge of the duties of the teaching profession (Wiseman & Bakr, 2013).

The Bachelor of Education degree (BEd) comprise 4 years of study at education faculties within Saudi universities or other tertiary education providers. The program of study includes general education theory and methods (described in more detail below), as well as courses for specialist areas such as mathematics, physics, biology, English and Arabic language, and Islamic studies. PSTs undertake their ITE through either colleges of education (within universities) or stand-alone teacher colleges. The teacher college prepares PSTs for elementary (primary school) level teaching and includes general courses in science and mathematics. University-colleges of Education provide courses that are designed to prepare PSTs to teach at intermediate and secondary school levels and help them to become more proficient in their chosen speciality area (e.g., courses for science teachers will concentrate on teaching physics, chemistry and/or biology; courses for mathematics teachers concentrate on teaching mathematics).

For PSTs the BEd includes: (1) specialist content knowledge (SCK), (2) pedagogical knowledge (PK), and (3) pedagogical content knowledge (PCK). The SCK is obtained via a bachelor degree in the chosen subject area (e.g., mathematics); PK is covered by general education courses, and PCK in the methods courses (Alghamdi, 2015). Method courses cover general subject concepts, especially concepts that help them teach key principles of their subject, and teaching methods and strategies for teaching. In these courses, students have the opportunity to learn how to use new tools, illustrations, and materials from the immediate

environment in teaching their subject (Aljabber, 2002). This structure is in line with international studies (e.g., Darling-Hammond & Bransford, 2005; Grossman & MacDonald, 2008) that note that content knowledge (CK) by itself is not enough to prepare teachers for their roles.

In Saudi Arabia, the expectation is that the practicum experience provides opportunities for PSTs to teach (in their final semester of study) for at least eight lessons per week for the entire semester, with their mentor or supervising teacher present for support. Depending on the school policy, a mentor may either be present continually in the classroom, or may visit the classroom during the PST's lesson to make observations and provide support, and then to evaluate the PST's performance and progress. Additionally, an examiner (usually a College of Education professor or a school district supervisor) will visit the classroom towards the end of the practicum to evaluate the PST (Alghamdi, 2015). PSTs, like full-time teachers, are expected to spend the entire school day on site at the schools and to carry out most if not all of the roles of official teachers (Alsharif, 2011).

The practicum experience is a vital part of ITE. Throughout the literature, in worldwide contexts, it is noted that PSTs frequently perceive that they learn more during their practicum experience than from the theoretical parts of their program (Brown et al., 2015; Hudson, 2009; Rodie, 2011). Despite general agreement that the practicum experience forms a "vital part of teacher education" (Kennedy & Archambault, 2012, p. 186), some researchers argue that because the practicum experience has not been fully studied (Skamp & Mueller, 2001) we know too little about how it contributes to ITE. A frequently cited concern is that ITE does not sufficiently link the more theoretical side of teacher education (CK and PK) to actual activities and experiences in the classroom (Alzaydi, 2010; Bakr & Wiseman, 2013). This claim is particularly relevant in the Saudi context, with few studies having investigated the practicum experience, the most significant being Alghamdi (2015).

Investigating the challenges faced by science PSTs across two ITE, Alghamdi (2015) found that many of the ITE in Saudi Arabia were overly theoretical and put too much focus on knowledge of theory. Alghamdi noted that courses concentrated too much on general PK with insufficient attention to subject-specific pedagogical knowledge. As a result of her findings, Alghamdi called for ITE in Saudi Arabia to increase the amount of practicum experience and increase the teaching time within the course so that PSTs could learn more about learning and teaching experiences and activities prior to practicum. Alghamdi suggested this could be

achieved through visits to schools, classroom observations, and meetings with the mentor teachers at the host schools.

Significantly, Alghamdi (2015) also found that many PSTs did not receive adequate school-based mentoring. Concerns about mentoring related to the potential mismatch of teaching techniques and methods used in the classroom with those promoted in ITE programs (Alsharif, 2011). A Ministry of Education report (2000) noted that classroom teachers were often very conservative focusing on rote learning of facts more so than the development of higher order thinking skills. Alghamdi (2015) suggested that the mentor teachers needed to be more aware of the student-centred goals of the ITE courses. In addition to opportunities to apply the teaching methods they have learnt about during their course work, Alghamdi recommended that PSTs should be provided with more opportunities to observe and analyse their mentor in action in the classroom.

2.2 The national qualification framework and graduate standards in Saudi Arabia

In line with international trends to establish graduating standards for teacher education (Sinnema, Meyer, & Aitken, 2017), the Saudi Arabian National Commission for Academic Accreditation and Assessment (NCAAA), established in 2004, designed a national assurance framework of generic standards for learning outcomes at each level.

The framework (NCAAA, 2013) consists of generic standards relating to the learning outcomes for academic qualifications and describes the characteristics that graduates are expected to have. This framework distinguishes four learning outcomes domains for graduate or beginning teachers:

- (1) Professional Knowledge
- (2) Promoting Learning
- (3) Supporting Learning
- (4) Professional Responsibilities

The four domains are represented by 12 teaching standards as shown in Table 2.1 Standard three has further been elaborated for each discipline.

Table 2. 1. Teaching standards for mathematics within the general framework (adapted from (Al-Saud & Alsadaawi, 2014, pp. 5-6).

Domains of teaching	Standards
<u>Professional knowledge</u>	1. Knowledge of students and how children and young people learn 2. Basic skills of literacy and numeracy 3. Understanding of the central concepts, methods of inquiry, structures and pedagogy specific to the discipline 4. Knowledge of general pedagogical principles 5. Designing coherent learning programs
<u>Promoting learning</u>	6. Creating opportunities for and advancing student learning 7. Assessing students' learning and providing useful feedback
<u>Supporting learning</u>	8. Establishing a respectful and supportive environment for learning within the classroom 9. Establishing a culture of learning and having high expectations for student achievement
<u>Professional responsibility</u>	10. Working productively with school committees and colleagues to improve teaching practice 11. Ongoing professional development 12. Understanding of the professional duties of teachers within the Saudi context

Chapter three will outline how these four domains fit into the internationally accepted framework of Darling-Hammond and Bransford (2005).

Teaching standards, and therefore the content of the curricula in the ITE, needs to be based on what society considers to be acceptable and appropriate for teachers and students, as well as what has been learned by the profession as a whole through research into education (Darling-Hammond, 2010). The newly developed framework attempts to clarify expectations with the aim of bringing Saudi Arabia into line with international standards. In addition to the general knowledge and practice in the field of teaching, the framework also includes subject-specific standards. The professional standards 3 for mathematics teachers cover seven content domains: (1) numbers and operations; (2) algebra, real functions, and mathematical analysis; (3) geometry and measurement; (4) statistics and probability; (5) discrete mathematics, logic, and mathematical inference; (6) mathematics education; and (7) mathematical procedures. These seven domains are further divided into 13 standards and 73 sub-standards (see Appendix F). For mathematics teachers, these mathematics standards alongside the generic standards are assessed via the official Teacher Test in Mathematics of the National Center for Assessment in Higher Education (NCAHE) as a necessary part of earning a teaching qualification. This test measures whether or not the candidate has sufficient basic levels of mathematical knowledge

and skills needed for a teaching position. Test results are often taken into consideration when PSTs apply for a teaching position (NCAHE, 2018).

At present, this framework is being used to develop teacher education standards. (Marzano & Toth, 2013). As revealed by the Saudi Arabian Ministry of Education (2000), traditional Saudi mathematics classrooms have tended to be dominated by teacher-directed learning opportunities, with some of these methods (e.g., rote learning) still being widely used within ITE. However, the standards framework described above signals the intent to align Saudi education with international standards for the teaching profession (Shannag et al., 2013). The intent of these standards is that they provide a benchmark for ITE. That is, the standards clarify what PSTs are expected to know and to do in order to be effective. It goes beyond the previous standards, which largely focused on curriculum content, to cover the many facets involved in the teaching profession that PSTs need in order to be prepared for their role (Al-Saud & Alsadaawi, 2014).

Overall, the development of this quality assurance system and review and accreditation process, along with the support provided by the NCAAA, have helped to develop and improve the quality of education in Saudi Arabia (Al-Eisa & Sahab, 2006; Darandari & Ward, 2011). Although much has been achieved regarding quality assurance within the educational system to bring Saudi Arabia into line with international standards for education, including ITE, more remains to be done (El-Maghraby, 2011).

The past 10 years have seen an increase in education research and ITE in the Saudi context. In mathematics education, much of this research has focussed on pedagogy, principally because the majority of mathematics teachers do not tend to cultivate higher-order thinking skills (Alfarhod, 2009; Saudi Arabian Ministry of Education, 2000). Almoathm's (2008) observation that there was less emphasis on research on mathematics ITE programs in Saudi Arabia is backed by Albalawi's (2010) discussion paper that highlighted eight main areas of concern for mathematics education—one of which was the preparation and training of mathematics teachers. Research into teacher preparation is thus critical to support potential reform of teaching approaches in the classroom. In this context of calls for the reform of mathematics teaching, this study, exploring pre-service teachers' perspectives, will help to understand the extent to which female mathematics PSTs feel prepared, adding to our knowledge about ITE.

3. Literature review

3.1 Introduction

This study investigates the construct of preparedness for teaching for female mathematics PSTs in Saudi Arabia, alongside factors contributing to their sense of their own levels of preparedness. Of the few studies that have investigated the perceptions and beliefs of mathematics teachers regarding preparedness and the related construct of efficacy, the literature search was unable to find any studies on the preparedness of mathematics teachers, either male or female, in Saudi Arabia. However, several studies have been conducted in Saudi Arabia regarding the history and development of Saudi education (Al-Saud & Al-Sadaawi, 2014), ITE educational reforms (Alsharif, 2011; NCAAA, 2013), women's education (Alghamdi, 2013), the integration of technology into teaching mathematics and ITE (Alshehri, 2012; Robertson & Al-Zahrani, 2012), the attitudes of Saudi teachers (Alghamdi, & Al-Salouli, 2012), continuing professional development provision for science and mathematics teachers (Sabah et al., 2014), science PSTs' self-efficacy (Albayrak & Unal, 2011), and teachers' perceptions of the qualities of effective teachers (Alqahtani, Kanasa, Garrick, & Grootenboer, 2016). Taken together, these studies provide a context for the research undertaken in this thesis. The majority of the literature sourced to inform the study draws from the international field of research concerning teacher beliefs, efficacy, and initial teacher education.

The review is organised in four sections followed by a summary. The first section examines the literature relevant to teacher quality—aiming to establish the standard that ITE intends to uphold and the level that should be attained by PSTs. The second section reviews definitions of preparedness—what it means to be prepared to teach. The third section, a critical review of literature on efficacy, particularly teaching efficacy is provided. The fourth section examines what other studies have found regarding PSTs' perceptions and definitions of preparedness and what a “good teacher” is, and the factors that influence these perceptions.

3.2 Pre-service teachers' preparedness

3.2.1 *Preparing quality teachers*

The goal of ITE is to help to develop high quality classroom teachers (Mayer, 2014; NCATE, 2006; Tatto et al., 2012; Teacher Education Ministerial Advisory Group (TEMAG), 2015). In this regard, the nature and quality of ITE is linked to beginning teacher quality (Darling-Hammond, 2006) and thus ultimately to student learning outcomes or achievements (Levine, 2006; Preston, 2014). An important aspect contributing to teacher quality is teachers' feelings of preparedness (Brown et al., 2015). Some researchers claim that the ability of PSTs to teach effectively and meet the graduating standards can be predicted by their feelings of preparedness (Housego, 1990; Hoy & Spero, 2005; Nasir & Safran, 2014).

The link between preparedness and teacher quality leads us to consider what teacher quality consists of, especially as this is likely to be linked to PSTs' perceptions and definitions of good teaching. However, quality is a subjective measure and the literature does not have a uniform definition to inform researchers. Defining and assessing teacher quality is contentious and definitions vary when different constructs are used (Kennedy, 2008), for example, 'good' teaching or successful or effective teaching. Although these aspects overlap, they are not identical. For example, a 'good' teacher is more likely described in terms of one who uses good teaching practices that uphold standards (e.g., is able to create a good classroom environment and is able to engage students) whereas a 'successful' teacher is one whose students attain desired learning goals (Fenstermacher & Richardson, 2005; Knight et al., 2015).

In recognizing both of these aspects of teacher quality, Kennedy argued that "we need to start talking about teacher qualities, rather than 'teacher quality'" (p. 60). To do this, Kennedy proposed three broad groupings of teacher qualities that teachers bring with them to their jobs: "personal resources; those related to teachers' day-to-day work, which I call performance; and those that refer to teachers' impact on students, which I call effectiveness" (p. 60).

Personal resources include teacher's beliefs, attitudes, and values, personality traits, knowledge, skill and expertise, and credentials.

Definitions that consider a teacher's performance—what teachers actually do in their practice (Lampert, 2010)—assume that certain actions and strategies will contribute to and support student learning (Wang, Lin, Spalding, Klecka, & Odell, 2011). This perspective also considers

teachers' experience, inside the classroom and beyond, and holds that experience contributes to teaching quality and the quality of student learning (Wang et al., 2011). In the current study, PSTs lack depth of this experience and thus these definitions may not be applicable to them.

Definitions of quality that consider impact on student learning outcomes assume that because the teacher can influence the students in terms of knowledge, skills, and values, student performance and student outcomes are measures of teaching quality (Kennedy, 2008). Importantly, effectiveness measures also include affective outcomes. For example, a quality teacher is one who can “inspire students to learn, to incorporate their interests into the curriculum, to earn their trust and cooperation, and to channel their energies into productive work” (Yatvin, 2007, pp. 8–9). In a bicultural country such as New Zealand, effectiveness is inclusive of cultural sensitivity and the ability to respond appropriately to students' needs (Ell & Grudnoff, 2012).

Incorporating these viewpoints, Knight et al. (2015) also argues for a more comprehensive view of teacher quality. Knight et al. offer three categories to define quality: (1) cognitive resources (e.g., knowledge, beliefs, attitudes and dispositions), (2) the ability to assess and respond to students' knowledge and needs (a performance factor), and (3) a commitment to continuing professional development (a performance and a cognitive resource factor). This reconceptualisation of “teaching quality [being] connected to student learning rather than teacher quality focused on teacher characteristics” provides a more complex definition that is closely linked to “complex learning outcomes and tied explicitly to content” (p. 106). Applying this construct to PSTs would suggest that practicum experience would be a significant factor in determining their perceived levels of preparedness.

Specific to the current study, several research studies propose definitions of quality/effective teaching for mathematics education (Anthony & Walshaw, 2009; Askew, Brown, Rhodes, Johnson, & Wiliam, 1997; Ruthven, 2011; Stronge, 2007; Wilson, Cooney, & Stinson, 2005). For example, in the US, the National Council of Teachers of Mathematics (NCTM) (2014) specify that an effective teacher must have:

a deep understanding of mathematical knowledge that they are expected to teach
and a clear view of how student learning of that mathematics develop and
progresses across grades ... it also requires teachers to be skilled at teaching in

ways that are effective in developing mathematics learning for all students. (p.

7)

Research studies looking at teacher quality in the field of student-focussed reforms include the ability to promote students' understanding of mathematics by using a combination of meaningful verbal, situational, and visual techniques (e.g., Yackel, 2000); an emphasis on problem-solving and allowing students to develop a range of strategies for solving problems (Franke, Kazemi, & Battey, 2007); and extensive use of mathematical discourse (both by the teacher and by the students) to clarify concepts and ensure a deeper understanding of mathematical principles (Drake & Sherin, 2006; Hufferd-Ackles, Fuson, & Sherin, 2004). The NCTM (2014) summarised teacher quality as a set of eight teaching practices:

- establishing mathematics goals to focus learning,
- implementing tasks that promote reasoning and problem solving,
- using and connecting mathematical representations,
- facilitating meaningful mathematical discourse,
- posing purposeful questions,
- building procedural fluency from conceptual understanding,
- supporting productive struggle in learning mathematics, and
- eliciting and using evidence of student thinking.

Accordingly, a quality teacher is no longer one who tells/shows the students how to solve a certain type of problem but is one who engages students “in solving and discussing tasks that promote reasoning and problem solving” (NCTM, 2014, p. 8).

Researchers have also highlighted that effective teachers create classroom environments that help students reach their mathematical goals. This includes providing students with opportunities to participate in mathematics activities through both individual and group learning opportunities, helping students see how the different strands of mathematics are interconnected and how mathematical principles can be applied in real life (Anthony & Walshaw, 2009). An effective teacher is also able to integrate student interests when creating problems to be solved as a classroom exercise (Hemmi & Ryve, 2014). In supporting student agency, effective teachers also believe that all students are capable of becoming numerate and will take responsibility for helping the students achieve this (Askew et al., 1997).

Within Saudi Arabia, curriculum reforms reflect the changing perspectives of teacher quality moving towards defining teaching quality as being student-centred rather than teacher-centred (Wilson et al., 2005). The new school mathematics and science curricula introduced in 2008 (see <http://obeikaneducation.com/obeikanmodules/>) emphasise student-centred learning and understanding concepts in direct contrast to reliance on rote learning. These curricula also attempt to make mathematics and science relevant by connecting them to real life. Underpinned by constructivist theories of learning these curricula emphasise critical thinking and problem solving skills (Alghamdi & Al-salouli, 2012). Consequently, measures and definitions of teacher quality derived from the Western context are increasingly relevant to the Saudi Arabia context and may well have had an effect on how female Saudi PSTs, who are the focus of this research define and perceive ‘good teaching’.

Within school settings teacher accountability has in many countries been strongly tied to national testing and standards as a measure of student achievement (Knight et al., 2015; Thrupp & White, 2013); a trend that is likely to be adopted in Saudi Arabia within the current education reforms (NCAAA, 2013). In mathematics education in particular, this has led to concerns that definitions of teacher quality will become more pragmatic, characterizing a quality teacher as one who can help students improve their test scores (Ell & Grudnoff, 2012). Rather than assessing against student achievement, PSTs’ quality is typically assessed against criteria related to nationally derived graduating standards. In many countries, this typically involves assessment of teacher inputs—their knowledge base in the areas of content knowledge, pedagogical knowledge, and pedagogical content knowledge; classroom effectiveness during the practicum experiences; and their attitude towards teaching (Gerber, 2012).

However, definitions of teaching quality that define the experienced/expert classroom teacher, such as the ability to recognise and adjust to different learning needs (Darling-Hammond & Baratz-Snowden, 2007); clear communication of tasks (Stronge, 2007), and the ability to identify and anticipate mathematical misconceptions (Smith & Stein, 2011), arranging the classroom for maximum learning efficiency, and professional skills (e.g., the ability to communicate with parents and the ability to collaborate with other teachers in curriculum development) (Darling-Hammond & Baratz-Snowden, 2007) will no doubt influence PSTs’ perceived levels of preparedness. As summarised by Stronge (2007), characteristics used to define what an effective experienced teacher is and does include: (a) the teacher as an

individual, (b) teacher preparation, (c) classroom management, and (d) the way a teacher plans, teaches, and monitors students' progress (p. xi).

Drawing on definitions originally developed for experienced teachers, some studies define teacher quality in terms of characteristics that are relevant to PSTs (Hogan, 2011; Pietila, 2003; Pratt, 2008). These characteristics include thorough content and pedagogical knowledge and pedagogical content knowledge; flexibility; a positive attitude towards the subject (Pietila, 2003); the ability to care, and build a community and establish a positive learning culture that maintains that learning is fun (Pratt, 2008). In addition, Hogan (2011) stressed that interpersonal skills such as the ability to adapt to the students are vital characteristics of teaching quality, both for experienced teachers and PSTs.

Notions of quality teaching have also been linked to the concept of “adaptive expertise” (Anthony et al., 2015a). Framed within the lens of sociocultural views of learning, Luciano Beltramo (2017) claims that adaptive teachers “attend to how students make meaning of academic content, the social context of the classroom, and the broader works outside of school; and then appropriately use such student information to reshape instruction toward improved classroom learning opportunities” (p. 327). According to Timperley (2013), an adaptive expert tends to be self-reflective and can identify when something “isn’t working” and will make changes. In contrast to routine experts, an adaptive expert teacher does not discard older routine approaches to learning but finds a balance between innovation and tradition (Wetzel, De Arment, & Reed, 2015). Regarded “as the hallmark of a professional teacher” (Aitken, Sinnema, & Meyer, 2013, p. 4) developing teachers adaptive expertise is increasingly recognised as one of the key goals of ITE.

In looking to promote adaptive expertise within ITE, Timperley (2013) suggested that developing adaptive expertise within ITE requires a number of shifts in PSTs' attitudes and thinking. The first shift needed is from focussing on one's self to focussing on students. Related to identity and efficacy, a PST shifts from seeing their self as a learner to seeing their self as a professional who is able to create an effective learning environment. The second shift involves how PSTs view the teaching and learning processes, including ideas about knowledge, interactions and responsibilities, and the location of learning. In developing adaptive expertise, PSTs begin to perceive teaching as a process of working with the students and sharing power with them in the process of helping the students acquire knowledge and skills. Utilising this framework within practice-based mathematics methods courses, Anthony et al. (2015a)

claimed that the dynamics of teaching and learning that develop from practice-based pedagogies (e.g., taking risks and providing opportunities to experiment) help PSTs develop adaptive expertise. In Saudi Arabia, although social and educational change is taking place slowly, it is important for ITE to develop teachers who are able to “manage and meet educational needs of an ever more connected, dynamic world” (Jordon, 2016, p. 199). This will require teachers to think beyond familiar teaching methods and to use innovative adaptive teaching modes (Anthony et al., 2015a).

Aligned with adaptive expertise, another characteristic of quality teachers is the notion of a positive disposition. Teacher disposition, defined as “an attributed characteristic of a teacher ... that summarizes the trend of a teacher’s action in particular contexts” (Katz & Rath, 1985, p. 301), ultimately affects teachers’ attitudes towards their careers, their motivation to teach, and their commitment to the profession (Byrnes, 2008). It includes their interests and values, and their attitudes towards teaching, and represents “a trend of a teacher’s judgments and actions in [specific] contexts [and situations]” (Johnson & Reiman, 2007, p. 677). While a teacher’s disposition is influenced by their goals, knowledge, beliefs, and values (Byrnes, 2008), it can also be cultivated as part of ITE (O’Neill, Hansen, & Lewis, 2014). With reference to disposition, The Association of Mathematics Teacher Educators (AMTE) (2017) describe a well-prepared beginning teacher as one who:

hold positive dispositions about mathematics and mathematics learning, such as the notions that mathematics can and must be understood, and that each and every student can develop mathematical proficiency, along with a commitment to imbue their students with similar beliefs and dispositions. (p. 7)

Many researchers have noted that the way a PST feels about how well they are prepared provides a useful indicator of future performance—the quality of teaching—in the classroom (Clark, 2009; Housego, 1990; Kraut, 2013). In this thesis, I take the stance that PSTs’ sense of preparedness can provide another important indicator of their potential for teaching quality (Clark, 2009; Housego, 1990; Kraut, 2013).

Studies (e.g., Darling-Hammond, 2006; Harris & McCaffrey, 2010; Hattie, 2012; Wenglinsky, 2002) advocate that high-quality ITE is crucial to ensuring the quality of a nation’s teaching and improvements in student outcomes. Indeed, the concept of teacher quality is frequently mediated by the socio-political culture, educational traditions, and views of mathematics as a

subject (Cai, Perry, Wong, & Wang, 2009; Li, 2011). Proponents, such as Darling-Hammond (2006), claim that there is a large body of evidence confirming that ITE matters greatly for teacher effectiveness. In arguing for the desirability for well-prepared graduates, studies note that well-prepared graduates are likely to outperform those who are not prepared in a number of areas. Most notably, they are more likely to produce higher student achievement and also are more likely to remain in teaching for longer (NCATE, 2006). In contrast, no credible research has revealed any advantage to students of having unprepared teachers (NCATE, 2006). Rather, studies have criticised PSTs' lack of preparedness, suggest that poorly prepared teachers disrupt the learning environment (Mitchell, Marsh, Hobson, & Sorensen, 2010; Sinclair, Downson, & Thistleson-Martin, 2006) and leave the teaching profession at high rates (Cochran-Smith, 2003; Darling-Hammond et al., 2002). However, in striving for quality teaching, commentators have argued that differences in beginning teacher effectiveness can be related to differences amongst ITE programs (Darling-Hammond et al., 2002; Henry, Bastian, & Smith, 2012; Henry, Patterson, Campbell, & Yi, 2013). Thus, it is important to determine what being well prepared to teach means.

3.2.2 What does it means to be well prepared to teach?

Discussing the definition of teacher preparedness, Cochran-Smith and Power (2010) claimed that teacher preparation “encompasses a range of complex and even controversial issues” (p. 6). Similarly, Kraut (2013) suggested that defining and evaluating teacher preparation needs several “lenses”. According to NCTE (2006), a well-prepared teacher should have:

Confidence in themselves, the knowledge of students, the understanding of their discipline, the awareness of the ways in which contexts affects education, and the need to make the appropriate choices – about goals, objectives, materials, strategies, assessments – to help as many students as possible learn and grow in skill, content knowledge, and understanding of self and others. (p. 4)

From a ‘knowledge’ perspective, ITE is charged with equipping PSTs with the basic knowledge they need to begin their professional activity—in terms of adequate preparation both in the subject they will teach and in the relevant teaching methods. Broadly speaking, teacher knowledge includes knowledge about content, specialised pedagogical content, pedagogical knowledge, as well as appreciation for the broader contexts of education, and awareness of key educational issues (e.g., influences of sociocultural backgrounds, equity) (Kraut, 2013; Ponte & Brunheira, 2001). However, as advocated in the NCTE (2006) position

preparation involves much more than acquiring ‘knowledge’. A PST who is well prepared will need to develop not only content knowledge and pedagogical knowledge (e.g., techniques and routines that help make the classroom an efficient learning environment), but also an image or vision of teaching and learning that will help her make the decisions that will best support student learning and outcomes (Ghousseini & Herbst, 2016).

From a practice perspective, a well-prepared teacher should take on the responsibility of knowing her students and being able to use a range of approaches to help all students learn (Kraut, 2013). The report by the National Council for Accreditation of Teacher Education (NCATE) (2010) in the U.S. argued that teacher education needs to adopt a practice-based approach that allows “varied and extensive opportunities for candidates to connect what they learn with the challenge of using it, while under the expert tutelage of skilled clinical educators” (p. ii) rather than the traditional “norm which emphasizes academic preparation and course work loosely linked to school-based experiences” (p. ii). As such, practice-based approaches “view teaching not only as a resource for learning to teach but as a central element of learning to teach” (McDonald et al., 2014, p. 500). For mathematics education, practice-based teacher education utilise pedagogical approaches such as rehearsals (Kazemi, Franke, & Lampert, 2009) to support PSTs learn the complex relational pedagogies that use student’s mathematical thinking and reasoning to drive learning forward (Anthony, Hunter, & Hunter, 2015b). For some researchers, the ability to notice, elicit, and respond to students’ mathematical thinking is perceived as a critical hallmarks of the well-prepared mathematics teachers—termed an adaptive teacher (Ghousseini & Herbst, 2016; Santagata & Yeh, 2014).

Efforts to define the well-prepared teacher graduate are captured in set of qualifications measured by teacher licensure—for ITE often referred to as graduating teaching standards. Regarded as an important tool for the definition, recognition, and development of a profession, teaching standards promote definitions of effective and ‘good’ teaching that are consistent at institutional, national, and/ or international levels (Darling-Hammond, 2006). Clarifying what effective teaching “looks like” (i.e., its attributes and practices) (Australian Institute for Teaching and School Leadership (AITSL), 2011) standard “define effective practice in terms of desired outcomes and in terms of preferred procedures and performance” (Yinger & Hendricks-Lee, 2000, p. 97). As such, standards can be used by teachers to self-evaluate their own effectiveness as well as for the processes of evaluating particular classroom interactions, and providing a basis for professional discourse regarding improvement and learning (Darling-

Hammond, 2012). In the context of ITE, teaching standards can be used as a reference point for exploring the preparedness of beginning teachers (Swabey, Castleton, & Penney, 2010).

In response to numerous reports on teacher quality, Ministries of Education in many nations, including Saudi Arabia, are or have established measurable quality outcomes for teacher education institutions (Cumming & Jasman, 2003). Although agreement on the nature of standards is not universally shared (Sinnema et al., 2017) it is apparent that standards are now a common feature of teacher preparation across many ITE systems (Aitken et al., 2013; Ingvarson, 2013).

Darling-Hammond and Bransford (2005) laid the groundwork for setting standards for beginning teachers by asking key questions related to:

- the type of knowledge that effective teachers need to have regarding their subject matter and the learning process and development of their students;
- the skills that will allow teachers to create effective learning experiences, to evaluate and provide feedback to their students, as well as evaluating their own teaching practice; and
- the professional commitment that teachers have to make in order to help their students to succeed, including the need for continuing professional development.

These questions have been used as a framework to create sets of standards for ITE worldwide in countries as diverse as Australia, Chile, England, New Zealand, Scotland, and the United States (Ingvarson, 2012). Table 3.1 outlines how the framework of Darling-Hammond and Bransford (2005) has been used in diverse countries—including Saudi Arabia—to define domains used within national teaching standards. At the domain level nations have a similar framework based around professional knowledge, practices, and responsibilities.

Table 3. 1. Domains for standards in six countries, following the framework of Darling-Hammond and Bransford (2005) (adapted from Ingvarson 2012, p. 13).

Australia	New Zealand	USA (InTASC)	England	Scotland	Saudi Arabia
Professional knowledge	Professional knowledge	The learner and learning Content knowledge	Professional knowledge and understanding	Professional knowledge and understanding	Professional knowledge
Professional practice	Professional practice	Instructional practice	Professional skills	Professional skills and abilities	Promoting and supporting learning
Professional engagement	Professional values and relationships	Professional engagement and responsibility	Professional attributes	Professional values and personal commitment	Professional responsibilities

While exhibiting commonalities within frameworks, across countries the standards for graduate teachers vary in their context and focus. In some countries, there are standards that focus specifically on newly graduated (i.e., pre-service) teachers (e.g., New Zealand Teachers Council (NZTC), 2007). In other countries, the graduate teacher standards form part of a set of standards that consider a teacher’s long-term career path (e.g., AITSL, 2011). In the United States, The Interstate Teacher Assessment and Support Consortium (InTASC) standards reflect both the preparation and licensing of beginning teachers, as well ongoing professional development. Bullough Jr (2014) note with reference to U.S. standards that changes in recent years reflect a greater emphasis on “performance”, with the standards undergoing further review and redefinition.

While teaching standards reflect prevailing notions of classroom instruction at different moments in history within specific culturally ascribed educational systems, Table 3.1 suggests a fundamental consensus for graduate teacher standards. Ingvarson (2012) suggests that this is because countries appear to be borrowing from each other and benefitting from international research, and because the standards themselves appear to be context-free. Further, Ingvarson argues that notions of what makes a teacher good and effective will look much the same from culture to culture. However, because classroom practices are shaped by cultural, environmental, and societal assumptions (Bryan, Wang, Perry, Wong, & Cai, 2007; Clarke, Emanuelsson, Jablonka, & Mok, 2006) we can expect some cultural differences in how standards are applied. For example, while all teachers would be expected to manage students’

behaviour, norms of ‘good’ behaviour and methods may differ. For example, in some cultures, techniques such as giving detentions and the use of time out will be used while others may sanction the use of corporal punishment.

Although teaching quality standards from different countries and cultures share many aspects and goals in common, there is in some countries evidence of a move away from performance-based teaching standards. Most notably, Sinnema et al. (2017), from their experience in the New Zealand context, have proposed graduating teacher standards based on the Teaching for Better Learning (TBL) model that explicitly acknowledges teaching as a complex inquiry-orientated process. Sinnema et al.’s inquiry-oriented standards for teaching argue that the inquiry efforts of teachers into teaching and learning matters. Rather than specification of knowledge, skills, and attitudes, this novel approach differs from earlier designs that focused on contextual free specific outcomes and behaviours to now include six aspects of teacher behaviour: deciding on learning priorities, deciding on teaching strategies, enacting teaching strategies, examining impact, deciding on and implementing professional learning priorities, and critiquing the education system.

Although some definitions of preparedness confine themselves to topics that can be studied, skills that can be used or situations that can be either experienced or observed during a teaching method course, other definitions include a PST’s background, personal qualities, and dispositions (Kraut, 2013), alongside self-efficacy measures. These measures of preparedness are associated with teaching self-efficacy and are backed by claims that these constructs influence teacher quality and how effective a teacher is (Brown et al., 2015).

The acknowledgement that teaching is a cultural activity demands that it is only through context-specific research that we can understand whether and how the practical application of these goals and facets of teaching quality is affected by the cultural, national, and historical-political context within an educational system (Tatto et al., 2012). In the present study, the established teaching standards of Saudi Arabia (Section 2.2) are used as a starting point for the exploration of PST’s perceptions of preparedness.

3.2.3 Mathematical knowledge for teaching

Early efforts to define mathematical knowledge for teaching focused on contrasting effective teachers and beginning teachers. For example, Grossman (1990) and Zimmerlin and Nelson (2000) noted that less effective and beginning teachers were focussed on “getting the right

answer” rather than the process of reaching that answer. It was noted that for teachers who relied on mathematical content knowledge (CK), their procedural focus did not create as many connections among various facts, rules, and algorithms as effective teachers do. This contrast led to elevation of pedagogical content knowledge (PCK) for effective teachers. Whereas CK is the “amount and organisation of knowledge per se in the mind of the teacher” with “understanding the structures of the subject matter” (Shulman, 1986, p.9), PCK is knowledge of how to present the content knowledge to students. Shulman (1987), and many others (e.g., NCATE, 2006; Petrou & Goulding, 2011; Toh, Kaur, & Koay, 2013), subsequently argued that teacher knowledge should include CK and PCK. To these two mathematical aspects of knowledge, we can add a third strand, that of pedagogical knowledge (PK)—the knowledge needed for teaching that does not apply just to mathematics (e.g., knowledge of child development, and theories of teaching and learning).

PCK, as elaborated by Shulman (1987), uses CK and transform it into a different but related kind of knowledge that links CK, students, and pedagogy. In the context of mathematics, PCK includes the ability to select the best way to illustrate and explain certain mathematical concepts, to use appropriate questioning and build on students’ prior knowledge, and to use multiple representations (e.g., analogies, illustrations, examples, and explanations) as well as the correct terminology for key concepts. CK also includes the ability to anticipate potential misunderstandings and areas of confusion of a mathematical topic (Petrou & Goulding, 2011; Schoenfeld, 2007). Importantly, teachers draw on their PCK, in combination with CK, to engage students and help them gain a deep conceptual understanding of the content rather than merely memorizing facts and formulae (AMTE, 2017; Ball et al., 2008; Lim, 2011; Petrou & Goulding, 2011).

Some researchers, in exploring these three broad knowledge categories have expanded the separate knowledge strands or proposed different categorisations. For example, Ball et al. (2008) provide a three-stranded definition of the knowledge needed by teachers as common content knowledge (CCK), specialised content knowledge (SCK), and horizon knowledge. CCK contains the mathematical knowledge and skills that apply in all contexts and not just in teaching (e.g., concepts such as calculating interest or percentages, which are used in finance and budgeting), as well as the ability to solve mathematical problems and calculate answers correctly. SCK covers what teachers need to know to help them teach effectively. It thus overlaps with the definition of mathematical CK used in the present study, and covers both PK

(i.e., “knowledge that combines knowledge about students and knowing about mathematics” (Ball et al., 2008, p. 36)) and PCK. Lastly, horizon knowledge describes a teacher’s awareness of the ‘big picture’ of mathematics education and how skills and concepts learned in one academic year relate to what is learned in later years, or how skills taught in the mathematics class relate to other curriculum topics (e.g., how statistics are used in social studies or how algebra is used in physics).

In another study, Rowland, Huckstep, and Thwaites (2005) developed a model of mathematical knowledge for teaching that considered four dimensions: foundation, transformation, connection, and contingency. Foundation knowledge covers teachers’ mathematical CK, PK, and their beliefs about it. Transformation knowledge covers how a teacher represents skills and concepts, and the examples they use to demonstrate ideas to their students, as well as how they explain ideas to students and respond to their questions. Connection knowledge relates to links made between/among different lessons, topics and mathematical ideas. This includes a teacher’s knowledge of how to sequence or scaffold learning activities along with awareness of possible difficulties and problems that students may have with new mathematical CK. Contingency knowledge relates to a teacher’s ability to respond to questions, respond to students’ incorrect responses and react to unplanned situations appropriately.

This study utilised the broad knowledge categories——CK, PCK, and PK—to frame the investigation of the knowledge that mathematics PSTs perceive that they need in order to be well prepared. Each branch of knowledge is explored in more detail in the subsections below.

3.2.4.1 Content knowledge

Studies (e.g., Hill, Rowan, & Ball, 2005; National Mathematics Advisory Panel (NMAP), 2008) have attempted to define the required mathematical content knowledge (CK) for a well-prepared PST are based on a variety of frameworks (Tirosh & Even, 2007). Accepting that defining and explaining “deep understanding” is difficult (Ball, Hill, & Bass, 2005; Kajander, 2010), there is agreement across all frameworks that PSTs need a deep, broad, and thorough knowledge of the mathematics they are about to teach (Gerber, 2012; Hill et al., 2005; Hill et al., 2008; Langham, Sundberg, & Goodman, 2006; Ma, 1999; McCray & Chen, 2012; Schoenfeld & Kilpatrick, 2008; Toh et al., 2013). As argued by Ball et al. (2005), “knowing mathematics for teaching demands a kind of depth and detail that goes well beyond what is needed to carry out the algorithm reliably” (p. 22). Deep content knowledge—knowledge that goes beyond the level of the students PST are likely to teach—enables teachers to form

connections across mathematical topics and to explain why students need to know certain skills or facts (Darling-Hammond, 2000; Greenberg & Walsh, 2008).

However, the link between the level of content knowledge and teaching efficiency can be complex; a good mathematician may not be a good teacher (Petrou & Goulding, 2011). While earlier studies (e.g., Askew et al., 1997; Begle, 1968) claimed limited evidence for a link between teachers' content knowledge (measured by academic qualifications) and the ability to teach effectively, more recent studies highlight a positive correlation between the mathematical CK and teacher effectiveness. For example, Hill et al. (2008) found that mathematics teachers with high levels of content knowledge were less likely to make mistakes, and were more likely to use more rigorous mathematics in their teaching, and to respond to students' questions appropriately and skilfully. Researching the converse, Hutchinson (1997) provided examples of teachers who wanted to be effective but were held back by their lack of content knowledge expertise.

Recent studies (e.g., Ball & Bass, 2003; Ball et al., 2009; Ball et al., 2008) advance three main reasons supporting the importance of content knowledge. Firstly, teachers need to be able to understand why a certain fact or skill needs to be learned as well as how the content should be developed (Ball et al., 2009; Ball et al., 2008). Secondly, a teacher needs to be able to use their mathematical CK to help students make connections and identify several solutions to a problem (Ball et al., 2009; Ball et al., 2008). And, thirdly, teachers need to know how to use mathematical CK to help them respond to situations that arise in the classroom and to show how concepts are connected (Ball & Bass, 2003).

Despite agreement about the importance of mathematical content knowledge, numerous international studies (Afamasaga-Fuata'i, Meyer, & Falo, 2008; Hine, 2015; Ma, 1999) highlight concerns about graduating teachers' (especially primary level teachers) level of content knowledge. Studies that have interviewed PSTs' about perceived levels of mathematics content report concerns about lack of opportunities to study curriculum within their ITE (e.g., Anthony, Cooke, & Muir, 2016; Wilburne & Long, 2010). Studies have also found that many PSTs could not see connections between the mathematics they learned at university and school mathematics (Ma, Millman, Wells, 2008; Toh et al., 2013). In making recommendations for secondary ITE curricula, experts in mathematics education have noted that the content knowledge needed by PSTs is different from the type of mathematics taught in university courses, arguing that mathematics teachers should learn more about the connections between

secondary school-level and university-level mathematics (Wilburne & Long, 2010). Thus, researchers (e.g., Ball et al., 2008; Flake, 2014) argue that ITE should provide PSTs with the opportunity to develop, deepen, and improve their content knowledge, alongside opportunities to improve their levels of pedagogical content knowledge.

3.2.4.2 Pedagogical knowledge

According to the NCATE Guidelines (2006), the following components of pedagogy are vital for teachers to be aware of and understand:

- strategies that help students increase their achievement and how to apply them;
- knowledge of child and adolescent development and how to apply this knowledge to motivate and engage students;
- the ability to diagnose individual learning needs and adapt to them;
- how to create a positive classroom climate and make the classroom a stimulating place that is conducive to learning.

While PSTs need to know general aspects of pedagogical knowledge (PK) such as learning theories, classroom management, and different methods of instruction (Wilson et al., 2001), some specific recommendations apply to mathematics. The National Council of Teachers of Mathematics (NCTM, 2014) contends that a beginner mathematics teacher should know a variety of teaching strategies such as selecting exercises to develop student knowledge, conducting classroom discussions, making connections between content strands and real world applications, and using a variety of tools and technologies (e.g., electronic and manipulatives). Also, knowing how students think and develop mathematical competency and understanding is important (Ball & Forzani, 2011). This enables a teacher to be alert to possible misunderstandings and build understandings according to trajectories of learning (Ball & Forzani, 2011; Clements & Sarama, 2014).

To understand how students develop mathematical understandings and build relationships with and in mathematics takes time; a skill that beginning teachers will further develop in the workplace. Nevertheless, as part of their ITE, a well-prepared teacher needs to learn how to form relationships with student that acknowledge their abilities and interests, as well as how

the relationship between the teacher and her students can affect students' attitude towards mathematics and to mathematical learning (Gutiérrez, 2013; Martin, 2015; Wager, 2012).

Moreover, a well-prepared PST needs to be willing to collaborate with other teachers, parents, and people in the community to help create the best possible learning environment and opportunities for students (AMTE, 2017; The Teacher Education Ministerial Advisory Group (TEMAG), 2015). However, there is limited opportunity for PSTs to develop these skills in practice—for example, the ability to communicate with parents about their children's progress—and hence one might look to the development of awareness and disposition in ITE. Given the continuum of learning for teachers, a professional disposition towards lifelong learning is an important part of teacher preparation. Well-prepared graduates should have a commitment to ongoing professional development to increase their PK as well as their mathematical CK throughout their career (Conference Board of The Mathematical Sciences (CBMS), 2012).

3.2.4.3 Pedagogical content knowledge

To teach effectively, mathematics teachers have to know *how to teach* the content to their students (Ball & Forzani, 2010). Coined by Shulman in the mid-1980s, pedagogical content knowledge (PCK), involves interweaving pedagogy and content knowledge (Rosas & West, 2011; Shulman, 1987). This interweaving is captured in Grossman's (1991) four criteria to evaluate PCK:

1. The teacher understands why certain subject matter is important to teach and learn.
2. The teacher knows a range of teaching strategies and how to present different mathematical topics.
3. The teacher is aware of students' understanding and possible misconceptions.
4. The teacher knows the curriculum and the resources that can be used to help students grasp the content.

In an early study that used PCK, Fennema and Franke's (1992) model of mathematical knowledge for teaching comprised four components: content knowledge, pedagogical knowledge, knowledge of students' cognition, and the teachers' beliefs. The dynamic interplay among the four components determined the teacher actions within the classroom context. Importantly, this teacher knowledge is not considered static, but changes and adapts through

experience and interactions with the students. For example, building knowledge about possible student misunderstandings can be strengthened by teacher noticing and listening to students during classroom activities (Petrou & Goulding, 2011). Consequently, recognising possible areas of misunderstanding enables teachers to help the students self-correct if they have made a mistake and learn from their mistakes (Ball & Hill, 2009). PCK will also help a teacher know how to answer students' questions as well as how to pose effective questions to students (Kilic, 2011).

For PSTs, developing PCK involves exploring a range of techniques, resources, and learning activities for a particular topic (e.g., where it is best to use hands-on methods, when it is best to use video clips, etc.) (Gerber, 2012). The use of a range of strategies for teaching helps to keep students engaged, which is vital for helping students learn mathematical content (Ball & Forzani, 2009; Hiebert & Stigler, 2009). Twenty plus years on, Fennema and Franke's suggestion of dynamic interaction in generating PCK is reflected in the growing move towards practice-based pedagogies and increased school-university partnerships within ITE (Anthony, 2018; Zeichner, 2012). In the context of this study, we would expect that opportunities for PSTs to develop PCK might be situated within the practicum experiences.

Aligned with the view that teachers who are successful have sound PK and PCK as well as CK (Hudson, 2009; Murphy, Neil, & Beggs, 2007; Toh et al., 2013), researchers (e.g., CBMS, 2001; Darling Hammond, 2000; Rosas & West, 2011) emphasise the need for ITE to provide courses that develop PSTs' PCK in mathematics. More recently, in response to calls to support PSTs to learn the work of ambitious mathematics teaching (Anthony, Hunter, Hunter, & Duncan, 2015), many mathematics education researchers advocate practice-based ITE reforms that teach PSTs how to do teaching rather than just simply talk about teaching (Anthony & Hunter, 2012; Ball et al., 2009; Ball & Forzani, 2011; Hlas & Hlas, 2012; Lampert, 2010). They argue that teachers are more likely to advance student learning if they can skilfully enact a specific set of core practices that underpin ambitious teaching. In the U.S., Grossman, Hammerness, and McDonald (2009) led this move, arguing that the focus of ITE curriculum shift from what teachers need to know towards a curriculum "organized around core practices, in which knowledge, skill, and professional identity are developed in the process of learning to practice" (p. 274).

Although researchers in the field of teacher education propose slightly different definitions of what constitutes a high-leverage practice, all definitions share these characteristics (Grossman et al., 2009, p. 277):

- practices that occur with high frequency in teaching
- practices that novices can enact in classrooms across different curricula or instructional approaches
- practices that novices can actually begin to master
- practices that allow novices to learn more about students and about teaching
- practices that preserve the integrity and complexity of teaching
- practices that are research-based and have the potential to improve student achievement.

According to Anthony et al. (2015) practices identified as the key to the principles and vision of ambitious mathematics teaching—“most notably, pedagogical practices that place students’ mathematical thinking and reasoning at the centre of instruction and support equitable engagement of diverse learners in rich mathematical activity” (p. 6) include: teaching towards an instructional goal; eliciting and responding to students’ mathematical reasoning; orienting student to each other’s’ ideas and to the mathematical goal; setting and maintaining expectations for student participation; positioning students as competent; assessing students’ understanding; and using mathematical representations.

3.2.4 Saudi definitions of preparedness for pre-service teachers

In considering different components of teacher knowledge, this study will explore which components Saudi PSTs regard as important for defining their perceptions of preparedness. In Saudi Arabia, the NCAAA’s (2013) framework of teaching standards specifies that effective teachers should have professional knowledge that includes knowing how to plan quality lessons, how students learn, and how to use resources appropriately in order to support student learning. This is known as “planning for learning” and covers:

- knowledge of children/students and how they learn,
- basic literacy and numeracy skills

- the central concepts, including methods of inquiry and structures of the discipline
- general pedagogy
- learning program design.

According to the Saudi professional standards for mathematics teachers (NCAHE, 2017), PSTs should acquire knowledge of learning and teaching methods for mathematics and its techniques. This knowledge is developed through:

- identifying the elements of mathematical CK (concepts, relationships, and skills) and how to analyse, teach, and evaluate them;
- efficiently using the methods and strategies of teaching mathematics that suit the specific stages
- recognizing the skills of mathematical thinking and methods of developing and teaching them;
- recognizing the learning theories related to the learning and teaching of mathematics and its applications; and
- using modern techniques in the learning and teaching of mathematics . (p. 37)

3.3 Issues and controversies

Although the issue of teacher preparation is complex and multifaceted, the solutions that have dominated reforms in teacher preparation have been less subtle. In developed nations, such as the US, broad-brush solutions tend to focus on outcomes and results by looking at student and teacher performance on standardized assessments (Kraut, 2013). However, this trend towards outcomes based teacher education—part of a more general tendency towards defining education accountability more broadly (Cochran-Smith, 2006)—ignores the complexity of ITE, particularly as it relates to the long-standing practice-theory divide scenario. As Marshall and Smith (1997) caution “the preparation of teachers is anything but simple, and the gap between the institution that teaches them and the institution where they must teach is anything but healed” (p. 267).

Currently, the practice–theory divide is marked in Saudi Arabia—with a wide gap between theory, as taught in the ITE courses, and practical application in the classroom. The focus of the university is on pedagogical theory and content knowledge, whereas the school community puts a higher value on practical skills such as classroom management (Alzaydi, 2010). In a

study of Saudi ITE provisions, Alaqail (2005) noted that PSTs were not able to apply the theories they learned because of the teaching methods used in the university itself, which tends to depend on rote learning¹.

In relation to the preparation of mathematics teachers, researchers have noted other shortcomings in ITE, not only in Saudi Arabia but also in other countries around the world. For example, *The Mathematical Education of Teachers II* (MET-II) (Conference Board of the Mathematical Sciences (CBMS), 2012) report noted that although most secondary mathematics teachers (in the U.S.) have a major in mathematics in their undergraduate degrees, many of these mathematics courses focused only on mathematical skills and knowledge (e.g., Hilbert spaces or cryptography) needed for graduate study or careers in business. As such, debates concerning the provision of opportunities for “future teachers to learn the mathematics they need to know to be well prepared beginning teachers who will continue to learn new mathematical content and deepen their understanding of familiar topics” (CBMS, 2012, p. 5) are prevalent. The MET-II report concluded that secondary mathematics teachers do not merely need high-quality mathematics courses; they also need different kinds of learning experiences that help make connections between tertiary and secondary mathematics (Murray & Star, 2013).

Collectively, these controversies have gained sufficient momentum to the point that critics of ITE question the role of teacher preparation, and university based preparation in particular, as a key to teacher effectiveness. In the U.S., some policymakers advocate that a passing score on a test of subject matter knowledge and a background check are all that is needed to become an effective teacher. Believing that teachers will learn how to teach effectively ‘on the job’ alternatives to ITE embrace approaches that permit teachers with little or no training in pedagogy or child/adolescent development to be classified as “highly qualified”, if they pass a test of subject matter knowledge (e.g., a licensing exam) (NCATE, 2006). However, other studies refute this idea claiming, “licensure test performance is clearly not a silver bullet” (Goldhaber, 2006, p.31). Clearly, developing a more comprehensive system for assessing teachers and determining their preparedness to enter the classroom is an open issue for exploration and debate (NCATE, 2006).

¹ This problem of the university putting heavy emphasis on theory rather than focussing on the needs of the workplace is not unique to the area of ITE; it has been noted in other areas of tertiary education in Saudi Arabia, such as accounting.

One way forward is to develop research-based evidence into teacher preparation. As noted by Cochran-Smith (2006) the field needs to invest in “the development of multifaceted research approaches that pose a range of questions, incorporate multiple research paradigms, and define student learning outcomes in ways much broader and richer than test scores” (p. 25). While the current tendency in teacher preparation in developed countries is to embrace clinical models and value-added or outcome-based assessment measures (Zeichner, 2012) many researchers in this field agree that the focus should include curriculum content and PSTs’ experiences and knowledge (Cochran-Smith, 2006; Kraut, 2013).

As part of this research agenda it is important that the PSTs themselves and their feelings about preparation should not be overlooked. While several studies have indicated a relationship between feeling prepared and an increased sense of teaching efficacy (Anderson & Stillman, 2013; Brown et al., 2015; Caires et al., 2012), the PSTs’ voice is notably absent in debates about teacher preparation. This present study aims to help resolve some of these controversies and address the knowledge gap about teacher preparedness and PSTs’ perspectives on this topic.

3.4 Self-efficacy

Teacher efficacy is highly relevant to the study of teacher preparedness, with previous research finding a close link between teacher efficacy and teacher effectiveness (Kraut, 2013). In most studies, efficacy measures feature as the typical form of measuring preparedness (e.g., Carter, 2006; Darling-Hammond et al., 2002; Knoblauch & Woolfolk Hoy, 2008; Schlette, 2006; Hoy & Spero, 2005; Zientek, 2007). For example, Clark (2009) claimed that beginning teachers’ feelings of preparedness and associated teaching efficacy are important indicators of how they will be able to cope with the daily challenges of the classroom and how successful they will be in their teaching careers. Likewise, Darling-Hammond et al. (2002) found that the strongest predictor of PSTs’ sense of preparedness was a sense of efficacy. Others have assessed levels of confidence, which is part of efficacy, as a measure of PSTs’ preparedness (Giallo & Little, 2003; Hudson, 2011; Kessell, Wingenbach, & Lawver, 2006).

3.4.1 Theoretical framework

Efficacy, also referred to as self-efficacy, is defined as a belief “in one’s ability to organize and execute the courses of action required to produce given attainments” (Bandura, 1997, p. 2).

Bandura (1977, 1997) stressed that efficacy is a subjective measure, as self-efficacy is not based on one's actual ability to carry out a task but rather it is a personal, individual perception of the ability to complete a task.

Considered the most powerful of all human characteristics, efficacy beliefs are “a major basis of action” (Bandura, 1997, p. 3). A sense of efficacy influences our inner beliefs about ourselves and our abilities, such as our mental resources, motivation, and the ability to act and/or control events (Bandura, 1997). Put simply, a sense of efficacy impacts how we think about ourselves and what we are able to do (Clark, 2009). Persons with high level of self-efficacy are more likely to have self-beliefs such as “I am good at what I do”, “I am able to overcome challenges and obstacles”, “I have the skills and characteristics needed for success”, and “I can make a positive difference”. In contrast, persons with low levels of self-efficacy are more likely to have self-beliefs such as “This problem is too hard”, “I can't make a difference”, and “It's beyond my control”.

Teacher/teaching efficacy—a set of self-beliefs teachers have that help them control their thoughts, feelings, and actions in the classroom—can be regarded as a subset of general self-efficacy (Stripling, Ricketts, Roberts, & Harlin, 2008). The concepts are linked, in that it is highly unlikely that a person with low general efficacy will have a high level of teaching efficacy. However, a person may have high levels of overall self-efficacy but a low level of teaching efficacy. Teacher efficacy has been used to measure a teachers' belief about their own effectiveness (Yilmaz, 2011); their ability to create a productive learning environment and or produce positive learning outcomes (Stripling & Roberts, 2013); and their capability to organize and execute courses of action required to successfully accomplish a specific teaching (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). For example, studies on specific aspects of teacher efficacy include the ability to engage their students in learning (Clark, 2009; Flegg, Mohamed, & Trimmer, 2013; Ross & Bruce, 2007), classroom management philosophies and strategies (Flegg et al., 2013; Lazarides, Buchholz, & Rubach, 2018; Oakes, Lane, Jenkins, & Booker, 2013; Tsouloupas, Carson, & Matthews, 2014), choice of alternative methods of teaching and assessment (Eckert, 2013; TaTar & Buldur, 2013), and organisational ability (Ross & Bruce, 2007). For each of these aspects, Tschannen-Moran and Hoy (2001) stressed that teaching efficacy is necessarily a subjective measure—a teacher's sense of competence—rather than an objective measure of actual competence.

Several researchers (e.g., Eckert, 2013; Tschannen-Moran & Hoy, 2001) have distinguished two separate but related constructs of teacher efficacy: (1) personal teacher efficacy (PTE) as a measure of how confident a teacher is in her ability to teach successfully, and (2) general teacher efficacy (GTE) defined as a teacher's confidence in her ability to encourage learners to be successful. Table 3.2, adapted from Eckert (2013), illustrates key differences between PTE and GTE.

Table 3. 2. Differences between PTE and GTE (adapted from Eckert, 2013, p. 77).

Personal Teacher Efficacy (PTE)	General Teacher Efficacy (GTE)
Self-belief statement: "I can do it"; "I have what it takes".	Self- belief statement: "My teaching makes a difference to my students' learning".
Measures how confident a teacher is in her ability to teach successfully (communicating ideas, managing the classroom, organisation, etc.)	Measures outcomes and/or outcome expectancies
Ability to plan and carry out lessons, follow a management plan, and perform day-to-day teaching duties	Confidence in the ability to produce measurable successful outcomes from students regardless of the students' situations
Concerns only a specific teacher and her individual personal abilities	Teachers with high GTE believe that they have a high degree of control over student outcomes such as student test scores and ability to complete homework, as well as over her own teacher evaluations
Not related to student outcomes	

Bandura (1977, 1994), the researcher who introduced the concept of efficacy, proposed four sources of influence: mastery experience, vicarious experience, social persuasion, and physiological state. In ITE setting, a mastery experience may occur when a PST undertakes a task in a realistic situation (e.g., practicum). Successful execution of the task would allow them to develop confidence. The second source is vicarious experience, where a PST watches others demonstrate an activity or situation to understand how it may be executed, such as would happen in practicum with an expert teacher. With social persuasion, a PST can increase her confidence from the messages received from others (e.g., student feedback can boost the teacher's confidence). The last influence is physiological state, namely physical and emotional

factors like stress, anxiety, and mood, which can affect how confident a person feels. These sources can act in isolation or in combination and involve personal judgments of the relative importance of the factors (e.g., what makes teaching difficult or not and personal assessments of one's own teaching skill) (Çakiroglu, Çakiroglu, & Boone, 2005). Further constructs (although not all related to PSTs) associated with self-efficacy highlighted by studies (e.g., Brown et al., 2015; Darling-Hammond et al., 2002) include the level of student achievement and motivation, sense of responsibility for student achievement, effective classroom management strategies, having more time available for academic instruction, and teacher retention rates.

Other theorists link teaching efficacy—especially as it related to one's sense of responsibility for student outcomes—to 'locus of control' theory. Initially developed by Rotter (1966), locus of control is an individual's expectations about the results of their actions, behaviours, and choices. Determining the locus relates to one's tendency to evaluate any given situation based on one's own actions, abilities, characteristics, and behaviours. Those with an internal locus of control see themselves as being responsible for the events they face: what happens to them is a result of their own choices and actions. Those with an external locus of control see what happens to them as being the responsibility of some force or factor outside themselves, such as luck, destiny, or the actions of others (Solmus, 2004). Teachers with an internal locus of control are more likely to act on their sense of responsibility and check up on students' successes and failures, and modify their behaviour accordingly (Aktas, Kurt, Aksu, & Ekici, 2013; Kurt, 2013). They are more likely to be motivated to try new methods, develop better ways of interacting with students and improve their teaching skills—all of which are hallmarks of a teacher with high levels of efficacy. Teachers with a more internal locus of control are more likely to take responsibility for students' success, classroom behaviour, and motivation (Adu & Olantundun, 2007; Akiri & Ugborugbo, 2009; Hoy & Spero, 2005). However, teachers with an external locus of control who believe that a student's success or failure lies within the student (e.g., whether the student is bright or slow, lazy or motivated), or in the student's situation (family or community), are less likely to make the effort to teach in a way that will improve student outcomes (Flegg et al., 2013).

Several studies have suggested that PSTs' efficacy is likely to be strongly influenced by their ITE and practicum experience (Aydin & Woolfolk Hoy, 2005; Darling-Hammond, 2005; Pendergast, Garvis, & Keogh, 2011; Hoy & Spero, 2005), practicum being advanced as the

most significant factor (Hoy & Spero, 2005). Aydin and Woolfolk Hoy (2005) identified significant practicum factors as follows: (a) the relationship between the PST and the mentor supervisor; (b) the level and quality of support from the cooperating teacher and the school as a whole as well as the supervisor from the university; and (c) the number of times the PST went on a practicum. These sources of development are discussed further in Section 3.5.

Although teaching self-efficacy is an important concept, the definition of teaching efficacy is still open to further refinement, and there is still much to be learned about how teachers develop efficacy (Brown et al., 2015), particularly in the context of ITE experiences. This present study will make a contribution to this branch of the literature.

3.4.2 Importance of teacher efficacy

Self-efficacy influences the choices people make, how much effort they put into certain activities, and how long they will persevere in order to accomplish tasks (Bandura, 1997; Clark, 2009; Goddard, Hoy, & Woolfolk Hoy, 2004; Stripling & Roberts, 2013). Importantly for those who are concerned about education, teacher efficacy has been found to have a profound influence on a teacher's ability to teach effectively (Brown et al., 2015; Jamieson-Proctor & Finger, 2006; Tschannen-Moran et al., 1998). Put simply, if a teacher believes they have the resources and ability to succeed, the higher their chances of success will be.

In terms of perceptions of preparedness, measures of self-efficacy in general, and teaching self-efficacy in particular, are key constructs influencing teacher quality and how effective a teacher is within the classroom (Brown et al., 2015). One reason that self-efficacy is regarded as a strong predictor of teaching quality is its link with the level of effort that teachers put into their work (Flegg et al., 2013; Stripling & Roberts, 2013). Studies have found that high effort results in better performance and outcomes such as student engagement (Bruce, Esmonde, Ross, Dookie, & Beatty, 2010; Goddard et al., 2004), and creates a feedback loop that continues to build or reaffirm efficacy (Cantrell, Almasi, Carter, & Rintamaa, 2013; Hudson, 2011; Skaalvik & Skaalvik, 2010; Tschannen-Moran & Hoy, 2001). In the context of ITE, Pendergast et al. (2011) compared the self-efficacy of PSTs at the beginning and at the end of their practicum experiences and found that teachers with a high sense of efficacy were more resilient in their teaching and tended to try harder to help all students reach their potential.

Longitudinal studies have also linked teacher efficacy to overall career trajectory. For example, researchers have found an association between measures of teacher efficacy and stress levels

and motivation to try new ideas (Cheon, Reeve, Lee, & Lee, 2018; Shidler, 2009; Skaalvik & Skaalvik, 2010; Tschannen-Moran & Hoy, 2001; Tschannen-Moran et al., 1998). Research focused on retention, for example, have found teacher efficacy to influence enthusiasm for teaching, rates of burnout and overall job satisfaction (Caprara, Barbaranelli, Borgogni, & Steca, 2003; Caprara, Barbaranelli, Steca, & Malone, 2006; Oakes et al., 2013).

An important consideration for this study is whether teacher efficacy—and the link to effective teaching, student performance, and career satisfaction—is a cross-cultural phenomenon. A large-scale cross-national study involving 73,100 teachers in 23 countries by Vieluf, Kunter, and van de Vijver (2013) found that teacher efficacy was positively correlated with characteristics of effective teaching and job satisfactions across countries. Indeed, Khoury-Kassabri's (2012) examination of 30 Arab schools found that teachers with lower reported self-efficacy had a higher incidence of using verbal or physical violence as a classroom management practice. Given that corporal punishment in schools has recently been outlawed in Saudi Arabia at all levels from secondary school to early childhood centres as part of a movement aimed towards limiting violence to children (Alanazi, 2008; Owen, 2013), this makes the exploration of pre-service teaching efficacy all the more pressing.

Collectively, these studies (e.g., Shidler, 2009; Skaalvik & Skaalvik, 2010; Tschannen-Moran & Hoy, 2001; Tschannen-Moran et al., 1998) indicate the importance of the role of teacher efficacy. This suggests that it is a useful measure to consider when evaluating teacher quality. Moreover, given the emergent findings that suggest efficacy is important for teachers in all cultural contexts, the review affirms the timeliness for exploration of efficacy within the present study of PST preparedness in Saudi Arabia.

3.4.3 Efficacy of pre-service and beginning teachers

The efficacy of PSTs and beginning teachers has been the focus of a number of studies—to date, mostly conducted in a Western education system. In the context of accountability, studies in the west have used the construct of efficacy to compare and contrast ITE programs. For example, in the U.S. Darling-Hammond et al. (2002) explored the relationships between teachers' views of their preparedness and their sense of teaching efficacy in a comparison study of teachers who had received ITE through university-based programs and those who undertook these studies via alternative pathways. They noted that the strongest predictor of preparedness in beginning teachers was their sense of efficacy. Likewise, Tschannen-Moran et al. (1998) and

Kraut (2013) also found that teachers' sense of preparedness could be measured by their level of teaching efficacy.

In this literature review, PSTs' efficacy is explored through three constructs:

- (1) Expressed confidence as a teacher (related to PTE).
- (2) A sense of responsibility for their students' success or failure (influenced by both PTE and GTE).
- (3) Beliefs about the level of impact on students' learning (related to GTE).

3.4.3.1 Pre-service teachers' confidence for teaching

Educational reviews (e.g., House of Representatives Standing Committee on Educational and Vocational Training (HRSCEVT), 2007; Masters, 2009; Victoria. Parliament. Education and Training Committee (VPETC), 2005) consistently present feelings of confidence as an important component of efficacy for teacher graduates, with Giallo and Little (2003) explicitly linking confidence measures to PSTs' perception of preparedness. Studies (e.g., Cripps Clark, & Walsh, 2002; Murphy et al., 2007) have claimed that teachers who are confident about their content and pedagogical knowledge are more likely to be effective teachers.

However, while many studies conflate the constructs of efficacy and confidence, it is important to note that efficacy and related measures of confidence about one's own ability cannot objectively measure skills, motivation, and knowledge (Depaepe & König, 2018; Lane, Lane, & Kyprianou, 2004). For PSTs, in particular, who have limited experience of teaching, one could argue that their efficacy beliefs are largely based on their predicted confidence.

Like efficacy studies, researchers have found that a teacher's confidence in their ability to teach is correlated to their actual teaching ability in the classroom (De Nobile, 2007; Jamieson-Proctor & Finger, 2006), as well as student performance (Dawson, 2008; Hudson, 2009). However, in studies that consider both experienced teachers and less experienced teachers, it has been found that experienced teachers are more likely to have stronger efficacy beliefs, expressed as confidence, but less experienced teachers (e.g., beginner and PSTs) are more likely to have lower levels of confidence (Tsouloupas et al., 2014).

While studies provide a range of survey type instruments to measure PSTs' confidence (Hoy, 2000; Kessell et al., 2006), there is less discussion about how ITE can build PSTs' confidence

(Hudson, 2009). There is, however, agreement that ITE courses that help PSTs develop sound curriculum and pedagogic knowledge, as well as the chance to practice their skills will also develop confidence (Dawson, 2008; De Nobile, 2007; Jamieson-Proctor & Finger, 2006). Moreover, studies (e.g., Carter 2006; Clark, 2009; Clark, Byrnes, & Sudweeks, 2015; Darling-Hammond et al., 2002; Hudson, 2009; Kee, 2012; Hoy & Spero, 2005; Zientek, 2007) unanimously identify the practicum experience as a significant influence related to PSTs' confidence (discussed further in Section 3.5.2). As noted by a student in Hudson's study:

[Practicum] experience with a year 7 class and then a year 8 class... gave me the confidence to know that I have the knowledge and I can develop the rapport to teach students in the middle years of learning. It increased my confidence because I had the opportunity to gain experience and link what I had been learning at university to the classroom. (p. 6)

Having sound teacher knowledge has also been reported as strongly linked to PSTs' confidence. Tarman's (2012) study of PSTs' beliefs and perceptions of teaching in the U.S. found that those who had strong content knowledge were more confident in their ability to teach and tended to believe that all they needed to become good teachers was some additional teaching strategies. In contrast to sound content knowledge, perceived 'gaps' in content knowledge has been found to engender lack of confidence for beginning teachers. For example, in Rodie's (2011) study, beginning teachers who had concerns about the subject content felt less confident about standing and speaking in front of a class. Similar findings about confidence to stand in front of a class or make decisions and teach in the moment have been highlighted in studies from Saudi Arabia. For example, Alghamdi (2015) in arguing for the importance of learning how to act as independent practitioners claimed that that the practicum provisions (3 weeks in her study) was not long enough to help PSTs develop feelings of confidence and efficacy. Some of the science PSTs in Alghamadi's study expressed frustration with and a sense of being overwhelmed by the amount of information they were exposed to in such a short amount of time. As a consequence it was conjectured that these feelings contributed to PSTs' low levels of efficacy. This study concluded that it is vital for Saudi ITE to help PSTs increase their self-confidence and self-efficacy.

3.4.3.2 Ability and responsibility to impact students' learning

Teacher efficacy reflects a teacher's belief in their ability to influence students' learning. As noted by Brown et al. (2015) and Henson (2001), the presence or absence of the belief that one is able to have a positive impact on student learning is crucial in determining whether a teacher is successful or not.

Strengthening teachers' levels of personal teacher efficacy (PTE) can support general teacher efficacy (GTE). For example, a teacher who is confident in their content knowledge and pedagogical content knowledge (an aspect of PTE) is more likely to believe that they can have a positive impact on their students' learning (GTE) (Cripps Clark, & Walsh, 2002; Hudson, 2011). This may be particularly relevant to PSTs and beginning teachers, as Darling-Hammond (2006) found that teacher graduates who felt well prepared were more likely to believe that they have a greater impact on student learning than the students' peers, family, and home environment—high levels of GTE efficacy.

Some studies (e.g., Brown et al., 2015; Bilali, 2013; Darling-Hammond et al., 2002; Tschannen-Moran & Hoy, 2001) discussed teachers' sense of efficacy based on three facets of effective instruction, namely student engagement and motivation, teaching strategies, and classroom management. Confidence in one's ability to help students be motivated to learn and to become involved in the learning process (Brown et al., 2015) relates directly to students' level of engagement. Morris (2010) found that efficacy relating to student engagement was able to predict how well a teacher was able to engage struggling learners, motivate students, and use effective methods of teaching and assessment. Likewise, Wolters and Daugherty (2007) and Tschannen-Moran and Hoy (2001) found that teachers who believed in their ability to inspire and support students were usually able to motivate their students and tended to focus on creating an engaging learning environment. In addition, Cheung (2008) found that teachers with a high sense of efficacy tended to be more proactive in meeting the needs of students.

The link between a sense of efficacy and the ability of teachers (including PSTs) to use a range of teaching strategies that enhance learning has been explored by several studies. Dibapile (2012) found that teachers with high efficacy were more able to plan and carry out teaching strategies that helped improve student performance. A sense of efficacy tends to influence the amount of effort put in by teachers in planning lessons and developing activities that promote student success (Lin & Gorrell, 2001). Teachers who use a range of teaching strategies are more likely to be effective in assisting student understanding (Alqahtaniet al., 2016; O'Neill &

Stephenson, 2012a; Lin and Gorrell, 2001), ultimately leading to improved efficacy. However, in studies that have investigated PSTs' perceptions of teaching efficacy PSTs expressed less confidence regarding student engagement. For example, Bilali's (2013) study of teacher efficacy noted that even though most of the PSTs expressed high levels of efficacy regarding use of teaching strategies, they had a lower sense of efficacy regarding student engagement, particular their ability to provide alternative explanations. Similarly, Poulou (2007) found that although PSTs felt confident about their teaching ability they were less confident about their ability to challenge and engage more able students.

Competency in using teaching strategies that promote student engagement has been linked to teachers' belief that they can manage student behaviour, organise the classroom, establish routines, and run activities smoothly (O'Neill & Stephenson, 2012a; Tschannen-Moran & Hoy, 2001). The impact of self-efficacy in classroom management on teacher efficacy is significant. Boni (2014), in a U.S. study, found that classroom management had the greatest influence on the PSTs' sense of self-efficacy and feelings of preparedness to teach. For example, PSTs in Biza, Nardi, and Joel's (2015) study reported that focusing on behavioural management makes it difficult for them to engage students with mathematical challenge and metacognitive discussions. Typically, studies note that beginning teachers and PSTs express concerns about their classroom management skills. For example, Anthony et al. (2008), in New Zealand, noted that classroom management issues were to the fore of concerns for many secondary beginning teachers. Similarly, Cabaroğlu (2012), in Turkey, found that secondary PSTs, before and after the practicum, were greatly concerned about their ability to manage the classroom and establish good communication with students. However, this is not always the case, Sivri and Balcı (2015), also in a Turkish study found the Primary PSTs tended to believe that they were capable of managing the classroom effectively (indicating a high level of self-efficacy for classroom management).

It must be noted that a belief in the ability to influence student learning outcomes is not fixed. For example, Hoy and Spero (2005), investigating changes in efficacy of beginning primary teachers, reported an increase in efficacy during ITE followed by a significant decline in efficacy in the first year of teaching. In a contrasting finding, Schlette's (2006) investigation of the perceptions of PSTs and beginning teachers regarding their ability to influence student behavior found that first-year teachers' efficacy in this regard was higher than PSTs. In a third scenario, Haigh and Anthony's (2012) study found that newly qualified teachers' sense of

efficacy remained the same across the first 18 months of teaching and these ratings of efficacy were closely aligned to their ratings on graduation.

General teaching efficacy (GTE) concerning a teacher's sense of responsibility for student outcomes (Alnabhan, Al-Zegoul, & Harwell, 2001; Tschannen-Moran & Hoy, 2001) is another important component of teacher efficacy. According to Guskey (1987), the relationship between efficacy and a sense of responsibility can be defined by whether the teacher is considering past or future outcomes. For PSTs, with less classroom experience and responsibility, efficacy beliefs will be formed from a different set of experiences than practicing teachers, which may impact their ability to build confidence. Chen and Brown (2013) suggest that PSTs' sense of responsibility can be evaluated by investigating their locus of control (see Section 3.4.1). In the locus-of-control framework, responsibility considers the extent to which teachers see themselves, rather than external factors, as the cause of student outcomes (Lauermann & Karabenick, 2013). However, having an internal locus of control (the belief that one is able to do something and influence the outcome) may not always imply a sense of obligation to carry out the actions that one feels capable of doing. For PSTs in particular, it may be possible to express high efficacy and an internal locus of control but not feel any obligation to act in a particular situation (Lauermann & Karabenick, 2013).

These interplays highlight that locus of control, responsibility, and efficacy are linked but not necessarily identical (Flegg et al., 2013). For example, a teacher with high efficacy may lean towards an external locus of control, particularly regarding student failure. Indeed, many researchers have found that some efficacious teachers express responsibility for students' successes but not failures (Akbaba-Altun, 2009; Kurt, 2013; Tschannen-Moran & Hoy, 2001). These teachers point to the significant influence of family and other social factors on student outcomes, arguing that social issues of poverty, violence, etc. will impair students' ability to succeed. The idea that a teacher can take responsibility for a student's success but not necessarily their failure also allows for input via the students' own efficacy and locus of control. Kurt (2013), in a study of Turkish science teachers' responsibility beliefs for student academic successes and failures, found that the majority of teachers felt that they should not be held responsible for student failure. They noted that a teacher may do their best to provide interesting and engaging lessons but if a student chooses not to engage (e.g., they skip class or decides to ignore the teacher) some of the responsibility for non-engagement rests on the student. Further blurring of the relationship between efficacy and external locus of control can be seen with

teachers who feel responsible for a student's failure. For example, a teacher with low efficacy might feel that they need to refer difficult students to support classes because they cannot adequately support the student. Alternatively, in an effort to support failing students a teacher may choose to stay with traditional teaching methods rather than risk failure by trying something new.

The distinction between personal teacher efficacy (PTE) and general teacher efficacy (GTE) is also relevant in the context of responsibility. Higher PTE may help a teacher to continue to act in a way that is consistent with high efficacy overall, even though that teachers' GTE may have been lowered by student failure. However, a teacher's GTE is more likely to be enhanced by student success. This may explain why beliefs that a teacher is responsible for a student's success but not failure may be more prevalent in experienced teachers (Ekici, 2012a, 2012b; Kurt, 2013) than in PSTs.

Cultural norms and religious beliefs may also influence a teacher's locus of control and thus their sense of responsibility—a point of interest for this current study. Çakiroglu et al. (2005) compared the efficacy of pre-service primary teachers from Turkey with U.S. pre-service primary teachers. While both groups mostly agreed that the teacher is responsible for ensuring that students learn the curriculum content, the Turkish PSTs were more likely than their American counterparts to agree that good teaching could overcome inadequate background knowledge on the part of the student, and to agree that the teacher is generally responsible for how well their students achieve. However, the study also revealed that the American PSTs had higher efficacy regarding their ability to influence student learning than their Turkish equivalents. This led the researchers to conjecture that the different cultural perspectives, the content of the ITE courses, and the personal characteristics of the PSTs might have influenced their efficacy beliefs.

3.5 Pre-service teachers' perceptions about preparedness

Perception involves “a complex system of ideas, feelings and desires, not necessarily well articulated or coherent” (Wolfolk, 1987, p. 105) based on previous knowledge and experiences. A “highly individualistic phenomenon” (Gutkin & Reynolds, 1990, p. 109), self-perception refers to how an individual perceives herself in specific contexts (Rodie, 2011). In this study, self-perception is referenced to the ideas, thoughts, and feelings that PSTs have about what it

means to be a good mathematics teacher and about their own level of preparedness, and their assessment of their levels of teaching efficacy.

While PSTs' perceptions about their state of preparedness can be viewed as an indicator of what PSTs know about mathematics and its teaching at respective points in their ITE (Lim, 2011), studies have also found that PSTs' perceptions of their preparedness may well influence their actual ability to teach. Darling-Hammond et al. (2002), for example, found that PSTs' perceptions of preparedness related to their sense of efficacy about whether they are able to make a difference in student learning and their confidence about their ability to achieve teaching goals. Moreover, studies (e.g., Brown et al., 2015; Clark, 2009; Darling-Hammond et al., 2002; Kraut, 2013; Tschannen-Moran et al., 1998) suggest that perceptions of preparedness and efficacy influence each other through feedback loops. For example, if a teacher believes that her teaching has been successful this will help create a sense of high efficacy. The high sense of efficacy will then serve to create an expectation that future classroom performance will be successfully. Conversely, if a teacher believes that her classroom performance has been ineffective, this will lead to feelings of low efficacy beliefs and expectations that future classroom performances will also be ineffective (Brown et al., 2015).

3.5.1 Pre-service teachers' beliefs about preparedness

"Human factors such as beliefs have a significant influence on teacher behaviours, and consequently their preparedness" (Gill & Dalgarno, 2008, p. 331). Therefore, we must explore what PSTs consider preparedness to mean as understandings of preparedness will influence one's rating of how prepared and efficacious one feels. For example, Kraut's (2013) investigation of how pre-service middle and secondary English teachers in the U.S. define preparedness to teach revealed that the phenomenon meant different things to different groups of PSTs. For some, feeling prepared to teach meant having appropriate knowledge and skills, being in possession of teaching strategies, tools and qualities, and/or having confidence in one's ability to teach and being mentally prepared to teach. PSTs were also aware of the need to be able to deal with the political and administrative elements of teaching, and of being open to the potential of the collaborative nature of teaching (e.g., the development professional learning teams or simply the ability to get along well with colleagues in the staffroom).

While many studies claim that teachers' beliefs about teaching and learning influence their instructional practices (Fives & Buehl, 2008; Grootenboer, 2008; Lavy & Shriki, 2008), fewer have considered teachers' beliefs about the knowledge, skills, and attributes they need as part

of their preparation for becoming a teacher (Buehl & Fives, 2009; Leong, 2012). Beginning teachers' definitions/viewpoints of good teaching are highly likely to influence how they select and enact their methods of instruction and assessment practices (Chen & Brown, 2013; Mapolelo & Akinsola, 2015). However, some studies (e.g., McCoy, 2011; Stuart & Thurlow, 2000) report that PSTs portray, at least at the beginning of their teacher education, very narrow or simplified notions of what is needed to be a successful teacher, believing that teaching is merely a matter of transmitting knowledge and providing information. PSTs may also view knowledge as being absolute, and thus believe that their educators have all the answers, and that there is only 'one right way' to teach (McCoy, 2011).

In general, studies investigating the beliefs of PSTs have found that PSTs focus greatly on content knowledge, believing this to be most important component for effective teaching. For example, the beginning secondary mathematics teachers in Leong's (2012) U.S. study considered content knowledge to be more important than the teacher's personality in determining teacher quality, arguing that content knowledge was the best indicator of good mathematics teaching. Some participants explicitly linked content knowledge to feelings of confidence, arguing that being confident in mathematics helped them improve their lesson planning as they could concentrate on developing activities rather than re-learning the content to be taught. Other participants described how having strong content knowledge helped them explain concepts in a number of different ways and/or take a number of different approaches to problem solving. Similarly, Buehl and Fives (2009), again looking at the beliefs of American pre-service primary, middle, and secondary teachers, noted that content and pedagogical knowledge were identified as the two most important components for effective teaching.

However, in recent studies researchers have found that mathematics PSTs have a broader view of what it takes to be a successful teacher. For example, Dayal's (2013) study of Pacific Island pre-service secondary mathematics teachers found that this group defined good mathematics teachers in a number of ways, including preparedness, resourcefulness, thorough content knowledge, ability to structure lessons well, and the ability to use a variety of teaching methods. Participants also listed personal characteristics such as a caring or nice nature, approachability, a willingness to give students extra help or counsel, punctuality, and a desire to help students achieve good marks. Balatti and Rigano's (2011) study exploring PSTs' perceptions of good mathematics teachers found that PSTs mentioned a range of personal characteristics such as the ability to relate to students, good organisational skills, and communication skills. Other

attributes of good teachers listed by this study group included the ability to use creative and fun learning tasks, the ability to use real-life examples in teaching, and the ability to use student-centred teaching strategies. Likewise, an Australian study of secondary PSTs (Prescott & Cavanagh, 2006) cited both content and pedagogical factors (e.g., the ability to explain things clearly, the use of real-life examples, and the ability to maintain control within the classroom) as well as personal characteristics (e.g., enthusiasm and friendliness) as attributes of a good teacher. Interestingly, beginning secondary mathematics teachers in Leong's (2012) study broadened the focus from lists of skills and capabilities to include an explicit reference to high expectations of students.

Studies based in non-Western contexts provide evidence of both commonalities with the above studies and indications of cultural specificity. Chen and Brown (2013) investigating good teaching as defined by Chinese PSTs found that although PSTs defined a good teacher as one who cares for students, care was explicitly defined in terms of student outcomes and thoroughness in preparing students for exams. This curriculum and outcome-focussed definition of good teaching contrasts with the more relational notions of care found in Western contexts (see Walshaw & Anthony, 2007). A cross-cultural study (Bryan et al., 2007) involving PSTs from Western nations (Australia and the U.S.) and Asian locations (Mainland China and Hong Kong SAR) found both differences and similarities between the Western and Eastern perceptions of 'good teaching'. The Australian and U.S. teachers discussed teacher attributes such as enthusiasm and the ability to establish rapport with students, whereas the Asian teachers were more likely to discuss the ability to present clear explanations and to prepare and present lessons. Other interesting comparisons between and among the different cultures were also found that did not align to an East–West divide. Teachers from Australia, Mainland China, and Hong Kong considered sound content knowledge to be a vital characteristic of good teaching, whereas teachers from the U.S. made limited mention of this factor. Teachers from Mainland China were more likely to emphasise careful use of textbooks and anticipating possible areas that could confuse students. Teachers from the U.S. were much more likely to mention classroom management in their definition of good teaching than the other three groups. Despite these cultural differences, the study also revealed several characteristics that were considered to be hallmarks of good teaching in all four cultures, namely:

- the ability to communicate clearly and explain the topic and the goals of the lesson,
- the ability to use a variety of teaching strategies, and

- capturing students' interest, especially by making mathematics relevant to the student's daily lives and experiences.

Only one relevant study from Saudi Arabia was sourced concerning perceptions and definitions of effective teachers. Alqahtani et al. (2016), used a Likert-type scale to investigate female Saudi secondary mathematics and science teachers' perceptions. Teachers' responses included the following characteristics as being crucial for effective teachers:

- a caring nature (defined as demonstrating positive interpersonal behaviour)
- fairness and respect for students;
- dedication to teaching
- able to interact well with students
- enthusiasm and motivation
- reflection and self-evaluation
- classroom management (including organisation of the room and disciplining students)
- the ability to plan lessons well
- use of a variety of teaching strategies.

Differences in these study findings indicate the need for more research directed towards understanding PSTs' beliefs about the importance of teacher knowledge alongside other attributes. Of interest is whether the definitions of good teaching given by PSTs in Saudi Arabia in this study are similar to those of PSTs in other non-Western nations, or are closer to their counterparts in Western nations. These understandings will further our understanding of what kinds of knowledge Saudi PSTs regard as important in order to be a well-prepared teacher.

Although educational standards authorities and teacher education institutions agree that teacher knowledge and classroom management are hallmarks of teacher quality, variance can arise as to how these are to be achieved and measured. Uncertainty can lead to problems for ITE in claiming assurances that their teachers are adequately prepared. As pointed out by Lerman (2006), "if teacher education is about preparing students to be as good teachers as they can be,

it would be very useful to have a clear notion of what might be meant by good teaching” (p. 299).

3.5.2 Factors shaping pre-service teachers’ perceptions

Many factors influence PSTs’ perceptions of what preparedness to teach means as well as how well they themselves feel prepared to teach. Of interest for this study is the role that ITE plays in shaping PSTs’ feelings of preparedness and self-confidence. However, research studies (Bandura, 1977; Clark, 2009; Grudnoff, & Tuck, 2002; Sünger, 2007) note that the influence of ITE, especially when related to personal assessments of confidence and preparedness, are notoriously hard to measure. Feelings about one’s personal abilities fluctuate depending on current moods, emotional condition, physical state, and stress levels (Bandura, 1977). Moreover, personal assessments will be in a state of change during the continual process of ‘becoming’ a teacher (Clark, 2009; Sünger, 2007). This point is well made by Hoy and Spero (2005) and Clark (2009) who found that many PSTs’ feelings of efficacy or perceptions of self-confidence increased while studying but then levels of confidence and efficacy fell when these PSTs first entered the profession.

While the ITE courses and associated practicum experiences are key factors shaping PSTs’ perceptions of preparedness (Leong, 2012), factors such as their prior schooling experience, their motivation for choosing teaching as a career, other prior experiences (e.g., in the workplace), and personal factors such as personality, beliefs about mathematics, and general sense of self-confidence (Kraut, 2013; Leong, 2012) are also important. Understanding which factors shaping PSTs’ perceptions are within the control of education authorities suggests a practical application of the findings of this present study.

3.5.2.1 Prior experiences

PSTs’ prior experiences as a learner impact on their beliefs about teaching, learning, students, and the school system, even if they are unaware of these beliefs (Martin & Van Gunten, 2002). Clearly, formal schooling, and subsequent university study, contribute to one’s image of teachers and what they do (Goodwin, 2002). Indeed, numerous studies conclude that PSTs, at least in the first instance, are likely to base their classroom practices as much on their own school experiences as on the pedagogical theories learned during ITE (Balatti & Rigano, 2011; Dayal, 2013; Goodwin, 2010; Prescott & Cavanagh, 2006). For example, Goodwin (2010) reported instances where PSTs decided to use particular teaching strategies based on their own

experiences as a learner: “I know I was really helped by my teachers and I’d like to help others in the same way”.

However, the concern is that based on these prior experiences PSTs may enter ITE feeling as though they already know what teaching is all about (Jackson & Povey, 2014; Nolan, 2012). And, they have developed an idea of what mathematics teaching should look like by watching the people who taught them (Leong, 2012; McCoy, 2011). In mathematics education many current PSTs, be they in Saudi Arabia or elsewhere, experienced traditional-based teacher-centred instruction rather than reform-based pedagogies advocated in current curriculum documents. For example, PSTs in the U.S. study by Goodwin (2010) reported spending a lot of time memorizing facts and engaging in passive learning tasks rather than student-focussed active learning. PSTs in a study by Anthony et al. (2015a) reported limited exposure to group work associated with rich tasks and mathematical discourse. These findings are replicated in Saudi Arabia (Allamnakhrah, 2013).

Described by Lortie (1975) as the “apprenticeship of observation”, these prior experiences, if left unchallenged, can affect teacher preparation and feelings of preparedness (Rios, Montecinos, & van Olphen, 2007). Studies reporting PSTs’ inability to connect what they have learned in ITE to what they experience in the classroom as a teacher, note that beginning teachers often revert to methods that their own teachers used (Kraut, 2013). Darling-Hammond (2006) summed up the situation, stating that the problem of learning to teach “is complicated by the common experience virtually all adults have had of school, which creates strong views among PSTs and members of the community alike about what school and teaching are ‘supposed’ to be” (p. 35).

However, the beliefs of PSTs can be challenged, adapted, and changed within ITE. Studies in the ITE context (Aitken et al., 2013; Gowrie & Ramdass, 2012; Ogden, 2012; Suárez Flórez & Basto Basto, 2017) note the importance of PSTs being made aware of their prior beliefs so that they can build on this foundational knowledge more effectively and gain greater understanding of the knowledge and skills needed to be an effective teacher.

3.5.2.2 Initial teacher education

Although prior experience is a significant factor shaping the expectations and beliefs of PSTs, ITE can have a positive effect on the efficacy, self-confidence and preparedness of PSTs (Albayrak & Unal, 2011; Cheon et al., 2018; Clark, 2009; Dack, 2018; Darling-Hammond,

2006, 2010; Zeichner & Conklin, 2005). Upon graduation, PSTs who have been through well-structured courses feel more knowledgeable and prepared to teach; furthermore, their supervisors and employers are also likely to rate them as being adequately prepared to teach (Darling-Hammond, 2010). Elements of ITE design that have been found to positively impact on efficacy include modelling, feedback, and instruction (Darling-Hammond, 2006), providing opportunities to use and become familiar with digital technologies (Center for Teaching Quality (CTQ), 2013), and developing appropriate links between ITE and practicum schools (Darling-Hammond, 2006; Furlong, 2015; Levine, 2009; Le Cornu & Ewing, 2008; Zeichner, 2010).

Various elements of the ITE courses can shape PSTs' feelings of preparedness. In the study by Kraut (2013), PSTs noted that their feelings of preparedness to teach were influenced by their courses, the faculty, textbooks, research projects, and support from their peers. PSTs in Leong (2012) study reported that video analysis of a mathematics lesson, with a focus on knowing how to use different strategies in lessons, helped them feel prepared for their practicum. Similarly, Rodie (2011) found that PSTs felt that their teaching methods course had helped them feel more prepared in the areas of lesson planning and selecting appropriate teaching strategies.

Debates about the length of the course influencing PSTs' preparedness and feelings of efficacy remain unresolved. Housego (1990) found that a one-year teacher methods course was effective at increasing PSTs' feelings of efficacy and preparedness, especially in the areas of classroom management and lesson planning. Thompson's (2011) study involving PSTs studying at a Masters level found that these teachers felt very prepared to teach. However, these findings are not universal. The study by Rodie (2011) found that PSTs often found that time constraints were an issue. Borko et al. (1992) also found that the teaching methods course was unable to adequately support those mathematics PSTs who entered ITE within limited mathematical knowledge. Moreover, Darling-Hammond (2006) found that PSTs who had received high grades in their teaching methods courses did not always have high levels of efficacy. In other words, a PST may meet all the expectations of their instructors but they still may not have the feelings of preparedness and self-efficacy needed to teach well.

Studies in Saudi Arabia concerning ITE influence on preparedness report a number of negative findings. Almazroa (2014), in an attempt to develop a list of characteristics for professional development that are suitable for Saudi science teachers, found that ITE lacks intensity and that courses did not have enough time to cover the full range of knowledge and skills needed by teachers. A smaller study by Aljabber, (2002) focused on one ITE provider noted that the requirement that middle and secondary science PSTs complete only one short subject-specific teaching method course constrained PSTs ability to develop in-depth teacher knowledge.

3.5.2.3 Practicum

High-quality ITE is associated with programs that work closely with schools so that the connection between theoretical knowledge is integrated with classroom practice (Darling-Hammond, 2006; Wilson et al., 2001). In making this link, the practicum is regarded as an essential component of ITE (Tatto et al., 2012). The practicum experience provides opportunity for PSTs to apply what they have learned in their theoretical and content-related courses (Allen & Wright, 2014; Wilson, Floden, & Ferrini-Mundy, 2002) and give them the chance to try out new ideas, practice a range of instructional activities, use technology, create relationships, work with children with differing (mathematical) abilities (Flake, 2014), create respectful learning environments, assess student's mathematical skills and adapt the curriculum to fit the needs of all learners (Ball & Forzani, 2009).

Studies into how the practicum helps to shape PSTs' sense of preparedness typically focus on changes in beliefs and efficacy measures. Tarman (2012), for example, reported that PSTs regarded practicum as an opportunity to reflect on their understandings of what good or effective teaching involves. Other studies noted how practicum could have a positive effect on the PSTs confidence levels (Darling-Hammond et al., 2002; Kee, 2012; Zientek, 2007) or that practicum experiences increased PSTs' levels of teaching efficacy (Brown et al., 2015; Carter, 2006; Guyton & McIntyre, 1990).

However, simply requiring that PSTs complete a period of practicum may not be adequate for increasing a sense of preparedness and feelings of efficacy. Many studies affirm that the quality of the school-based experience is significant in shaping the perceptions of PSTs (Beck & Kosnik, 2002; LaBoskey & Richert, 2002). Of concern are those studies (e.g., Caires et al., 2012; Darling-Hammond (2006); Leung, Wong, & Wong, 2013; Wilson et al., 2001) that report PSTs' negative experience of practicum. For example, the PSTs in Kraut's (2013) study frequently reported that classroom management was a problem area. In addition to suggestions

for improvements in ITE courses themselves, calls for associate teachers or mentors to provide more demonstrations of good teaching practice (Brown et al., 2015; Rodie, 2011) and the need for more appropriate feedback—feedback that enables PSTs to grow as a teacher and learn from their experiences—are consistent across multiple studies (e.g., Brown et al., 2015; CTQ, 2013; Lim, 2011). Quality feedback is noted as particularly important for enabling PSTs’ sense of preparedness and efficacy to be based in reality (Knoblauch & Woolfolk Hoy, 2008).

Sufficient teaching time in the classroom was identified as an issue by PSTs across several studies. For example, PSTs in Hudson’s (2009) and Rodie’s (2011) studies reported that spending more time in the classroom would have helped them feel more confident and enable them to develop more strategies for teaching. However, in a Catch-22 situation, studies report that at times associate teachers are unwilling to give PSTs the opportunity to practice in the classroom, claiming that these PSTs lack readiness to teach or that they will disrupt the learning environment (Mitchell et al., 2010; Sinclair et al., 2006). Given that PSTs may struggle with classroom management and with lesson planning, especially in their initial practicum, (Hogan, 2011; Mitchell et al., 2010), these perceptions may be justified. However, the reluctance to allow PSTs an opportunity to teach must be overcome as this classroom experience is highly important in ITE for preparing the teachers of the future and helping them to be confident.

3.5.3 Pre-service teachers’ perceptions of their level of preparedness

Having established the desirability of PSTs being well prepared in terms of future teacher quality and efficacy effects, this section reviews a series of studies that explore PSTs’ perceptions of preparedness. The findings of these key studies, while all conducted in Western contexts, inform the design of the current study.

Jones (1998) produced some of the earliest research into perceptions of preparedness in ITE. His study compared the perceptions of PSTs who completed ITE with those who began teaching without completing an ITE. The study explored PSTs’ perceptions of their ability and preparedness to adapt the curriculum content, to apply a variety of teaching methods, to interact with school officials, parents and guardians, to develop lesson plans, to manage the classroom environment, and to understand the legal rights and responsibilities of students and teachers. The study concluded that although both groups of teachers perceived themselves to be prepared to teach content, those teachers who had completed an ITE were likely to perceive themselves as being more prepared overall—a finding that was replicated by Zientek (2007). Building on Jones’ study, Darling-Hammond et al. (2002) surveyed approximately 3000 beginning teachers

in New York City regarding their perceptions of their preparation for teaching, their beliefs and practice, and their plans to remain in teaching. This larger study found that PSTs who felt better prepared were more likely “to believe they could reach all of their students, handle problems in the classroom, teach all students to high levels, and make a difference in the lives of their students” (p. 15). In contrast, PSTs who felt underprepared were “more likely to feel uncertain about how to teach some of their students and more likely to believe that students’ peers and home environment influence learning more than teachers do” (p. 15).

Clark (2009), reporting on the overall sense of preparedness of elementary education PSTs and beginning teachers, noted some interesting differences. The PSTs stated that they felt mostly ‘well prepared’ regarding their general teaching knowledge and skills as well as (mathematics) content knowledge. However, beginning teachers felt less prepared and had a lower level of reported efficacy. Clark conjecture that this may be due to a mismatch between the teaching methods courses and the realities of the classroom. However, differences between graduating and beginning teachers’ perceptions was not observed by Moore-Hayes (2008). Focused on specific areas of classroom performance such as inclusion, classroom management, technology integration, and the teaching practicum as a way to measure PSTs and beginning teachers’ perceptions of preparedness, differences between PSTs’ and beginning teachers’ perceptions of their own preparedness to teach was not statistically significant.

Studies that have explored PSTs’ sense of preparedness across a range of curriculum areas (e.g., Darling-Hammond, 2006; Ogden, 2012) again confirm that the majority of graduates from the ITE felt adequately prepared to teach and rated the program as being effective at preparing them for their careers. However, many studies that note PSTs’ overall sense of preparedness to teach, have also identified that PSTs feel less confident about certain aspects of teaching. For example, in New Zealand, a large-scale study involving 855 secondary teaching graduates (Anthony et al., 2008; Kane & Fontaine, 2008) also found that ~87% of graduating secondary teachers felt well prepared or very well prepared to begin teaching. However, PSTs felt less prepared in assessment and monitoring of student progress, giving feedback, and using students’ results when planning, responding to students’ diverse needs, inclusive educational practices related to Māori, and communication and working with parents. Regarding the use of technology, this study found that although these PSTs felt prepared and confident in their ability to use technology to support student learning, they felt less prepared to use computerised systems and the internet to track students’ results or to encourage group

work. Rodie (2011), in research carried out in the Solomon Islands, found that PSTs felt that they had been generally well prepared but expressed less confidence in planning assessments, writing reports, communication with students and other teachers, standing up in front of the class, preparing teaching resources, and dealing with problem behaviours. Similarly, in the U.S., Koehler, Feldhaus, Fernandez, and Hundley (2013) found that the PSTs felt prepared regarding content knowledge, but felt less prepared about classroom management and meeting the psychological needs of their students.

While the literature search was unable to locate any studies exploring PSTs' feelings of preparedness of mathematics in Saudi Arabia, some have been carried out in other developing nations, such as Ghana (Agyei, 2012) and Kenya (Ng'eno, Githua, & Changeiywo, 2013). Common to these studies in developing countries was the findings that mathematics PSTs felt inadequately prepared to use digital technology when teaching mathematics. This was related to a lack of familiarity with technology or low accessibility and a lack of appropriate infrastructure. It will be interesting to discover whether the results of this present study will be similar to the findings of these two studies or not.

3.5.3.1 Knowledge for teaching and pre-service teachers' feelings of preparedness

In teacher education, numerous studies have investigated PSTs' levels of content and pedagogical content knowledge (e.g., Gowrie & Ramdass, 2012; Kajander, 2007; Kraut, 2013; Leong, 2012; Rodie, 2011). This section reviews the much smaller subset that explores the interplay between knowledge and feelings of preparedness in PSTs.

Of the limited studies, several point to the impact of confidence in mathematical content knowledge in shaping and/or predicting teachers' sense of preparedness (e.g., Clark, 2009; Lotan & Marcus, 2002). Secondary PSTs, in particular, are commonly found to feel more prepared and confident in their specialist subject content than they do with pedagogical knowledge (Anthony et al., 2008).

Studies have noted that PSTs who perceive themselves as poorly prepared were more likely to attribute this to a lack of content knowledge or pedagogical content knowledge, or both. For example, in a U.S. study, Rosas and West (2011) found that underprepared PSTs rated their preparedness in the area of mathematical content knowledge to be only adequate. Moreover, in Australia, Hine's (2015) exploration of primary and secondary PSTs noted that 60% of upper primary and middle school PSTs felt unconfident about their levels of content knowledge. This

reflects the trend that primary and intermediate teachers, rather than with specialist secondary teachers are concerned about levels of mathematical content knowledge (Lim, 2011).

Some of the studies of teacher preparedness and mathematical content knowledge have pointed to weaknesses in the ITE. For example, Hudson (2007) found that some final-year PSTs in Australia did not receive sufficient support from their school-based mentors in the areas of content knowledge and in using problem-solving strategies. Wilson et al. (2001), in the U.S. context, found that although PSTs may have sufficient content knowledge they may not have adequate preparation in pedagogical content knowledge—seen as particularly relevant given that the PSTs noted a significant shift in teaching and learning practices from when they were learners.

Of the few studies involving mathematics PSTs' levels of knowledge that have been carried out in the Saudi context it was found that many of PSTs lacked the mathematical knowledge needed for teaching. Both Al Nazeer (2004) (with middle school teachers) and Khashan (2014) (with elementary school teachers) found that the majority of mathematics teachers had average conceptual and procedural content knowledge, rather than profound understanding of fundamental mathematics (Ma, 1999). A recent study (Ben-Motreb & Al-Salouli, 2012) investigating the knowledge level of elementary school teachers involving teaching observations of 40 PSTs during their practicum concluded that PSTs did not often explain the concepts that they were teaching nor show the connections between/among the different strands of knowledge and everyday life. Affirming findings from the earlier studies, it appeared that these PSTs' content knowledge was largely procedural—a finding that they claimed impacted the PSTs' ability to teach effectively. However, as was the case with international studies Alshehri's (2012) study of secondary in-service teachers considered their content and pedagogical content knowledge to be strong and also found that they felt confident about their pedagogical knowledge. In the same study, the school principals rated the effectiveness of their mathematics teachers as somewhat high, noting, however, that mathematics teachers were less effective in the area of technology.

Confidence in pedagogical knowledge, especially behaviour management, is another area that contributes to feelings of preparedness. Behaviour management appears to be a problematic one for many PSTs, who often feel poorly prepared in this aspect. For example, O'Neill and Stephenson (2012b) found that the Australian primary PSTs felt only somewhat prepared regarding their ability to manage disruptive behaviour, disobedience, and poor organisation. In

general, the PSTs in this study tended to use only a few strategies, such as the use of praise and encouragement. In contrast, a study from Turkey (Cabaroğlu, 2012) described secondary PSTs' classroom management and dealing with student misbehaviour practices as focusing mostly on reactive or corrective strategies such as giving warnings, shouting, shaming students, and using threats. This contrast may not be representative of a Western and non-Western divide as it is noted that Roble and Bacabac (2016) study of preparedness and proficiency of secondary mathematics PSTs in the Philippines found that the PSTs were confident in their ability to manage the classroom and students' behaviour via the implementation of a range of strategies.

This inconsistency in findings about feelings of preparedness, especially in the area of teacher knowledge indicates that standards and expectations are different in ITE institutions, and that more research in this area is needed, providing further motivation for the present research. Collectively, given the results of these studies, especially the study of Çakiroglu et al. (2005), which found that PSTs in the Turkish culture had higher GTE than their American equivalents, it would be reasonable to expect that Saudi mathematics PSTs will have a high sense of PTE and/or general teaching efficacy (GTE).

3.6 Measures of preparedness and efficacy

For research into the perceptions of a particular group, it is important to establish means of measuring preparedness and efficacy. To help develop the research methods for this thesis, this section reviews studies that explicitly sought to explore teachers' sense of preparedness.

Some studies used ethnographic methods typically involving extensive interviews to explore PSTs' levels of preparedness and efficacy. Lang (1996), for example, asked final year primary PSTs to comment on "areas in which I feel the school of education has prepared me well" and areas for which they "could have prepared me better" (p. 39). Ord (2010) used the ethnographic method of individual and extensive group interviews with PSTs for researching the phenomenon of 'preparedness'. Giovacco-Johnson (2005) in a study of early childhood special education teachers observed participants as a means of stimulating discussion in subsequent interviews. The study by Gowrie and Ramdass (2012) used in-depth semi-structured interviews, followed by analysis and coding for themes revealed in these interviews. However, as Zeichner and Conklin (2008) point out, self-reporting in interviews may be subject to bias or misperceptions as what beginning teachers or PSTs believe about their preparedness.

An alternative way to measure the preparedness of PSTs is through the perceptions of others. For example, Hogan's (2011) descriptive study investigated cooperating teachers' views regarding the preparedness of PSTs combined with the views of the PSTs, school administrations, and university supervisor experiences. Grudnoff and Tuck (2002) also interviewed tutors and beginning teachers to evaluate PSTs' levels of preparedness. Both of these studies noted that it was useful to investigate the preparedness of PSTs from different perspectives, because using multiple voices contributed to constructing the validity of the findings of the study.

The most common method for larger studies is to seek participants' perceptions of their level of preparedness using some form of self-rating through pre-determined scales (surveys) or interviews. In the early 1990s, Housego (1994) developed a tool for measuring the degree to which PSTs felt prepared to carry out a set of tasks; this scale was later adapted for subsequent research on graduates' feelings of preparedness (Housego & Badali, 1996). Similarly, Kane and Fontaine (2008) also used a scale, some items of which were taken from international research and others which were created using the teacher standards that were active in New Zealand at the time (where they were carrying out their research). In the Australian context, Ingvarson, Beavis, and Kleinhenz (2005) developed a survey instrument using the professional standards developed by the Victorian Institute of Teachers.

Other studies have also looked at PSTs and/or novice teachers' feelings of efficacy regarding their ITE and their preparedness to teach via a quantitative research design based on a survey (Carter, 2006; Kessell et al., 2006; Knoblauch & Woolfolk Hoy, 2008; Lim 2011; Schlette, 2006; Hoy & Spero, 2005; Zientek, 2007). Using Likert-type scales in these surveys to investigate the beliefs of PSTs is common: Hoy (2000) derived the 32-item Teacher Confidence Scale for this purpose. Other popular tools used to evaluate efficacy and measures of confidence are the Rand two-item scale (Armor et al., 1976), the Gibson and Dembo 30-item scale (Gibson & Dembo, 1984), and Bandura's 30-item Teacher Self-Efficacy scale (Bandura, 1997). Such tools gather data on the extent to which PSTs feel or do not feel confident in a range of areas that are important attributes of beginning teachers, such as evaluating student work, teaching basic mathematical concepts, using cooperative learning approaches, etc. Nevertheless, Lim (2011) believed that one limitation of his survey of mathematics PSTs was that the survey participants were not interviewed to elicit further details to clarify and frame the survey responses, confirming the importance of a mixed-method approach; Lim also

believed that classroom observations would also be useful for verifying and giving extra validity to the survey findings.

More recently, mixed-method approaches have been used to explore preparedness in PSTs. For example, Anthony et al. (2008) used survey, observational data provided by school principals and tutor teachers, and interviews to explore PSTs' (and then as beginning teachers) feelings of efficacy and sense of preparedness. Kraut's (2013) phenomenological research used a mixed methods design to gain a deeper understanding of the phenomenon of teacher preparedness, inclusive of the extent to which PSTs felt prepared to teach, the factors influencing their sense of preparedness, and what being 'prepared to teach' meant to them. In a more specialised sense, some studies track how a sense of preparedness changes and develops over time. For example, Anthony et al. (2008) surveyed participants at the end of their ITE and then used interview data to explore teachers' feeling of preparedness during the first and second years of teaching. With a similar intent, Clark's (2009) quantitative longitudinal study used pre-survey and post-survey data, where teachers were surveyed upon graduation of their ITE and a second time at the end of their first year of teaching. Other studies investigate the sense of preparedness during a short time (e.g., Kraut 2013; Lim 2011). For example, Brown et al. (2015) used a mixed-methods design to investigate how practicum experiences affected PSTs' sense of teaching efficacy and feelings of preparedness.

Studies that used mixed methods, claimed that combining the strengths of the qualitative and quantitative techniques supported the exploration of teachers' feelings of being prepared to teach (Kraut, 2013). In the next chapter, I introduce the mixed-methods approach used in this study for investigating female Saudi mathematics PSTs. The selection of the methodology is justified in terms of the suitability to provide a broad overview of general perceptions of preparedness through the quantitative approach as well as rich data illustrating individuals' experiences via the qualitative approach.

3.7 Summary

This literature review has revealed a number of key findings related to the current study focus. Firstly, the literature revealed that there has been some frustration with and calls for reform in the Saudi ITE space in attending to a desire to bring Saudi Arabia's national standards for ITE

into line with international teaching standards. In order to do this, the PSTs graduating from these courses need to be and feel prepared to teach so that they can be effective teachers.

Internationally, the effectiveness of a teacher is determined by the learning outcomes in the classroom; that is the effective teacher is one who has a positive influence on student outcomes. This requires sound content, pedagogical knowledge alongside pedagogical content knowledge. For the mathematics teachers, she should be able to plan lessons that create opportunities for students to engage in active exploration of mathematical activity and practices. Supporting mathematical understanding requires that the teacher can engage and motivate her student to be active participants in learning through using a range of teaching strategies, including the use of ICT tools. An effective teacher is also able to organise the classroom, manage student behaviour, and establish rapport with students in a way that fosters a positive learning environment.

The perceptions of the PSTs about their efficacy are important in helping them become effective teachers, and will likely influence how well the teachers perform in the classroom. Efficacy defined as the belief that one is able to do something, is closely linked to notions such as confidence, locus of control, and a sense of responsibility. Efficacy has many facets relating to teaching, such as efficacy related to classroom management or to the ability to communicate with students. Numerous factors contribute to PSTs' sense of efficacy and feelings of preparedness, including the structure and design of their ITE courses, their experiences during the practicum period, feedback received from cooperating teachers and mentors, prior school experiences, and their definitions of a 'good' teacher.

Surveys using Likert-type scales are most commonly used for measuring teacher preparedness, although many studies combine the use of scales with other tools such as observations of interviews within a mixed-methods design. The methods used in this study to measure the level of preparedness and efficacy of Saudi PSTs are discussed in depth in the next chapter.

4. Methodology

4.1 Introduction

This chapter discusses and explains the methodological approaches used to address the research questions. In particular, it describes the choice of a mixed methods design, the research design, sampling methods, the data collection procedures used (including the pilot test, questionnaires and interviews), analysis techniques, ethical considerations, validity and reliability, and the limitations of the study.

4.2 The Mixed Methods Design

The philosophy that defines any epistemology needs to be considered by any social researcher. Different epistemologies exist because researchers have differing views about the nature of knowledge—how humans interact with the world and how we think (Walliman, 2006). Because epistemology drives and shapes the methodology, it is important to understand the terms ‘epistemology’ and ‘methodology’. Of the two terms, methodology is the simpler to define. A more concrete term, methodology describes the researcher’s “strategy, plan of actions, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes” (Crotty, 1998, p. 3). Epistemology, however, is more abstract. It deals with “the nature of knowledge, its possibilities, scope and general basis” (Crotty, 1998, p. 8). Put simply, epistemology asks and answers the question “How do we know that we know something?” Two major branches of epistemology are recognised: positivism and interpretivism (the latter is also known as constructivism).

Positivism is the worldview behind the standard scientific method that involves formulating a hypothesis, designing and carrying out experiments to test that hypothesis, and drawing a conclusion from the results (Hirschheim, 1985). A positivist research approach tends to rely heavily on quantitative data collection methods that can easily be turned into ‘hard numbers’ that can be analysed for statistical trends, which, in turn, lead to deductions and conclusions (Saunders, Lewis, & Thornhill, 2007).

In contrast, constructivism as an approach focuses on meaning as created by the participants and their subjective views and consequently uses qualitative approaches (Creswell, 2007) to

find out the meaning of certain phenomena. An interpretive research stance usually explores the meaning or meanings people have for a particular phenomenon (Myers, 1997). Interpretivism maintains that we can obtain knowledge by using methods and techniques that “[respect] the differences between people and the objects of natural sciences and therefore requires the social scientist to grasp the subjective meaning of social action” (Grix, 2004, p. 64). In this study, the phenomenon to be explored is preparedness, and the aim is to discover how PSTs perceive and understand preparedness, and use this understanding to assess their own levels of preparedness to teach. According to Mack (2010), the interpretive approach assumes that how an individual perceives an event or phenomenon defines reality, and that this interpretation or perception (and therefore reality itself) is subjective. All perspectives are considered to be valid (Cohen, Manion, & Morrison, 2011; Flyvbjerg, 2004; Mack, 2010).

Frequently, a researcher’s epistemology lies midway between the positivist and constructivist approach, leading to the choice of a mixed-method research design. Generally, the epistemology shifts from a positivist stance in the early stages of a study to a constructivist approach when the researcher collects data that reflect multiple perspectives and highly detailed descriptions (Creswell & Plano Clark, 2011). This can help the researcher to adopt multiple worldviews or paradigms, encouraging them to be more flexible in their interpretation of the data rather than being restricted in their vision by prior assumptions (Creswell & Plano Clark, 2007). The present study takes an interpretive epistemological approach, as it aims to investigate the “experiences, behaviours, feelings and knowledge of the participants” (i.e., PSTs) (Hittleman & Simon, 2006, p. 133).

For this study, a mixed methods approach was selected to investigate how Saudi PSTs perceived their preparedness and level of efficacy to teach mathematics, as well as the factors that influence their perceptions. According to Johnson, Onwuegbuzie, and Turner (2007), the combination of qualitative and quantitative research methods is highly appropriate for examining complex social phenomena, providing an understanding of a topic that is simultaneously broad and deep. The quantitative approach allows one to gain a wide-scale macro-level picture of a particular phenomenon, whereas the qualitative approach explores aspects of that phenomenon at the micro-level (Bryman, 2012; Confait, 2014).

Several reasons influenced the choice of the mixed methods approach. Firstly, this is the most appropriate method to use for providing a deeper investigation of multipart research questions that consider “context and outcomes, meanings and trend, and narratives and numbers”

(Creswell & Plano Clark, 2007, p. 184). With the qualitative and quantitative perspectives complementing each other (McMillan, 2008), the mixed methods approach is able to answer a variety of question types. This includes open-ended questions, yes/no questions, or those involving a Likert-type scale (Creswell & Plano Clark, 2007). The quantitative part of this study used a Likert scale to measure how prepared PSTs felt to teach. In the qualitative part of the survey, the study explored definitions of preparedness using three open-ended questions, which were complemented by interviews that aimed to reveal how and why participants felt prepared to teach.

Secondly, a mixed methods approach was used because it can provide efficient data collection and analysis (ACET, 2013). In this study, the data collection process, divided into two phases, enabled efficiencies in that I was able to draw conclusions in two stages, which allowed me to write and present the results more clearly.

This study methodology was also selected in order to increase the power of the results, especially their reliability and validity. It has often been noted that the mixed method approach can be used as a way to strengthen the quality of a study (Gay, Mills, & Airasian, 2009; Hudson, 2011; Johnson, & Christenson, 2008). In this study, the lack of explanatory detail in the quantitative data was compensated for by the use of qualitative data drawn from a smaller respondent pool that participated in the interviews. The interviews provided contextual information that gave a better insight into the topic and provided richer detail (Creswell, 2009; Creswell & Plano Clark, 2007; Johnson & Onwuegbuzie, 2004). Using a mixed methods approach thus enabled me to maximise the strengths of the qualitative and quantitative approaches so as to obtain a deeper understanding of the phenomenon of preparedness to teach than either the qualitative or quantitative approach alone (Creswell & Plano Clark, 2007; Onwuegbuzie & Teddlie, 2003).

4.3 Research design

Aligned with the philosophical and epistemological research stance, as outlined in Section 4.2, a mixed methods approach was selected. In enacting the design, I considered how the two types of quantitative and qualitative data would be weighted, and when in the study the different approaches will be used. I had to decide whether the qualitative interviews would be used to bring out an idea or theme, which would then be explored quantitatively with a wider survey,

or whether the findings of a wider survey would be explored in more depth later on in interviews (Creswell & Plano Clark, 2007). Other pragmatic factors, such as time and resource constraints also needed to be considered.

In the present study, my time for collecting data in the field was limited to a single visit to Saudi Arabia. This visit was planned to occur during the last semester of the final year of the PSTs' university course. In practical terms, this meant that the surveys and expressions of interest to be involved in the interviews had to be collected at the same time.

The questionnaire provided a broad-brush overview of how mathematics PSTs defined and perceived preparedness to teach, with a particular focus on their practicum experience. The survey results were complemented with in-depth interviews. This was done by contacting the survey respondents who indicated a willingness to participate in a further interview. The interview, conducted shortly after administering the questionnaire, were arranged at a time that was suitable for myself as researcher and the participants. From a methodological perspective, this allowed for qualitative data to be collected to complement and extend the questionnaire data and provide further insights into the interpretation of the quantitative.

The compressed timeframe for data collection meant that the research design involved concurrent as well as sequential components, which is referred to in the literature as “multiphase combination timing” (Creswell & Plano Clark, 2011). Multiphase combination timing describes the situation when a researcher has to, or wants to, carry out multiple phases of the study that include sequential (one after the other) and /or concurrent (simultaneous) timing within the study period. In a concurrent research design, the researcher carries out the qualitative and quantitative data collection periods separately during the same phase of the research, so that the two types of data are separate and the results of one does not depend on the results of the other (see Figure 4.1). For example, in a concurrent design, the topics to be explored in an interview are pre-determined and do not arise from an analysis of the preliminary findings of a quantitative survey. Furthermore, the datasets are analysed separately before the researcher looks for links and connections between the two sets of results, as well as areas in which the two datasets conflict (see Figure 4.1). This research design has the benefit of allowing the strengths of one approach to compensate for the weaknesses of the other and vice versa. For example, the quantitative methods involve a large sample size that is suitable for finding trends and making generalizations, whereas qualitative methods are able to explore a topic in depth (Patton, 1990). A researcher may also select this research design in order to

illustrate the quantitative results with detailed examples drawn from the qualitative findings (Creswell & Plano Clark, 2011).

A sequential research design (sometimes called an explanatory design) involves two distinct interactive phases (see Figure 4.2). The most common explanatory design, as used in this study, involves the researcher first conducting a quantitative data collection phase and following this up, or specific aspects of the results, in a second phase, which often involves in-depth interviews. In the sequential research design, the quantitative data are primarily used to address the research questions, with the qualitative data being collected in a second phase (see Figure 4.2). The instruments and specific details of the qualitative phase are usually designed in response to the results of the quantitative phase. In the final analysis, a researcher following a sequential design will explain how the results of the qualitative study explain and illustrate the findings of the quantitative data (Creswell & Plano Clark, 2011).

This study used a partly concurrent research because the researcher developed the survey and interview questions simultaneously and thus the focus questions of the interviews did not arise from the findings of the quantitative data collection and analysis. Furthermore, the two instruments were applied within the same timeframe and the results of both datasets were analysed afterwards. But also the study had a partly explanatory sequential design, in that the questionnaire was used to find general trends (about Saudi mathematics PSTs' perceptions regarding their preparedness to teach) and "hard" statistics (a quantitative approach), then to probe for more detail into the reasons behind these trends via interviews (a qualitative approach).

According to Creswell and Plano Clark (2011), an explanatory design is preferable if a researcher wants to clarify the mechanisms or reasons that underlie the trends revealed in the quantitative dataset. Specifically, in this study, the qualitative interviews aimed to explore the factors influencing PSTs' perceptions regarding their preparedness to teach mathematics in more detail. The researcher also wanted to discover how and to what extent the qualitative results explained and added depth to the quantitative results. This contrasts again with a purely concurrent study design, an approach that aims to triangulate the qualitative and quantitative methods by directly comparing and contrasting the findings of the quantitative data with their qualitative counterparts in order to corroborate and validate both datasets (Creswell & Plano Clark, 2011).

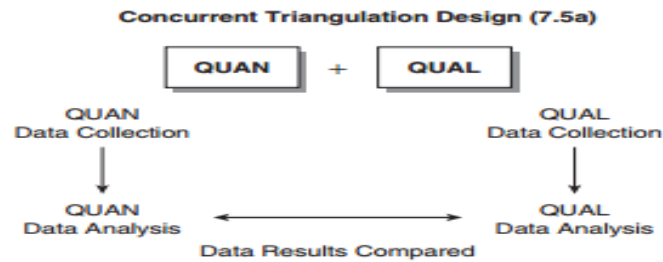


Figure 4. 1. Adapted from Creswell, Plano Clark, Gutmann and Hanson (2003), p. 226.

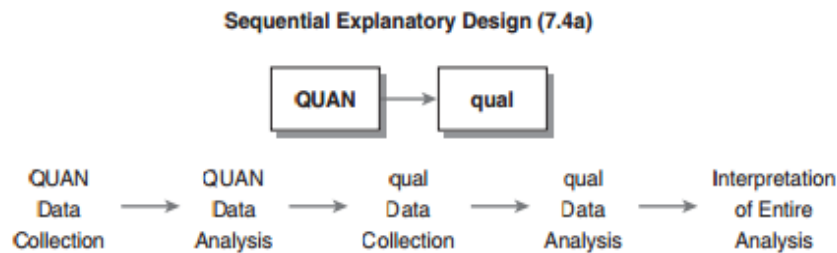


Figure 4. 2. Adapted from Creswell, Plano Clark, Gutmann, and Hanson (2003). P. 225.

4.4 Methods design

4.4.1 Questionnaire

A questionnaire gathering the data from the sample cohort was used to provide insight into the phenomenon of preparedness and reveal overall trends. Given the spread of the participants' locations, a questionnaire was seen as an effective and versatile instrument for collecting data (Check & Schutt, 2012). The first step in designing the questionnaire involved searching the literature for similar studies, exploring exemplars that I could base my survey on. This search revealed that self-reported data (e.g., data obtained via interviews and questionnaires) have been widely used by researchers examining preparedness to teach and the perspectives of PSTs (e.g., Hickey, Whitehouse, & Evans, 2010; Housego & Badali, 1996; Ingvarson et al., 2005; Kane & Fontaine, 2008; Kraut, 2013). The literature review (see section 3.3.2.3) also noted value in considering PSTs' level of mathematical knowledge (e.g., Anthony et al., 2008; Clark, 2009; Hine, 2015; Kilic, 2011; Rosas & West, 2011), on the grounds that teachers who are confident about their content knowledge are more likely to feel prepared to teach and/or be effective teachers (Murphy et al., 2007).

Many previous studies (see literature review 3.4) focused on efficacy measures as a way to measure preparedness (e.g., Carter, 2006; Darling-Hammond et al., 2002; Knoblauch &

Woolfolk Hoy, 2008; Schlette, 2006; Hoy & Spero, 2005; Zientek, 2007). As found by Clark (2009). Feelings of preparedness and beliefs about teaching efficacy were strong indicators of how well teachers were able to perform and succeed as teachers. This link between efficacy and feelings of preparedness has been found by many other researchers (e.g., Darling-Hammond et al., 2002; Kraut, 2013; Tschannen-Moran et al., 1998). Due to the link between efficacy measures and feelings of preparedness, I chose to examine PSTs' perceived level of preparedness via the survey, as this would help to evaluate their potential teacher quality (see Figure 4.3). As the focus would be on perceived level of preparedness, this made the use of a Likert-type scale appropriate.

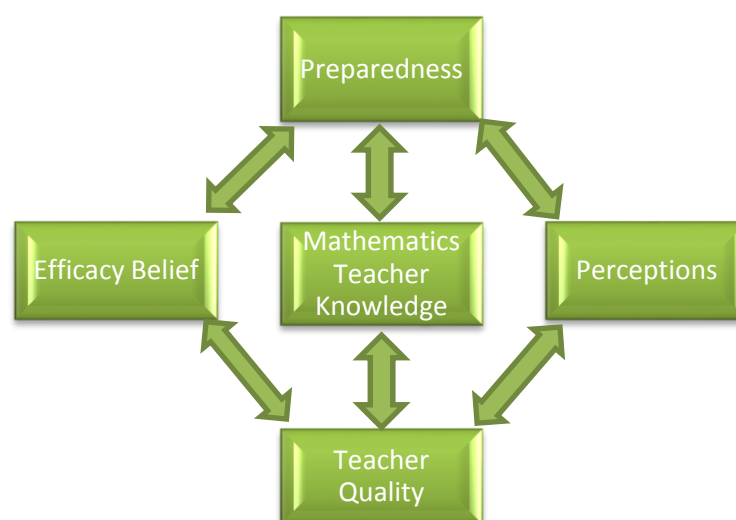


Figure 4. 3. *Factors contributing to teacher quality.*

While several previous studies explored preparedness as a general construct, the literature search failed to find published surveys that explored notions of preparedness and factors influencing the preparedness of mathematics PSTs in depth. To this end, a new survey was developed, based on previous literature relating to surveys of preparedness and surveys of mathematics teachers regarding teaching-related beliefs and knowledge. Most of the questions in the survey were sourced from Albayrak and Unal (2011), Alshehri (2012), Clark (2009), Fives and Buehl (2014), Gowrie and Ramdass, (2012), Kajander (2007), Kieffer and Henson (2000), Kraut (2013), Leong (2012), Lin and Gorrell (2001), McCoy (2011), Rodie, (2011), Rosas and West (2011), Tschannen-Moran and Hoy (2001), with some of the questions modified by the researcher to make them more relevant to the context of this study (see Table 4.1 for more details).

Table 4. 1. Sources of the questions used in the final survey design.

Sections	Types of questions	Sources
A. Beliefs about math and teaching math	Multiple choice	Modified by the researcher
B. Being prepared to teach	Open-ended	Fives and Buehl (2014), Kraut (2013), Leong (2012)
	Likert scale	Clark (2009), Gowrie and Ramdass, (2012), Rodie, (2011), Rosas and West (2011), and some are modified by the researcher
C. Teacher knowledge	Likert scale	Alshehri (2012), Clark (2009), Gowrie and Ramdass, (2012), Kajander (2007), Kraut (2013), Leong (2012), Rodie (2011), Rosas and West (2011)
D. Efficacy	Likert scale	Albayrak and Unal (2011), Kraut (2013), Kieffer and Henson (2000), Lin and Gorrell (2001), McCoy (2011), Rodie (2011), Tschannen-Moran and Hoy (2001)
E. Factors influenced feelings of preparedness	Likert scale	Kieffer and Henson (2000), Kraut (2013), Leong (2012), and some are modified by the researcher
	Open-ended	Modified by the researcher

The questionnaire included a mixture of open-ended questions and closed questions, design as follows:

First section included three questions regarding the participants' demographic information (name of College and University, types of schools where the PSTs had recently completed their teaching practicum (middle/secondary schools) and the participants' age), which helped to provide a context for this study. In the second section, there were three multiple-choice questions regarding the PSTs' beliefs about mathematics and teaching mathematics.

The third section started with three open-ended questions. Firstly, participants were asked to define what they understood preparedness to teach meant. Secondly, the participants were asked to name the most important attributes of a good mathematics teacher. Thirdly, there was a question asking respondents to name the kinds of knowledge or skills that are important for being a well-prepared teacher. However, the main instrument for this phase of the study, consisted of a 67-item Likert scale survey (Appendix B) covering different aspects of perceptions of preparedness, as identified in the literature review. Questions asked participants

to indicate across eight different areas (e.g., overall preparedness to begin teaching mathematics, mathematics content knowledge, pedagogical content knowledge, teaching basic knowledge and skills, using mathematical problem solving processes, supporting students to engage in mathematical discourse, taking into account students' prior conceptions about mathematics, and using technology in teaching) how prepared they felt to teach mathematics. This was complemented by a four-item Likert scale related to the PSTs' perceptions about their satisfaction with their level of preparedness. In addition, there was a section on perceptions relating to mathematical teaching knowledge consisting of 24 Likert-type items and another section on teacher efficacy consisting of 21 Likert-type items.

In the fourth section, the survey asked the participants about the factors that had influenced their feelings of preparedness via 10 items that also used a Likert scale (Appendix B). In addition to the quantitative data provided by the Likert-type scales, participants were asked to list other factors that they believe have influenced their sense of preparedness that were not provided on the Likert scale list.

The first three open-ended questions were presented before the Likert-scale questions in order to discover the participants' general feelings and definitions of preparedness without being influenced by any prompting by the other questions or use of terminology in the Likert scale surveys. In addition, I wanted the participants to be mentally fresh when answering these richer open-ended questions and generating their own responses, rather than being fatigued by the Likert scale survey.

A Likert-type scale was chosen as the most appropriate means of eliciting quantitative data on self-reported levels of preparedness, factors influencing preparedness and beliefs about mathematics teaching and learning. Some items were developed using a four-point Likert scale ranging from "very well prepared" to "not at all prepared", or from "strongly agree" to "strongly disagree" to avoid a fence-sitting midpoint (e.g., "neither agree nor disagree"), while others used a multiple choice format. In order to overcome any potential issues of response bias, which can occur if participants always give the same answer (e.g., always giving a response of "agree" or "moderately well prepared", no matter what the question actually asked), some of the survey questions were worded positively and others were worded negatively, as recommended by DiStefano and Motl (2006).

The survey was created in Google Drive (formerly Google Docs). After the researcher had developed and prepared the questionnaire, all questions and other sections of the survey were translated into Arabic, the native language of Saudi Arabia. This translation was confirmed after piloting the questionnaire with subsequent refinements to its final form. The translated and original (English) versions of the questionnaire were sent to an expert in English translation in order to check that the translation was accurate, clear, and easily understood.

4.4.2 Interview

The second phase of data collection involved interviews with a subset of the survey participants. Exploring how and why the participants felt prepared to teach (or otherwise), the interviews aimed to deepen and extend the information obtained via the questionnaire.

Interviews are an extremely effective means of collecting and understanding “people's perceptions, meanings, definitions of situations and constructions of reality” (Punch, 2005, p. 168). Interviews also have a high degree of versatility and flexibility (Sarantakos, 2005). Nevertheless, interviewing requires the ability to concentrate on the topic and not waste time pursuing side-issues, and to ask the right questions and probe for further detail (Richards & Morse, 2007). A semi-structured approach, where the interviewer (myself) had a pre-designed set of questions to help steer the direction of the conversation, helped the interview to remain on topic while still allowing room for more in-depth answers and probing questions.

Participants were asked to expand on the responses sought in the questionnaire, although the questionnaires and the participants’ answers were not directly referred to. The interview had two parts. In the first part, questions (see Appendix D) related to the first two research questions, specifically:

1. What beliefs do PSTs hold about “preparedness to teach”?
2. What perceptions do PSTs have about their levels of preparedness?

The second part of the interview explored in more detail the research question: “What are the factors influencing the formation of PSTs’ sense of preparedness?” To do this, participants were also asked to discuss how they would define or describe being prepared to teach. The researcher asked questions that covered general and specific areas regarding preparedness in order to probe how PSTs defined and perceived preparedness to teach and how those teachers’ perceptions had been shaped (Appendix D).

While some of the interview questions were adapted from Rodie (2011), most of the questions were designed by the researcher. The interviews were conducted in Arabic, as this was the first language of the respondents and the researcher. As was the case for the questionnaire, translation of interview questions was confirmed after the pilot test and some of the interview questions had been reworded (see Section 4.4.3). Both the Arabic translation and the questions in English (the originals) were sent to an expert in English translation to ensure that the translation was accurate, clear, and easy to understand.

4.4.3 Pilot test

Pilot testing of the survey and interview were conducted in December 2015 with three PSTs from Al-Jubail College of Education. The participants were asked to comment on a number of aspects of the questionnaire and the interview, including how easy it was to answer the questions, whether or not the terminology was easy to understand without any ambiguity, and how long the questionnaire took to answer.

The pilot test revealed that the PSTs found it relatively easy to complete the survey and they commented that the questions and statements were understandable and did not take too much time. There were, however, a few suggested improvements to the questionnaire and the interview questions. Specifically, in order to improve the clarity of some questions (in the Arabic version of the survey only), the wording of several of the Likert scale questions and two of the open-ended questions in the survey were altered. Namely, “What does the phrase “prepared to teach” mean to you?” and “Name four kinds of knowledge or skills that you think are important to be a well-prepared teacher”. The rest of the survey was kept the same.

The participants in the pilot test reported that the interview did not take an excessive amount of time and that it was interesting. Some of the questions in the interview were also reworded in response to the feedback. Changes needed to clarify the meaning of these questions in regard to Arabic language were made to the questions: “What sort of mathematics teachers would you like to be when you graduate?”, “In what way is this vision of teaching the same or different to the teaching you experienced when you were at school?”, and “Talk about those areas that you feel most confident or prepared in, and those that you feel less prepared in”.

Initial coding of the responses in the pilot study indicated that most of the responses were extremely positive and fell into the “well prepared” and “prepared” and “agree” or “strongly agree” categories. It was conjectured, that as a result of a culturally-driven bias the PSTs were

probably trying to portray themselves in a good light to an authority figure, as they may have felt that a negative self-report would affect their future chances of employment. With this in mind, I altered the typeface of the “Sharing information” and “Confidentiality” statements in the information sheet (Appendix A) from normal to bold hoping to reaffirm that all information received from the survey would not be shared with the university program teaching staff, mentors, or potential employers. I also made it clear that the survey did not aim to evaluate the participants’ personal effort or skills but that it was intended to find generalisations about how well Saudi PSTs felt prepared to teach mathematics at secondary or intermediate level, with the ultimate goal of supporting improvements in Saudi ITE.

4.4.4 Samples

This research, carried out in the context of Saudi ITE, drew from the population of PSTs in their final semester of the ITE. The 105 female mathematics PSTs participants were in their final year of study at a range of Colleges of Education. At the time of the data collection, the PSTs had all recently completed their teaching practicum experience, which took place in intermediate and/or secondary schools over a period of approximately 4 months; this comprised the final semester of university study (see Table 4.2).

Table 4. 2. Number of participants in each college of education and university.

College name, University	I am a PST in			Total
	Middle School	Secondary School	Both	
1. Al-Jubail College of Education, University of Dammam	25	8	1	34
2. College of Sciences and Humanities at hotat Bani Tamim, Sattam University	4	2	2	8
3. College of Sciences and Humanities at Al-Aflaj, Sattam University	6	0	0	6
4. College of Education in Al-Dalam, Satam University	7	2	6	15
5. Faculty of Science, King Faisal University	2	1	0	3
6. College of Education in Al-Majmaaha, University of Al-Majmaaha	1	2	10	13
7. University College in Al-Qunfudah, Umm Al Qura University	2	6	0	8
8. College of Education, University of Jeddah	9	0	1	10
9. College of education at Aldawadmi, Shaqra University	1	0	0	1
10. Teachers Training College, King Saud University	1	0	0	1
11. Hail University	0	0	1	1
12. college of education , Taibah University	0	1	0	1
13. College of Education, University of Tabuk	0	0	1	1
14. Faculty of Science and Arts, University of Najran	1	0	0	1
15. College of education at Shaqra, Shaqra University	0	0	1	1
16. College of Education at Al-Zulfi, University of Al-Majmaaha	1	0	0	1
Total	60	22	23	105

The majority of participant PSTs were aged between 21 and 25, although a sizeable minority (17) were aged 26+ years (see Table 4.3).

Table 4. 3. Participants' age group.

	Age	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	21-25	88	83.8	83.8	83.8
	26 or over	17	16.2	16.2	100.0
	Total	105	100.0	100.0	

The process of recruiting participants took several steps. I obtained a list of the Saudi Colleges of Education (87 colleges). A review of the universities' websites determined that 28 institutions offered a BEd in mathematics that provided a teaching methods course for mathematics. The contact details for the mathematics department and the academic staff who taught the mathematics teaching courses were accessed from the websites. Where possible, contact with the college to verify that they still provided the mathematics education course revealed that some universities no longer did so (see Section 4.5 for details of the reasons). Where current contact details were provided, I contacted (via both email and phone) the staff/mentors of the mathematics education course to enquire about the number of PSTs and the timing of the practicum. At this point, I discussed the ethical requirements of the universities with the mentor(s) (more details are given in Section 4.7) and sought a list of the PSTs' names, email addresses, and/or mobile phone numbers. The number of potential mathematics PSTs with suitable contact information within each college varied from as low as one to as many as 34.

I obtained contact information for 20 colleges that met the criterion of including a practicum as part of the requirements to graduate with an education degree. Offering an invitation to participate in the study ultimately resulted in a sample of PSTs from 16 different colleges of education (see Table 4.2). The participating colleges were located in several different regions around Saudi Arabia (see Figure 4.4): Al-Jubail City (Eastern Region), Al-Ahsa'a City (Eastern Region), Riyadh (Central), Shaqra (Central), Al-Zulfi (Central), Aldawadmi (Central), Al-Dalam (Central), Al-Aflaj (Central), Hotat Bani Tamim (Central), Al-Majmaaha (Central), Makkah (Western Region), Almadinah (Western Region), Jeddah (Western Region), Tabuk (Northern Region), Hail (Northern Region), and Najran (Southern Region), effectively minimising regional effect.

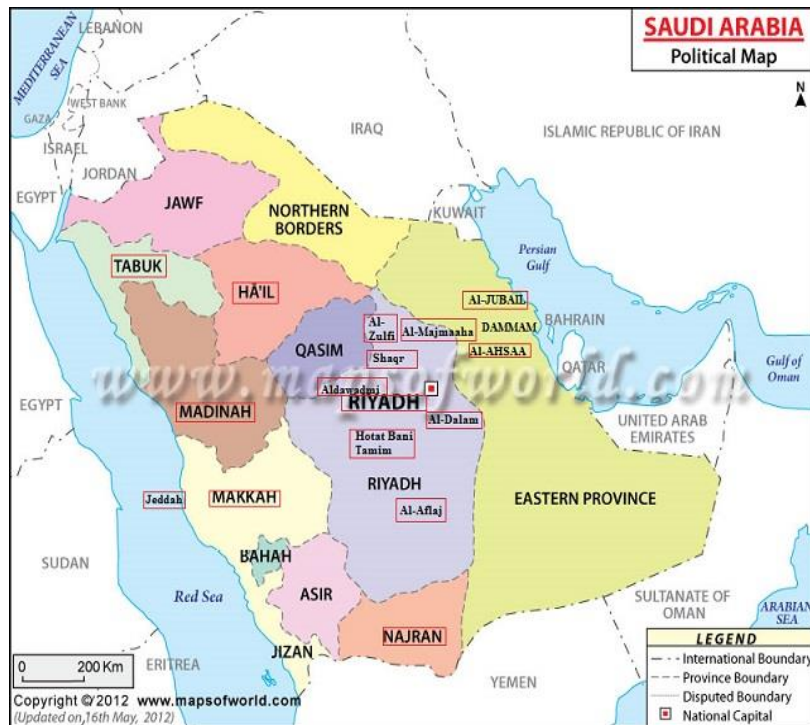


Figure 4. 4. Map of Saudi Arabia, showing the centres where the colleges of education are located.

The somewhat low responses rate was partly caused by contact difficulties. Where the mentors failed to provide a current contact list, contact was initiated via Twitter. This often resulted in low response rates (<5) (see Table 4.2). In another instance, travel to the University of Najran was considered to be too risky, as this is located close to the border with Yemen and there is currently a war between Saudi Arabia and Yemen. Therefore, the researcher had to recruit participants through the university's Twitter account.

4.5 Data Collection Procedures

A quantitative data collection was carried out by using a questionnaire completed by 105 PSTs (5 printed surveys and 100 online surveys shared via e-mail, "WhatsApp", and Twitter). The questionnaires were complemented with interviews with a volunteer sample who indicated willingness to participate on the survey form. Sixteen PSTs were interviewed, two of them via face-to-face interviews and the others via telephone.

The data collection was carried out over 4 months, first in December 2015 for 1 month, during Semester A in Saudi Arabia, then during a second period from March to May 2016 (Semester B in Saudi Arabia). Originally, the goal was to have a 3-month data collection process (March–May 2016 only). However, during the pilot phase of the study carried out in Al-Jubail College

of Education, it became clear that the number of PSTs studying in each College of Education in Saudi Arabia was less than anticipated. Previously, the expected cohort size within colleges of education was much higher, with some colleges reaching as high as 200 PSTs per year. In addition, some universities had stopped offering ITE courses. This decrease in the size of PSTs cohorts has occurred because of the problem of a high unemployment rate for recently graduated PSTs, with universities reducing their intake of education students as a solution to this problem. For this reason, I chose to interview some potential participants in December 2015 (the final month of Semester A and the practicum) before the final examinations, thus providing an additional pool of participants. In this initial phase, 35 PSTs from three Colleges of Education (Al-Jubail College of Education, College of Sciences and Humanities at Al-Aflaj, and College of Sciences and Humanities at Hotat Bani Tamim) were surveyed plus five PSTs from Al-Jubail College of Education were interviewed. The other two colleges surveyed during Semester A (December) were excluded from the data obtained during the second period (Semester A), as one had temporarily discontinued the mathematics education course (College of Sciences and Humanities at Al-Aflaj) and the other (College of Sciences and Humanities at Hotat Bani Tamim) had only one female mathematics PST who had had experienced a practicum. All other surveys and interviews were carried out during March–May 2016, when the PSTs had spent approximately 1 month in their practicum (during their final semester of university study). These participants were drawn from 14 Colleges of Education across Saudi Arabia, including Al-Jubail College of Education (see Table 4.2).

4.5.1 Quantitative phase

Originally, the intention was to carry out paper-based surveys followed by interviews with PSTs on their university campus. It was felt that printed surveys presented directly to respondents would be preferable because they are more personal and the data collection could be controlled more easily by the researcher. However, the distribution of printed surveys was limited by the cost and time constraints of travelling to the survey location and similar geographic constraints. For example, at the outset of the study, I was able to visit King Faisal University and Al-Jubail College of Education several times, as these were located close to my home location. Nevertheless, even with the convenient geographical location, I was not able to meet with the entire PST cohort. I was, however, able to meet two PSTs from Al-Jubail College of Education during the first day of the data collection phase and three others the following week. At King Faisal University, only six mathematics PSTs were enrolled and I was not able to meet with any of them, as they were away from the college campus on their practicum.

Thus, to facilitate the collection of the quantitative data, I created an online survey using the Google Drive platform and sent the survey's information sheet (Appendix A) and a link to the survey via the PSTs' contact emails (from Al-Jubail College of Education). Out of 100 emails, I only received one response! It is possible that some of the PSTs may not have checked their email or that their email address may have been changed. However, an alternative contact approach using the social media online chat app WhatsApp allowed me to access PSTs in distant locations, while also providing for automatic data collection. In contrast to the 1% response rate from the email invitation, 105 PSTs – from 138 WhatsApp invitation—expressed an interest to participate in this study. Three of the mathematics PSTs were excluded because they only taught statistics, rather than mathematics during their practicum. In addition, 10 of the PSTs who agreed to participate failed to complete the survey (despite of three reminder messages). In total, the WhatsApp invitation (with reminder requests) resulted in 92 (67%) completed responses out of 138 initial invitation messages.

The higher response rate suggested that participants found the online survey easy to use, visually interesting, and flexible. This is in line with previous findings in the literature that have noted that time-poor and educated people who are unwilling to participate in face-to-face surveys may be more willing to answer questions posted directly to them via mobile devices (Duffy, Smith, Terhanian, & Bremer, 2005; Kellner, 2004). WhatsApp is popular among the target demographic (young Saudi females), who frequently use this app on their mobile devices.

Although participation was voluntary, it is possible that some PSTs may have felt pressure to participate in the survey, as they were nearing the end of their course and the invitation to participate was originally set up via contact between the researcher and the PSTs' mentors. Equally, however, the pressure of exams and course work at this time may have negatively affected some participants' willingness to participate. This can be illustrated by what happened in an approach to 10 PSTs studying at the College of Education at Al-Zulfi, where one PST who sent me her mobile number and showed an interest in participating in the study, and also volunteered to share the survey link with her peers opted out. In response to reminder messages, she explained that she and her colleagues were in the middle of mid-term exams and they also had to prepare lessons for their practicum experience. In an alternative way to increase the number of responses, I distributed the link to the survey via the universities' websites on

exclusive pages for PSTs, and via Twitter. The Twitter invitations resulted in a further seven responses.

4.5.2 Qualitative phase

The invitation to participate in the interviews was presented as an addendum attached to the questionnaires (Appendix C). This invitation asked interested participants to provide their contact details. In moving to the WhatsApp platform, further invitations were sent separately via WhatsApp once the survey was completed.

However, despite many expressions of interest, completing the interviews was challenging. For example, during my first visit to Al-Jubail College of Education, one of the two PSTs I met agreed to participate in the interviews; the other stated that she did not have the time but later (the following week) agreed to participate. Another three PSTs agreed to participate in the survey but declined to participate in the face-to-face interviews because their drivers were waiting to deliver them home² and they did not have time to participate in the interviews.

To overcome some of the constraints around face-to-face interviews, telephone interviews were suggested as an alternative. Telephone interviews give the researcher the opportunities to interview individuals who are widely geographically distributed (O'Connor, 2006) and allow the interviewer and the interviewee to choose a wide range of sites and have the comfort of familiar surroundings (Carr & Worth, 2001). Telephone interviews also enable researchers to take notes discreetly and can also help protect the anonymity and privacy of the interviewee, decrease any social pressure caused by a formal interview setting and the physical presence of the interviewer, and increase rapport (Novick, 2008). However, there are some limitations in using the telephone interviews compared to face-to-face interviews. Specifically, telephone interviews make it more difficult for the interviewer to establish a rapport with the interviewee, being limited to the use of voice and words only (O'Connor, 2006) and the interviewer cannot see or respond to non-verbal cues (e.g., facial expressions, gestures, body language, etc.); neither can the interviewee pick up similar cues from the interviewer.

In the present study, 16 respondents completed interviews. Two of the interviews were carried out face-to-face and 14 were conducted via telephone. The time taken for the interviews, both by phone and face to face was 30–40 minutes. The semi-structured interviews followed a pre-

² In Saudi Arabia, women could not drive a vehicle legally at the time when the surveys were carried out; this law has recently been changed to allow women to obtain their drivers' licences.

planned interview protocol (Appendix D) that included the name of the participant and her college, and the questions were asked during the interview. Using the protocol as a guideline (Creswell & Plano-Clark, 2011), I was able to reword, reorder, and adapt the questions as needed throughout the interview to stimulate PSTs to describe their experiences and opinions. During the interview, I was careful to let the individual's experiences drive the direction of the questions and probes, prompting the PSTs only when necessary.

The interviews took place at times or sites that were comfortable and convenient for participants. At the beginning of each interview, I outlined the aims of the study and reminded the participants that their responses would be kept confidential, and that the conversation would be recorded for later analysis. Throughout the interview, I made an effort to listen carefully and to monitor the interviewees closely (for example, providing an example to assist understanding), to show interest in the responses, and to thank the interviewees for their time and contribution. This is because the interviewer's responses, general demeanour, tone of voice and attentiveness all affect the interviewees' responses (Cohen et al., 2011). I was also careful to allow time for respondents to think about their answers, and paused to consider the interviewee's response and possibly probe for further detail before moving to the next question. Later, the recorded interviews were transcribed in Arabic. These interview transcripts were then translated into English in preparation for analysis.

4.6 Data analysis

Analysis is the process of transforming raw data into a description or story and how this story can be interpreted (Lecompte & Schensul, 1999). According to Bogdan and Biklen (2007), "analysis involves working with data, organizing them, breaking them down into manageable units, coding them, synthesizing them and searching for patterns" (p. 156). As in most mixed methods studies, the qualitative and quantitative data were analysed separately (Onwuegbuzie & Combs, 2010), with the analysis of each method intended to complement or confirm each other to reach to a final conclusion or outcome of a study (Cameron, 2009).

For the quantitative analysis, the Statistical Package for the Social Sciences (SPSS version 23) was used to analyse the participants' responses for the Likert scale questions in the questionnaires. The data were checked to ensure accuracy and to identify responses that were missing or incomplete before being entered into a Microsoft Excel spreadsheet for import into

SPSS. All responses, except for those to the open-ended questions, were given as percentages, which were used to create tables in SPSS. The descriptive statistics (with the mean and standard deviation) were also obtained, including frequencies, and cross-tabulations between some variables. Using descriptive statistics helped to establish the extent or level of the participants' views. The Chi-squared test was used to explore any possible relationships or differences between participants' responses to separate items. In addition, factor analysis was used to analyse the responses concerning the factors that have influenced PSTs' sense of preparedness for mathematics teaching (see Question E, Appendix B).

Answers to the open-ended questions from the questionnaire were analysed thematically. This thematic analysis used the research questions as guidelines to discover key themes and ideas, as was the case with the qualitative interview data.

The recorded interviews were transcribed into Arabic then translated to English for analysis. The transcripts were read through and sorted so the responses to each of the questions in the semi-structured interviews could be compared and contrasted. This process of manually sorting and categorizing the data allowed the researcher to understand the multifaceted nature of the topic and to become familiar with the data. The interview data were analysed through summarisation, coding, and derivation of themes through applying thematic analysis (Braun & Clarke, 2006) and coding. The data coding process is very important for analysing qualitative data accurately, as the process of analysing these data is less standardised or intuitive as analysing quantitative data (Neuman, 2006). Braun and Clarke (2006) state that thematic analysis and coding is a very useful method for transforming qualitative data into a format that can be used appropriately to answer the research questions.

During this stage, codes relating to the key research questions were developed. The analysis procedure of the qualitative research consisted of preparing, organising the data, and reducing the data into meaningful segments for analysis. The segments were then named through a process of inductive coding in order to represent the data as distinct themes and sub-themes or categories (see Appendix E) (Creswell & Plano Clark, 2007). The different categories were assigned to codes and then collated to themes aligned to the research questions. For example, the theme of 'Skills needed' (Theme III) included categories such as use of technology (coded as IIIA), classroom management (IIIG) and managing time (IIIK), among others. The codes were then applied to the collated interview responses, so that each time a response covered or

was related to a particular coded theme, this code was assigned to that response (responses could have more than one code assigned to them).

4.7 Ethical considerations

With any research involving human subjects, adherence to ethical principles is vital. Ethical considerations need to cover principles and values regarding privacy, risks to individuals and institutions, confidentiality, accuracy and integrity, voluntary participation, informed consent, and social and cultural considerations (Dingwall, 2012).

In this study, all the ethical principles were considered carefully in terms of the Massey University Code of Research Ethics (MUCRE) and in relation to insider knowledge of the role of female students in Saudi Arabia. Low risk approval for the research proposal was obtained from the Massey University Ethics Committee prior to the questionnaire and interview process.

In accordance with standard ethical procedures regarding access to participants, first, a letter from my supervisor to confirm my need to travel to Saudi Arabia to survey and interview the participants was sent to the Saudi Arabian cultural mission. Travel permission, in addition to a copy of the survey and interview, were emailed to the human ethics committees of four Saudi universities to seek their consent to participate in this study and to confirm that I could meet the students to request their participation in this study. The universities for which this initial approval was necessary were University of Dammam, University of Al-Majmaaha, Satam University, and University of Jeddah. The other eight universities did not have this explicit ethical requirement processes. Observing the standard ethical protocols around access and the confidentiality of responses, it was deemed appropriate that email contact (provided by university mentors) could proceed.

Confidentiality was a crucial ethical consideration, especially given the low number of female mathematics PSTs within each of the university sites. In writing up findings, pseudonym codes are used for all participants and no links (or sub-analysis) linking the pseudonyms to any particular College of Education were identified; in other words, the cohort members are pooled together as PSTs studying within Saudi Arabia.

In terms of informed consent, all participants were free to accept or decline the invitation to participate in the study, and rewards, incentives and other forms of coercion were not offered.

As mentioned in the description of the pilot survey, the hypothesised overly optimistic estimation of responses led to increased efforts to ensure that the participants were clearly informed of the purpose of the study and that their anonymity and confidentiality would be preserved. Participants were free to withdraw from the study at any time and to decline to answer any of the questions. They were also informed that they had the right to access all data collected from them, following standard procedures. During the interview process, participants were informed that the interview would be recorded. As both the researcher and the interviewees are Arabic, sharing a common language and culture meant that cross-cultural misunderstandings and conflicts were minimised.

4.8 Validity and reliability

Quality and validity are highly important in any study; “research needs to be defensible to the research and practice communities for whom the research is produced and used” (Onwuegbuzie & Johnson, 2006, p. 48). Concerns about validity and reliability can be allayed by paying careful attention to how the data collection, analysis, and interpretation process is carried out, and how the results are presented (Merriam & Tisdell, 2016). Both qualitative methods and quantitative methods have their own criteria for determining the quality and validity (Creswell & Plano Clark, 2011; Maxwell & Mittapalli, 2010). However, the issue of measuring or determining the validity of mixed methods research approaches is more controversial and researchers often disagree regarding the measures to use to determine the validity or quality of a mixed method study (Bryman, 2006; Onwuegbuzie & Johnson, 2006; Tashakkori & Teddlie, 2003). Nevertheless, most researchers agree that the mixed method approach *per se* is neither more nor less valid than either the qualitative or the quantitative approach (Bazeley, 2004).

Triangulation, often used in mixed method approaches that use a variety of data collection techniques. According to Merriam and Tisdell (2016), triangulation is a powerful tool that can be used to increase the internal validity of research that uses multiple methods of data collection and analysis. A mixed methods approach increases validity by using the quantitative data to back up the qualitative data and vice versa, linking and cross-checking between the two methods. Labelled “inter-triangulation” by McMurray, Pace, and Scott (2004), the simpler term “triangulation” is also used in the literature. Inter-triangulation allows the researcher to discover a more precise perception of reality (to approach the topic from a subjectivist paradigm) or to discover the true nature of a phenomenon’s reality (to use the explanation of

the objectivist paradigm). Because the questionnaire was anonymous, this study was not able to triangulate the interview data with individual interviewees' responses to the questionnaire. However, the interviews were still able to provide more detail and highlighted some interesting aspects of the phenomenon of preparedness. As pointed out by Firestone (1987), qualitative data give a reader enough detail to show that the conclusions are intuitive and congruent with reality.

As described in Section 4.5, considerable effort was taken to ensure that an appropriate and large enough sample for the survey (and interviews) was chosen to ensure that the results are representative of the wider female mathematics teacher cohort in Saudi Arabia. To represent mathematics PSTs' perceptions of preparedness to teach across the wider population, I took my sample from as many education institutions as possible around Saudi Arabia.

To maximise the response rate and to ensure that the survey would yield high-quality data, the survey design paid careful attention to the order in which questions were presented, the wording of the questions (adapted from pilot study (Section 4.4.3), the layout and the instructions accompanying the questionnaire (Cohen et al., 2011). In order to make the questionnaire easy to complete without inducing fatigue, a Likert-type scale was used (Ben-Nun, 2008). Superficial responses are undesirable, as they reduce the validity and reliability of the data being collected. Following Krosnick's (1999) suggestion, participants were told that their responses were valuable and very important to the researcher, which is also believed to keep satisficing to a minimum.

According to Merriam and Tisdell (2016), following sound ethical practices help to establish the trustworthiness of a study, as ethical protocols encourage respondents to answer honestly, fully and without bias. It was noted that the pilot questionnaire resulted in extremely positive responses beyond what would intuitively be expected. This was potentially a consequence of Saudi culture, where students, and especially female students, are discouraged from disagreeing with or giving negative responses to authority figures; possibly, my role as a researcher put me into the category of an authority figure. My reassurance that their responses would be kept confidential and their anonymity would be preserved was designed to help overcome this reticence. When starting the main phase of data collection, I also reminded the participants to read the information sheet carefully and this was followed by a request to answer the questions honestly and credibly. As a result, PSTs in the main study provided more varied range of answers, and some went into great detail in their answers to the open-ended questions.

It is also possible that another cultural feature may have been at work here. It has been noticed in other studies that in non-Western contexts, PSTs may be reluctant or reticent about reporting a low level of preparedness or similar negative self-reports (Lin & Gorrell 2001; Lin, Gorrell, & Taylor, 2002; Yeung & Watkins, 2000).

As a final step to help ensure the validity of the study, I aimed to be methodical when presenting the results of my research in order for the findings to have “sufficient clarity (e.g., in separate texts, tables, and exhibits) to allow readers to judge independently later interpretation of the data” (Yin, 2012, pp. 14 – 15).

4.9 Limitations

In all research, the limitations of the study need to be taken into consideration during the process of analysing and reporting the data (Hittleman & Simon, 2006). While the involvement of only female PSTs could be perceived as a limitation in terms of generalisability and relevance to those from non-Arabic cultures, the decision to include only female participants arises because of cultural and religious practice in Saudi Arabia. According to the principles of Islam, a female researcher may not directly contact or interview male participants, and thus all male PSTs were ruled out of this study. However, this limitation can also be seen as strength in terms of informing teaching education within Saudi Arabia. Because of the segregated education system, it is important to present women’s perceptions regarding preparedness to teach. These participants represent the voice of a teaching force of an important and culturally distinct education system for females in Saudi Arabia. It may well be that research exploring male PSTs’ perceptions of preparedness to teach mathematics—who are educated in different universities and have the goal of teaching male students—are different from those for females.

The second limitation was the low number of participants, in comparison to the previously much higher rates of teacher education graduates (approximately 200) per year from each educational institution around Saudi Arabia. As mentioned earlier, the target number of education students has been reduced by the Saudi Ministry of Education as a means of addressing graduate teacher unemployment. This meant that the researcher was not able to access large number of mathematics PSTs at some universities. Moreover, although participants were recruited from 16 colleges of education, only a small number of respondents from some universities (1 – 6) volunteered to participate in this study (see Table 4.2). The

participants in this study are estimated to be 30% of the cohort size of PSTs who were expected to graduate (approximately 300 PSTs) from the 16 participating colleges of education. Also it appears that the timing of the study influenced participation rates, with the pressure of exams and the practicum reported to have influenced PSTs' willingness to participate.

Thirdly, because participation in the survey and the interviews was voluntary, this may have introduced bias into the results. It is possible that those who had higher levels of confidence agreed to participate in the survey and interviews, whereas those who were shyer or less confident may have declined to participate. Potentially, this may mean that the results are skewed towards higher feelings of preparedness and efficacy than expressed by the overall cohort of PSTs.

Another limitation of the study is that the data are self-reported. Although self-reported data is suitable for revealing the perceptions, beliefs, and values of the participants, self-reports have their limitations. In this study, the data reflect the participants' memories of recent and past experiences, their perceptions of themselves as a learner, and their perceptions of themselves as a teacher. In comparing these perceptions collectively, we have no way of knowing how consistent the benchmarking on Likert scales is, nor how accurate their recall is, so the researcher had to rely on the participants to answer honestly (Patton, 2002). Moreover, as discussed earlier, potentially, some cultural influences may have made the participants reticent about providing a negative self-report.

A final limitation is that the interviews needed to be transcribed and then translated into English before analysis. Interview transcriptions can be problematic. For example, if an error is made during the transcription process, this can potentially affect the analysis and interpretation of the interviewees' words (Bryman, 2007). To mitigate the effects of the transcription and translation process, I, as the researcher and interviewer, transcribed and translated all of the interviews. The researcher's familiarity with both Arabic and English supported this process. In addition, transcriptions cannot record the more subtle aspects of the interview, such as the tone of voice, use of irony, the length and number of pauses and inflection, which may affect interpretation (Cohen et al., 2011). Similar to the more general limitations of telephone interviews discussed earlier, transcripts cannot capture the non-verbal subtleties that occur during face-to-face interviews, such as the use of gestures and facial expressions.

4.10 Summary

This study used a mixed-method study design. Following piloting of the questionnaire and interview protocol, quantitative data were collected via 70 items in a questionnaire that used a four-point Likert-type scale. Qualitative data were collected via open-ended questions in the questionnaire and from in-depth interviews that lasted 30–40 minutes—with two interviews carried out face-to-face and 14 conducted via telephone. The questionnaire and the interview protocol were first developed in English and then translated to Arabic.

The target population for the research was female mathematics PSTs studying at Saudi Colleges of Education who were in their final year and who had practicum experience. Cultural and religious reasons meant that males were excluded from the study. The study posed considerable challenges around the recruitment of participants, especially for the interviews. As the Saudi Ministry of Education has recently limited the number of education students due to employment problems, the pool of participants was more restricted than expected. In total, 105 female mathematics PSTs from 16 Colleges of Education responded to the survey and 16 respondents completed interviews.

The questionnaire, initially presented in printed format, was reformatted as an online survey, in an effort to increase access and participation rates. An invitation sent via the mobile app WhatsApp had a response rate of 61% and further invitations sent via Twitter resulted in further recruitments. For analysis, the quantitative data from the Likert scale questions presented in the survey were cleaned and entered into a Microsoft Excel spreadsheet. SPSS software was used for statistical analysis and the data were transformed into percentages as well as subjected to further analysis. The recorded interviews were transcribed and translated from Arabic for analysis. Key themes emerging from the transcripts were coded and categorised to allow for quantification of the data.

The study had several limitations:

- The study was only able to focus on female participants for cultural and religious reasons. The findings may therefore not be generalizable to male mathematics PSTs in Saudi Arabia.
- The number of participants was low.
- The data were self-reported and may have been affected by inaccurate memory or by unwillingness to provide a negative self-report.

- The interviews were transcribed, meaning that nuances (e.g., tone of voice, pauses) could not be captured.

In the next chapter, the research details the results from the quantitative and qualitative data.

5. Findings

5.1 Introduction

This chapter will present the findings of the PSTs. Section 5.2 focuses on the quantitative results of one hundred and five female mathematics PSTs responded to the questionnaire that formed the quantitative arm of this research. The questionnaire items were analysed to assess trends in PSTs' perceptions regarding their sense of preparedness, levels of teacher knowledge, and expression of teacher efficacy, and the factors that influenced these perceptions. The findings regarding each of these areas are explored below. Section 5.3 focuses on the qualitative data which were collected in two phases: the open-ended questions in the survey and the interview with 16 PSTs.

5.2 Quantitative results: Likert scale survey findings

5.2.1 Sense of preparedness

Participants answered eight items (see Appendix B) related to their sense of preparedness using a four-point Likert scale where 1 = very well prepared, 2 = well prepared, 3 = somewhat prepared and 4 = not at all prepared. Analysis of the responses (see Table 5.1) reveals that overall most PSTs reported feeling well prepared (89.5% of the participants felt “very well prepared” or “well prepared) to begin teaching mathematics (mean 1.6). This overall sense of preparedness appeared to be founded on feeling well prepared:

- to use mathematical problem-solving processes in teaching (mean 1.62),
- in mathematical content knowledge (CK) (mean 1.72),
- in supporting students to engage in mathematical discourse (mean 1.77),
- in pedagogical content knowledge (PCK) (mean 1.78),
- to use technology in teaching to increase students' interest and learning (mean 1.79),
- to take students' prior conceptions about mathematics into account when planning a curriculum and instruction (mean 1.81), and
- to teach basic knowledge and skills as specified by the curriculum (mean 1.81).

However, 10.5% of PSTs reported feeling somewhat prepared, with a small proportion (13-18%) of the PSTs reporting that they felt only “somewhat prepared” or “not at all prepared” in specific aspects of teaching (see Table 5.1).

Table 5. 1. PSTs’ overall sense of preparedness.

		Frequency (Percent)				Mode	Mean	Std. Deviation
		Very well prepared	Well prepared	Somewhat prepared	Not at all prepared			
1.	Overall, how well prepared do you feel to begin teaching mathematics?	57 (54.3%)	37 (35.2%)	11 (10.5%)	0	1.00	1.5619	0.67829
2.	How well prepared do you feel in your mathematics content knowledge?	44 (41.9%)	46 (43.8%)	15 (14.3%)	0	2.00	1.7238	0.70021
3.	How well prepared do you feel in your pedagogical content knowledge?	40 (38.1%)	49 (46.7%)	15 (14.3%)	1 (1.0%)	2.00	1.7810	0.72032
4.	How well prepared do you feel to teach basic knowledge and skills as specified by the curriculum?	38 (36.2%)	51 (48.6%)	14 (13.3%)	2 (1.9%)	2.00	1.8095	0.73505
5.	How well prepared do you feel to use mathematical problem solving processes in teaching?	56 (53.3%)	35 (33.3%)	12 (11.4%)	2 (1.9%)	1.00	1.6190	0.76436
6.	How well prepared do you feel to support students to engage in mathematical discourse?	43 (41.0%)	45 (42.9%)	15 (14.3%)	2 (1.9%)	2.00	1.7714	0.76280
7.	How well prepared do you feel to take into account students’ prior conceptions about mathematics when planning curriculum and instruction?	40 (38.1%)	47 (44.8%)	16 (15.2%)	2 (1.9%)	2.00	1.8095	0.76076
8.	How well prepared do you feel to use technology in your teaching to increase students’ interest and learning?	43 (41.0%)	43 (41.0%)	17 (16.2%)	2 (1.9%)	1.00	1.7905	0.78072

(1 = Very well prepared, 2 = Well prepared, 3 = Somewhat prepared, 4 = Not at all prepared, N= 105)

The high levels of expressed preparedness were aligned to PSTs' general sense of satisfaction about their ITE experience (see Table 5.2). All but five (middle school) PSTs agreed that their ITE programs had given them the necessary skills to become effective teachers (mean 1.46). However, despite a general sense of satisfaction many PSTs identified potential changes in opportunities to learn within their ITE that they felt could have supported their preparation to start teaching mathematics. Notably, nearly three-quarters of the participants (72.4%) agreed that they needed to spend more time in the mathematics methods course (mean 2.10). In addition, half of the participants (51.4%) believed that they need to spend more time in the school (i.e., a longer practicum) practicing how to teach mathematics (mean 2.46). The crosstab analysis of the responses for these two items reveals that although a quarter of the participants (25.7%) thought they needed more time studying in the mathematics methods course, they did not think they needed more time in the practicum experience. This highly statistically significant [$\chi^2(1) = 18.75, p < 0.001$] result may highlight one area of concern or possible improvement for the mathematics methods courses.

Table 5. 2. PSTs' satisfaction about preparedness.

		Frequency (Percent)				Mode	Mean	Std. Deviation
		Strongly agree	Agree	Disagree	Strongly Disagree			
1.	I believe my initial teacher education program has given me the necessary skills to become an effective teacher.	63 (60.0%)	37 (35.2%)	4 (3.8%)	1 (1.0%)	1.00	1.4571	0.62062
2.	I am satisfied that I have been well prepared to teach.	50 (47.6%)	52 (49.5%)	3 (2.9%)	0	2.00	1.5524	0.55437
3.	I think I need to spend more time in the mathematics methods course.	25 (23.8%)	51 (48.6%)	23 (21.9%)	6 (5.7%)	2.00	2.0952	0.82653
4.	I think I need to spend more time in the school practicing teaching mathematics.	17 (16.2%)	37 (35.2%)	37 (35.2%)	14 (13.3%)	2.00	2.4571	0.92016

(1 = Strongly agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree, N=105)

Although no significant differences between the age cohort were noted in the overall sense of preparedness, statistically significant relationships appeared between participants' age and

agreement with the statement “I think I need to spend more time in the mathematics methods course” [$\chi^2(1) = 4.79, p < 0.05$], and between participants’ age and agreement with the statement “I think I need to spend more time in the school practicing teaching mathematics” [$\chi^2(1) = 5.09, p < 0.05$]. Nearly one-third of the participants aged 21–25 (28 out of 88) believed they do not need to spend more time in the mathematics methods course, compared with only 5.9% of the PSTs aged 26 or over (1 out of 17). Moreover, 53.4% of the participants aged 21–25 disagreed that they needed more time in the practicum experience, compared with 23.5% of the PSTs aged 26 or over (4 respondents). The responses from the older cohort of PSTs indicating that they needed more time in both the methods and practicum courses may have contributed to their lower sense of preparedness score (although not statically significant) than the younger PSTs. However, caution is needed in this interpretation due to low sample of ‘older’ PSTs and lack of statistical significant.

5.2.2 Teacher knowledge

Participants were asked to rate their feelings of preparedness regarding teacher knowledge and skills on a four-point Likert scale (1 = strongly agree; 4 = strongly disagree). This subsection evaluated the participants’ feelings regarding 24 items: 8 items of CK, 5 items of PK, and 11 items of PCK. It is evident from their responses that the PSTs in this study felt confident about their teaching knowledge in general; however, they seem most confident about their CK and PK rather than their PCK.

In terms of specific areas of CK, as shown in Table 5.3, the participants were most confident about their level of understanding mathematics content for the school curriculum (mean 1.47), understanding how and why mathematical procedures work (mean 1.49), having a good understanding of mathematical concepts (mean 1.50), having good problem-solving skills (mean 1.54), having the ability to connect between mathematics ideas and having a good understanding of the purpose of teaching mathematics (mean 1.61). While still confident about applying multiple mathematical representations for problem-solving and making mathematical connections with problems outside mathematics, more than half the participants stated that they “agree” (rather than “strongly agree”) with these two items, and nine participants disagreed that they had the ability to apply multiple mathematical representations for problem-solving, and 17 PSTs disagreed that they had the ability to make mathematical connections with the problems outside of mathematics.

Table 5. 3. PSTs' confidence of their content knowledge.

		Frequency (Percent)				Mode	Mean	Std. Deviation
		Strongly agree	Agree	Disagree	Strongly Disagree			
1.	I have a good understanding of the purpose of teaching mathematics.	46 (43.8%)	54 (51.4%)	5 (4.8%)	0	2.00	1.6095	0.58004
2.	I have a good understanding of mathematics content for the school curriculum.	56 (53.3%)	49 (46.7%)	0	0	1.00	1.4667	0.50128
3.	I have a good understanding of mathematical concepts.	55 (52.4%)	47 (44.8%)	3 (2.9%)	0	1.00	1.5048	0.55684
4.	I have a good understanding of how and why mathematical procedures work.	58 (55.2%)	43 (41.0%)	4 (3.8%)	0	1.00	1.4857	0.57369
5.	I have good problem solving skills.	52 (49.5%)	50 (47.6%)	2 (1.9%)	1 (1.0%)	1.00	1.5429	0.58882
6.	I have the ability to apply multiple mathematical representations for problem solving.	37(35.2%)	59 (56.2%)	8 (7.6%)	1 (1.0%)	2.00	1.7429	0.63592
7.	I have the ability to connect between mathematics ideas.	46 (43.8%)	55 (52.4%)	3 (2.9%)	1 (1.0%)	2.00	1.6095	0.59639
8.	I have the ability to make mathematical connections with the problems outside of mathematics.	32 (30.5%)	56 (53.3%)	16 (15.2%)	1 (1.0%)	2.00	1.8667	0.69430

(1 = Strongly agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree, N=105)

Overall, participants provided positive responses regarding their levels of PK (Table 5.4). Most participants were strongly confident that they had the ability to maintain good relationships with their students (mean 1.41) and they had the ability to maintain an orderly and purposeful learning environment (mean 1.54). Participants also reported a sense of confidence about their ability to handle most discipline problems arising in the classroom (mean 1.62) and their ability to resolve interpersonal conflicts in the classroom (mean 1.68). PSTs were, however, less confident about their ability to work with parents and families to better understand students and to support their learning, with 13.4% disagreeing or strongly disagreeing with this aspect of teaching knowledge.

Table 5. 4. PSTs' confidence of their pedagogical knowledge.

		Frequency (Percent)				Mode	Mean	Std. Deviation
		Strongly agree	Agree	Disagree	Strongly Disagree			
1.	I have the ability to handle most discipline problems that may arise in my classroom.	50 (47.6%)	45 (42.9%)	10 (9.5%)	0	1.00	1.6190	0.65605
2.	I have the ability to resolve interpersonal conflicts in the classroom.	45 (42.9%)	50 (47.6%)	9 (8.6%)	1 (1.0%)	2.00	1.6762	0.67218
3.	I have the ability to maintain an orderly, purposeful learning environment.	54 (51.4%)	45 (42.9%)	6 (5.7%)	0	1.00	1.5429	0.60492
4.	I have the ability to maintain a good relationship with my students.	64 (61.0%)	39 (37.1%)	2 (1.9%)	0	1.00	1.4095	0.53160
5.	I have the ability to work with parents and families to better understand students and to support their learning.	37 (35.2%)	54 (51.4%)	13 (12.4%)	1 (1.0%)	2.00	1.7905	0.68914

(1 = Strongly agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree, N=105)

The majority of participants were confident with aspects of PCK (Table 5.5). For example, 94.2% felt that they had the ability to engage students in collaborative group-based activities. However, more than half the participants agreed rather than strongly agreed that they were confident in some areas, with the mean ranging from 1.61 to 1.84. Participants were least confident about their ability to make links between theory and the practice of teaching in the classroom (mean 1.84), and their ability to select effective teaching approaches to illustrate difficult mathematical concepts (mean 1.80). A small proportion of the participants (6-12%) indicated a sense of being less prepared in their ability to relate classroom learning to the real world, to understand the instructional strategies that best represent mathematical topics, to incorporate effective assessment strategies into planning and teaching (12.4%), to apply a variety of teaching strategies in teaching (10.5%), to conduct whole-class mathematics discussions (7.6%), to plan and prepare a variety of teaching resources to help them in their

teaching (6.7%), to engage students in collaborative group-based activities (5.8%), and to apply questioning and explanation skills well in teaching (5.7%).

Table 5. 5. PSTs' confidence of their pedagogical content Knowledge.

		Frequency (Percent)				Mode	Mean	Std. Deviation
		Strongly agree	Agree	Disagree	Strongly Disagree			
1.	I have the ability to apply a variety of teaching strategies in my teaching.	44 (41.9%)	50 (47.6%)	11 (10.5%)	0	2.00	1.6857	0.65507
2.	I have the ability to apply questioning and explanation skills well in my teaching.	47 (44.8%)	52 (49.5%)	6 (5.7%)	0	2.00	1.6095	0.59639
3.	I have the ability to conduct whole class mathematics discussion.	44 (41.9%)	53 (50.5%)	8 (7.6%)	0	2.00	1.6571	0.61751
4.	I have the ability to engage students in collaborative group-based activities.	51 (48.6%)	48 (45.7%)	5 (4.8%)	1 (1.0%)	1.00	1.5810	0.63217
5.	I have the ability to incorporate effective assessment strategies into my planning and teaching.	40 (38.1%)	52 (49.5%)	11 (10.5%)	2 (1.9%)	2.00	1.7619	0.71419
6.	I have the ability to plan and prepare a variety of teaching resources to help me in my teaching.	45 (42.9%)	53 (50.5%)	7 (6.7%)	0	2.00	1.6381	0.60644
7.	I have the ability to make links between theory and practice of teaching in the classroom.	34 (32.4%)	55 (52.4%)	15 (14.3%)	1 (1.0%)	2.00	1.8381	0.69509
8.	I have a good understanding of instructional strategies that best represent mathematical topics.	44 (41.9%)	48 (45.7%)	12 (11.4%)	1 (1.0%)	2.00	1.7143	0.70321
9.	I have the ability to relate classroom learning to the real world.	41 (39.0%)	51 (48.6%)	9 (8.6%)	4 (3.8%)	2.00	1.7714	0.76280
10.	I have the ability to select effective teaching approaches to illustrate difficult mathematical concepts.	36 (34.3%)	57 (54.3%)	9 (8.6%)	3 (2.9%)	2.00	1.8000	0.71253
11.	I have a good understanding of students' conceptual and practical understanding of mathematical concepts.	37 (35.2%)	56 (53.3%)	11 (10.5%)	1 (1.0%)	2.00	1.7714	0.66877

(1 = Strongly agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree, N=105)

5.2.3 Teaching efficacy beliefs

In this section, participants were asked to rate their feelings of efficacy and preparedness regarding their expressed confidence as a teacher, beliefs about whether or not they can have an impact on students' learning, and their sense of responsibility for students' success or failure. Rated on a Likert with scores ranging from 1 = "strongly agree" to 4 = "strongly disagree", this section considered 21 items. In general, the PSTs in this study expressed moderate levels of mathematical teaching efficacy.

In terms of PSTs' confidence as a teacher, Table 5.6 shows that participants had the highest level of efficacy (mean 1.43) regarding the statement "I can get any of my students to believe that I truly care about her", with only two PSTs (1.9%) indicating disagreement. PSTs had a good level of efficacy about actively listening to students' mathematical thinking (mean 1.65) and teaching all of the mathematics lessons for the middle/secondary curriculum (mean 1.70). A χ^2 -test showed that the relationship between participants' efficacy beliefs about this latter item and age grouping was statistically significant at the 0.05 level. Specifically, 23.5% of PSTs aged 26 or over had low efficacy about their ability and skills to teach all of the mathematics lessons for the middle/secondary curriculum compared with only 8.0% of the younger participants.

However, PSTs had a low level of efficacy regarding their skills of teaching mathematics and their ability to be effective or good teachers. Over than half of the participants (58.1%) wondered if they had the necessary skills to teach mathematics (mean 2.37) and approximately one-third of the participants (35.3%) believed that even if they tried very hard, they would not be able to teach mathematics effectively (mean 2.89), and/or tended not to believe others who encouraged them (i.e. told them they will be good teachers) (mean 2.94). The χ^2 -test showed that the relationship between responses to "I wonder if I have the necessary skills to teach mathematics" and "Even if I try very hard, I will not be able to teach mathematics effectively" was highly statistically significant [$\chi^2(1) = 31.26, p < 0.001$]. This relationship appears because one-third of the participants (33.3%) agree with both of these statements.

Table 5. 6. PSTs' sense of efficacy and confidence.

		Frequency (Percent)				Mode	Mean	Std. Deviation
		Strongly agree	Agree	Disagree	Strongly Disagree			
1.	I have the ability and skills to teach all of the mathematics lessons for the middle/secondary curriculum.	43 (41.0%)	51 (48.6%)	10 (9.5%)	1 (1.0%)	2.00	1.7048	0.67829
2.	I have the ability to actively listen to my students' mathematical thinking	41 (39.0%)	60 (57.1%)	3 (2.9%)	1 (1.0%)	2.00	1.6571	0.58554
3.	I can get any of my students to believe that I truly care about her.	62 (59.0%)	41 (39.0%)	2 (1.9%)	0	1.00	1.4286	0.53452
4.	I wonder if I have the necessary skills to teach mathematics.	21 (20.0%)	40 (38.1%)	29 (27.6%)	15 (14.3%)	2.00	2.3619	0.96201
5.	Even if I try very hard, I will not be able to teach mathematics effectively.*	15 (14.3%)	22 (21.0%)	28 (26.7%)	40 (38.1%)	4.00	2.8857	1.07698
6.	I tend not to believe others when they tell me I will be a good teacher.*	9 (8.6%)	28 (26.7%)	28 (26.7%)	40 (38.1%)	4.00	2.9429	0.99835

(1 = Strongly agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree, N=105)

Note: *scores have not been altered/reversed in calculating of statistics.

In terms of PSTs' belief in their ability to impact students' learning, Table 5.7 shows that the majority of PSTs had a high sense of efficacy regarding their ability to engage and motivate students, enhance students' learning and improve students' academic achievement, and their ability to adjust a difficult task to the students' developmental level. PSTs felt highly efficacious about encouraging students to believe they can do well in mathematics (mean 1.51), with only two (1.9%) PSTs disagreeing with this statement. However, half to two-thirds of the participants were slightly less confident about their ability to help students value learning (mean 1.61), use assessment results to enhance students' learning (mean 1.63), motivate students who show a low level of interest in mathematics (mean 1.63), improve the understanding of a student who is failing (mean 1.66), and help students learn to think critically and solve problems (mean 1.75).

Within the positive responses related to efficacy the lowest levels of efficacy in terms of modal scores concerned the somewhat linked skills related to their ‘ability to impact students’ learning in terms of helping all students achieve high academic standards’ (mean 1.83) and ‘Even a teacher with good teaching abilities may not reach many students’ (mean 1.85).

Table 5. 7. PSTs’ ability belief to impact students learning.

	Frequency (Percent)				Mode	Mean	Std. Deviation
	Strongly agree	Agree	Disagree	Strongly Disagree			
1. I can help all students achieve high academic standards.	33 (31.4%)	57 (54.3%)	15 (14.3%)	0	2.00	1.8286	0.65717
2. I can help students learn to think critically and solve problems.	34 (32.4%)	64 (61.0%)	6 (5.7%)	1 (1.0%)	2.00	1.7524	0.60098
3. I can use assessment results to enhance students’ learning.	45 (42.9%)	54 (51.4%)	6 (5.7%)	0	2.00	1.6286	0.59254
4. When a student is having difficulty with a task, I am usually able to adjust it to her developmental level.	51 (48.6%)	46 (43.8%)	7 (6.7%)	1 (1.0%)	1.00	1.6000	0.65925
5. If a student did not remember information I gave in a previous lesson, I would know how to increase her retention in the next lesson.	38 (36.2%)	57 (54.3%)	8 (7.6%)	2 (1.9%)	2.00	1.7524	0.67626
6. I can improve the understanding of a student who is failing.	40 (38.1%)	62 (59.0%)	2 (1.9%)	1 (1.0%)	2.00	1.6571	0.56888
7. I can get students to believe they can do well in mathematics.	53 (50.5%)	50 (47.6%)	2 (1.9%)	0	1.00	1.5143	0.53913
8. I can help my students value learning.	47 (44.8%)	52 (49.5%)	6 (5.7%)	0	2.00	1.6095	0.59639
9. I can motivate students who show low interest in mathematics.	45 (42.9%)	54 (51.4%)	6 (5.7%)	0	2.00	1.6286	0.59254
10. Even a teacher with good teaching abilities may not reach many students.	36 (34.3%)	52 (49.5%)	14 (13.3%)	3 (2.9%)	2.00	1.8476	0.75678

(1 = Strongly agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree, N=105)

In terms of PSTs' sense of responsibility for students' academic outcomes, Table 5.8 shows mixed findings. Almost all the participants (95.2 %) believed that the teacher is responsible for students' academic success (mean 1.58). However, while more than two-thirds of the participants (69.5%) agreed that if students underachieve in mathematics it is most probably because of ineffective mathematics teaching (mean 2.07), nearly one-third of the participants (30.5%) believed that the teacher is not responsible for students' failure. The crosstab analysis revealed that more than two-thirds of the participants (68.6%) believed that the teacher is responsible for both students' success and failure, and that approximately a quarter of the respondents (26.7%) believed that the teacher is only responsible for students' success but not their failure. There was a statistically significant relationship between these two beliefs [$\chi^2 (1) = 6.08, p < 0.05$].

The mixed findings were seen for other beliefs regarding responsibility. For example, nearly two-thirds of the participants (62.9%) agreed that the teacher is generally responsible for the achievement of students in mathematics (mean 2.17) while almost two-thirds of the respondents (65.7%) believed that a teacher is very limited in what she can achieve because a student's home environment has a strong influence on her achievement (mean 2.23). Similarly, more than two-thirds of participants (67.6%) believed that students are responsible for their own learning (mean 2.16).

In general, although the majority of PSTs believed that the teacher is responsible for students' academic achievement in mathematics, a significant proportion of PSTs believed that students themselves and their home environment had more influence. According to the crosstab analysis, almost one-quarter of the PSTs (22.9%) disagreed that the teacher is generally responsible for the achievement of students in mathematics because they believed students' home environment had a stronger influence on her achievement than the teacher did. In addition, 21.0% of the respondents disagreed that the teacher is generally responsible for the achievement of students in mathematics, but they believed that students are responsible for their own learning. The relationship between these two beliefs is statistically significant at the 0.05 level.

More than half the participants (54.3%) believed that students themselves and their home environment had a larger influence on students' achievement than the influence of the teachers. In addition, the relationship between the beliefs about the responsibility of students and their home environment on the students' academic achievement is highly statistically significant [χ^2

(1) = 20.65, $p < 0.001$]. Approximately one-quarter of the participants (23.8%) who disagreed that the teacher is generally responsible for the achievement of students in mathematics also believed the teacher is not responsible for students' failure. This belief that the teacher is not responsible for both student achievement and failure is highly statistically significant at the 0.000 level [χ^2 (1) = 33.11, $p < 0.001$].

Interestingly, nearly half the participants believed that all the three factors (teachers, students, and the home environment) had an influence on students' academic achievement in mathematics. Possibly, this could be interpreted as a belief in the shared locus of responsibility.

Table 5. 8. PSTs' sense of responsibility for students' academic outcomes.

		Frequency (Percent)				Mean	Mode	Std. Deviation
		Strongly agree	Agree	Disagree	Strongly Disagree			
1.	When a student gets a better grade than she usually gets, it is most likely because I found better ways of teaching that student.	49 (46.7%)	51 (48.6%)	5 (4.8%)	0	1.5810	2.00	0.58476
2.	If students underachieve in mathematics, it is most likely due to ineffective mathematics teaching.	28 (26%).7	45 (42.9%)	29 (27.6%)	3 (2.9%)	2.0667	2.00	0.81177
3.	The teacher is generally responsible for the achievement of students in mathematics.	26 (24.8%)	40 (38.1%)	34 (32.4%)	5 (4.8%)	2.1714	2.00	0.85998
4.	A teacher is very limited in what she can achieve because a student's home environment is a large influence on her achievement.	19 (18.1%)	50 (47.6%)	29 (27.6%)	7 (6.7%)	2.2286	2.00	0.82342
5.	Students are responsible for their own learning.	24 (22.9%)	47 (44.8%)	27 (25.7%)	7 (6.7%)	2.1619	2.00	0.85624

(1 = Strongly agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree, N=105)

5.2.4 Factors that have influenced the sense of preparedness for mathematics teaching

PSTs were asked to rate the influence of ten factors (see Table 5.9) on their sense of preparedness for teaching mathematics from 1 = “strongly influential” to 4 = “not at all influential”. All rated as having an influence on the PSTs’ sense of preparedness, the factor that was rated most as strongly influential concerned the student teaching experience or practicum (mean 1.43), closely followed by the students’ ITE (mean 1.53). Approximately half the participants rated three other factors as more moderately influential rather than strongly influential. These factors were beliefs about the nature of mathematics, learning mathematics, teaching mathematics (mean 1.70), graduate study (mean 1.70) and prior experiences as a student (mean 1.66).

Table 5. 9. Factors influencing the formation of PSTs’ perceptions.

Factors	Frequency (Percent)				Mode	Mean	Std. Deviation
	Strongly influential	Moderately influential	Less influential	Not at all influential			
1. My prior experiences as a student	47 (44.8%)	49 (46.7%)	7 (6.7%)	2 (1.9%)	2.00	1.6571	0.69099
2. My initial teacher education program	61 (58.1%)	32 (30.5%)	12 (11.4%)	0	1.00	1.5333	0.69430
3. My professors in my methods course	45 (42.9%)	42 (40.0%)	16 (15.2%)	2 (1.9%)	1.00	1.7619	0.77861
4. My graduate study	44 (41.9%)	50 (47.6%)	10 (9.5%)	1 (1.0%)	2.00	1.6952	0.68112
5. Actually teaching during student teaching experience (practicum)	67 (63.8%)	31 (29.5%)	7 (6.7%)	0	1.00	1.4286	0.61795
6. Feedback I received from my cooperating teacher during practicum	52 (49.5%)	33 (31.4%)	15 (14.3%)	5 (4.8%)	1.00	1.7429	0.87737
7. Watching other skilful teachers	56 (53.3%)	39 (37.1%)	10 (9.5%)	0	1.00	1.5619	0.66396
8. My beliefs about the nature of mathematics, learning mathematics, and teaching mathematics	40 (38.1%)	58 (55.2%)	6 (5.7%)	1 (1.0%)	2.00	1.6952	0.62209
9. My mathematics ability	52 (49.5%)	48 (45.7%)	4 (3.8%)	1 (1.0%)	1.00	1.5619	0.61899
10. My ability to interact with students	55 (52.4%)	44 (41.9%)	4 (3.8%)	2 (1.9%)	1.00	1.5524	0.66479

(1=strongly influential; 2=moderately influential; 3=Less influential; 4=Not at all influential, N=105)

A few participants rated some of the factors as being less influential or not at all influential. These included feedback from the cooperating teacher during the practicum (n=20), professors in the methods course (n=18) and the ITE (n=12). Although this question did not investigate what kind of influence these factors had on the PSTs' sense of preparedness, whether positive or negative, it could be assumed that PSTs rated the factors that had a negative influence on their sense of preparedness as less influential or not at all influential. The larger standard deviations seen for the scores for the influence of professors in the methods courses and feedback from cooperating teachers is suggestive of both positive and negative influences, possibly related to particular courses or professors that were recalled by the respondents.

Factors related to beliefs about the nature of mathematics, learning mathematics, and teaching mathematics were investigated further in three additional questions (i.e., "How much do you like mathematics?" "How much do you like teaching mathematics?" and "How do you regard mathematics?"). As shown in Table 5.10, nearly all (98.1%) of the PSTs reported liking mathematics. However, although the majority of the participants liked teaching mathematics, it is noteworthy that 8.6% (n=9) PSTs disliked or really disliked teaching mathematics and just over one-thirds (35.2%) of responses indicated that they regarded mathematics as only somewhat important. These findings might explain the indication given by half the participants that their beliefs about the nature of mathematics, learning mathematics, and teaching mathematics was moderately influential in determining their perceptions of preparedness (see Table 5.9).

Table 5. 10. Beliefs about mathematics and teaching mathematics.

		Frequency (Percent)				Mode	Mean	Std. Deviation
		Really Like	Like	Dislike	Really Dislike			
1.	How much do you like mathematics?	35 (33.3%)	68 (64.8%)	2 (1.9%)	0	2.00	1.6857	0.50601
2.	How much do you like teaching mathematics?	35 (33.3%)	61 (58.1%)	8 (7.6%)	1 (1.0%)	2.00	1.7619	0.62824

		Frequency (Percent)			Mode	Mean	Std. Deviation
		Very Important	Somewhat Important	Not Important			
3.	How do you regard mathematics?	68 (64.8%)	37 (35.2%)	0	1.00	1.3524	0.48000

(1=Really Like, 2= Like, 3=Dislike, 4=Really Dislike, 1=Very Important, 2=Somewhat Important, 3=Not Important, N=105)

In an attempt to categorize the ten factors concerning the formation of PSTs' sense of preparedness for teaching mathematics into fewer groups, factor analysis was used to find any possible relationships between the different factors. The results of the correlation matrix, and KMO and Bartlett's test show that the ten factors are highly correlated according to Bartlett's test of sphericity ($\chi^2 = 190.179$, $p < 0.001$) and the KMO measure of sampling adequacy (0.710). Principal component analysis and the scree plot revealed three possible principal components, and the values for each factor within each component loaded together well (see Table 5.11 and Table 5.12). In order of perceived influence (see variance calculations), the first component—'experience within classrooms'—covers five factors: (1) actually teaching during the practicum, (2) the ability to interact with students, (3) own mathematical ability, (4). my prior experiences as a student, and (5) beliefs about the nature of mathematics, learning mathematics, and teaching mathematics. The second component is labelled 'university study', and this includes three factors: (1) the ITE program, (2) graduate study, and (3) professors in the methods course. The third component is labelled "'benefitting from expertise', which covers two factors: watching other skilful teachers and feedback received from the cooperating teacher during the practicum.

Table 5. 11. Factor analysis- Principal Component Analysis.

Total Variance Explained									
Component	Initial			Extraction Sums of Squared			Rotation Sums of Squared		
	Eigenvalues	Loadings		Loadings		Loadings		Loadings	
		% of		% of		% of		% of	
		Total	Cumulative	Total	Cumulative	Total	Cumulative	Total	Cumulative
1	3.038	30.382	30.382	3.038	30.382	30.382	2.282	22.818	22.818
2	1.353	13.532	43.914	1.353	13.532	43.914	1.720	17.199	40.017
3	1.184	11.844	55.759	1.184	11.844	55.759	1.574	15.742	55.759
4	.864	8.637	64.396						
5	.802	8.016	72.411						
6	.742	7.422	79.834						
7	.642	6.418	86.251						
8	.544	5.438	91.689						
9	.463	4.629	96.319						
10	.368	3.681	100.000						

Extraction Method: Principal Component Analysis.

Table 5. 12. Factor analysis-Rotated Component Matrix.

Factors	Component		
	1	2	3
1. Experience within classrooms			
1. Actually teaching during student teaching experience (practicum)	0.556		
2. My ability to interact with students	0.443		
3. My mathematics ability	0.785		
4. My prior experiences as a student	0.669		
5. My beliefs about the nature of mathematics, learning mathematics, teaching mathematics	0.671		
2. University study			
6. My initial teacher education		0.692	
7. My graduate study		0.623	
8. My professors in my methods course		0.760	
3. Benefitting from expertise			
9. Watching other skilful teachers			0.767
10. Feedback I received from my cooperating teacher during practicum			0.780
Variance (Rotation Sums of Squared Loadings)	22.81%	17.19%	15.74%

5.2.5 Summary

Regarding their overall sense of preparedness and their sense of preparedness about different aspects of teaching (e.g., supporting students, using problem solving, etc.), the respondents tended to feel well prepared, although feelings of being unprepared or less prepared were noted for aspects such as taking student ability into account when planning the curriculum and instruction, and the use of technology.

Around three-quarters of the participants felt that they needed to have more time in their mathematics methods course and slightly over half of the participants believed that they needed to spend more time in the practicum. PSTs who were older (26 years or older) were more likely to agree that they needed more time in the mathematics teaching classroom or in the practicum or both, in contrast with PSTs aged 21–25.

The PSTs in this study felt most confident about their CK and PK, notably more so than their PCK. However, despite high levels of confidence with CK, participants felt less confident

about applying multiple mathematical representations for problem-solving and making mathematical connections with problems outside mathematics.

In the area of PCK, most PSTs felt mostly confident that they had the ability to engage students in collaborative group-based activities, but were less confident about the other areas of PCK such as selecting effective teaching approaches to illustrate difficult mathematical concepts.

The PSTs demonstrated a moderate level of efficacy regarding their expressed confidence as a teacher. However, a significant difference between the age groups was seen, with older PSTs (age 26 years or more) indicating a lower levels of efficacy than the younger PSTs (aged 21–25).

Overall, respondents had a lower level of efficacy regarding their mathematics teaching skills and their ability to be effective or good teachers. Regarding their ability to impact students' learning, the PSTs felt more confident about their ability to engage and motivate students, enhance students' learning, improve students' academic achievement and encourage students to believe they can do well in mathematics, which is in line with the qualitative results. However, they felt less efficacious about other aspects such as their ability to help students value learning, motivate students who show low interest, improve the understanding of a student who is failing, and help students learn to think critically. They demonstrated a particularly low level of efficacy regarding helping all students achieve high academic standards and improving students' retention of information. This may be explained why many respondents agreed with the statement that “Even a teacher with good teaching abilities may not reach many students”.

The findings regarding responsibility for student success and failure were mixed with a majority of respondents believing that the teacher is responsible for students' academic success and that if students underachieve in mathematics, it is most probably because of ineffective mathematics teaching. Nevertheless, a large proportion (one-third) believe that the teacher is not responsible for students' failure. Surprisingly, given that the majority of respondents agreed that the teacher is generally responsible for the achievement of students in mathematics, they also agreed that a teacher is very limited in what she can achieve because a student's home environment. That they felt that the home environment is a large influence on student achievement and that students are responsible for their own learning indicates possible confusion and inconsistency regarding the locus of responsibility.

The factor that was reported to have the strongest influence on the PSTs' feelings of preparedness was the experience of the practicum, followed by the ITE program. The factors that had the least influence on feelings of preparedness included professors in the methods course and feedback received from the cooperating teacher during the practicum. It is possible that the respondents rated factors that had a negative influence on their sense of preparedness as being less influential. Interestingly, prior experiences as a student were perceived as only moderately important.

Although a few differences were found in the perceptions of the two age groups, as described above, no differences were found in the perceptions of PSTs who had their practicum experience in middle or secondary schools or both. This likely reflects the fact that their methods courses focused on both middle and secondary teaching context.

5.3 Qualitative results

The qualitative data were collected in two phases. The first phase was the responses to the open-ended questions in the survey. The second phase was the interview data, which yielded much richer data that, on the whole, tended to verify the findings of the first phase of qualitative data collection. These qualitative data revealed a number of interesting findings that shed further light on the results of the quantitative data.

5.3.1 Qualitative Phase 1: Open-ended survey question results

In the open-ended section of the survey, the PSTs gave a range of answers regarding their definitions of what it meant to be prepared to teach, what a teacher needs to know in order to be prepared, and the attributes of a good teacher.

5.3.1.1 Defining 'prepared to teach'

An analysis of PSTs' perceptions about what the phrase 'prepared to teach' means revealed that most responses included descriptions regarding efficacy to carry out teaching tasks. In capturing PSTs' sense of preparedness, thematic coding revealed that responses could be represented by PSTs' description involving one or more components concerning a sense of 'doing', 'knowing', 'feeling', or 'being' prepared. The sub-themes and frequency of each type of definition, along with examples of each theme is presented in Table 5.13.

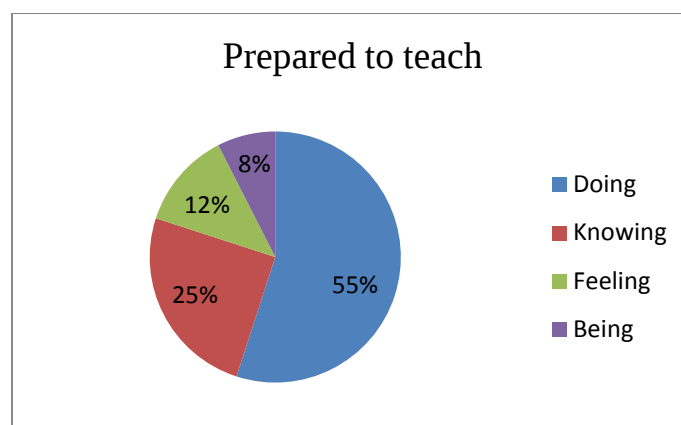


Figure 5. 1. *PSTs' definitions of the phase "prepared to teach".*

Table 5. 13. Frequency of the themes used to define being prepared to teach.

Theme	Sub-theme	Occurrences	Example
1) Doing	Teaching/self-efficacy:	88	
	a) Maths expertise and teaching expertise	77	1. Proficient in the subject 2. The ability to implement a good lesson plan 3. Having the ability to deliver mathematical information to the students 4. Making students love mathematics
	b) Classroom management	11	Able to manage the classroom
2) Knowing	a) Mathematics content knowledge	26	Being acquainted with the subject's content and curriculum knowledge
	b) Pedagogical knowledge:	14	
	1. Knowing about teaching	9	Preparedness to teach includes technical preparedness in terms of teaching technique and the educational methods that are used
	2. Knowing about classroom management	5	Acquainted with the rules of classroom management
3) Feeling	Being psychologically prepared	20	Being fully prepared to teach mentally and psychologically
4) Being	Professionalism:	12	
	a) Accountability	6	Taking responsibility for delivering information freely
	b) Passion	3	Loving the subject and loving the primary task, which is the teaching profession
	c) Professional interest	3	Development

Definitions of preparedness involved teacher efficacy ("doing") mostly referred to descriptions of teaching expertise, with a few related to mathematics expertise and efficacy in classroom management. Descriptions of teaching expertise included definitions referring to teaching efficacy in general, such as "able to teach", "being well versed in the teaching process and

performing it perfectly”, and “the ability to do everything in my power and bring out all my skills for teaching”. Definitions also referred to specifics such as lesson planning and preparation, assessment procedures, and mathematics delivery. In addition, nine definitions of preparedness mentioned supporting students’ to develop a positive attitude and motivation towards mathematics and learning. Responses that referred to teaching expertise in terms of ‘mathematics delivery’ were numerous (40 occurrences). Descriptions involving the delivery of information suggested that making mathematics “precise”, “linguistically sound”, and “easy” were priorities. Other responses also indicated an affective element, in that delivery included making mathematics “lovely, nice, and enjoyable”. In addition, delivery for some was associated with using “modern techniques”. Examples of mathematics expertise included being “proficient in the subject” or “understanding the lesson”. Efficacy of classroom management included 11 instances of describing one’s “ability to manage the classroom”, including examples of specific classroom management skills such as “the ability to maintain an orderly and quiet learning environment”, “the ability to deal with several types of students and to understand them”, and “the ability to create a good relationship with my students”.

PSTs’ definitions of preparedness in terms of “knowing” were categorised under two themes: mathematical content knowledge (CK) and general pedagogical knowledge (PK). There were few responses that directly referred to pedagogical content knowledge (PCK)—and these were more likely linked to teacher actions, such as differentiated planning—and coded within the ‘doing’ theme as discussed above.

PSTs’ believed that a teacher who is prepared should have good teacher knowledge, with knowing mathematics listed as the highest priority. Knowing mathematics included references to “mathematics”, “the subject”, “content”, “curriculum”, “lesson”, and “information”. Responses variously refer to this “knowing” through descriptors such as “having knowledge/understanding”, “familiar/acquainted/well versed”, “aware”, and “proficient”. Many descriptors also quantified the knowledge. For example, they expressed a need to have: “enough background in what will be taught”, or “a sufficient amount of information to deliver to the students”, “understand everything in mathematics”, and “an acquaintance with the subject’s content and curriculum knowledge”.

In terms of PK, PSTs reported examples of both knowing about teaching and knowing about managing the classroom. Knowing about teaching referred to knowledge about general teaching skills and teaching methods and strategies. Examples included “knowing teaching

steps and skills”, “having teaching methods and strategies that encourage students to learn”, and “technical preparedness in terms of teaching technique and the educational methods that are used”. Knowing about classroom management referred to classroom and behaviour management in general, such as “acquainted with the rules of classroom”. Responses alluded to the position that as teachers they needed to “be patient”, “prepared to face difficulties with students and dealing with different situations”, and “be prepared to deal with students and understand some of the teaching positions that might happen”.

PSTs’ perceptions about preparedness to teach included also a sense of “feeling prepared”, that is being psychologically prepared and having self-confidence. The twenty responses coded here included being: “prepared psychologically, intellectually and physically for the teaching profession”, “sufficiently ready to face students”, “prepared psychologically in terms of preparing one’s own self to accept different types of people’s behaviours”, and “having full confidence in myself and what I will serve”.

Finally, for a smaller group of PSTs (n=11) preparedness to teach included a sense of professionalism elaborated as accountability, passion, and professional interest. One teacher described accountability as:

Teaching is a responsibility on any teacher’s shoulders, and if the teacher finds herself facing the costs of responsibility and the hardship of teaching, she should accept this great profession. In addition, [she should be able] to bear the pressures of work from the administration and the job as a whole.

Other definitions stated that a prepared teacher should have a positive feeling towards the subject matter and the teaching profession (e.g., “loving a science that I have studied, and loving teaching it”). Professional interest captured in comments that referred to the need to be open to ongoing learning included: “having the ability to sacrifice one’s own time and thinking for the sake of the personal development, the development of our future generations, and the national renaissance”.

Overall, it is clear from the PSTs’ responses that preparedness to teach was related to their ability to do the teaching tasks (efficacy) in the first instance (see Figure 5.1). While some teachers mentioned building a relationship between students and mathematics and aspects of professionalism, for the majority of responses the “doing” related to a more traditional sense of mathematics delivery rather than supporting and engaging learners.

5.3.1.2 Important knowledge and skills for being a well-prepared teacher

As part of the survey, the PSTs were asked to list four important skills or areas of knowledge that a teacher needs in order to be well prepared. Mirroring their definition of preparedness (Section 5.3.1.1), mathematical CK and PK were identified as important factors. However, unlike the earlier section PK was mentioned more frequently. PCK was rarely mentioned as being important (see Figure 5.2 and Table 5.14).

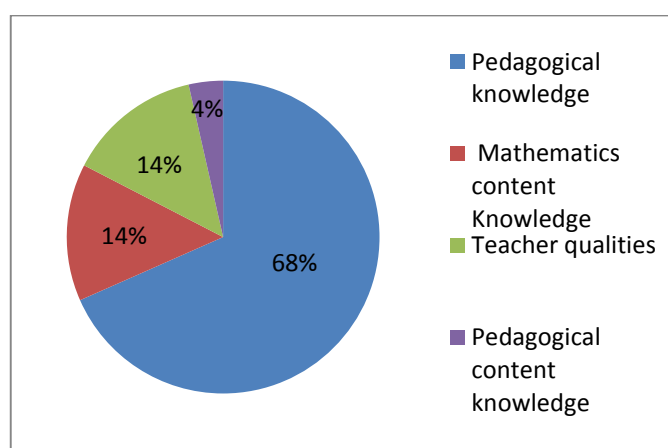


Figure 5. 2. *Important knowledge and skills for being a well-prepared teacher.*

Table 5. 14. Important knowledge and skills for being a well-prepared teacher.

Theme	Sub-theme	Occurrences	Example
1) Pedagogical knowledge	a) Teaching skills	146	1. Good lesson preparation 2. Knowledge of modern teaching methods 3. Opening an area of discussion and dialogue with student
	b) Classroom management	46	Teaching in the estimated time for the lessons
	c) Knowledge of students	20	Knowledge of individual differences among the students
2) Mathematics content Knowledge	Knowledge of mathematics content and curriculum	44	Knowledge of the curriculum and its content
3) Teacher qualities	a) Teacher personality	16	Strong personality
	b) Teacher professionalism	27	Honesty
4) Pedagogical content knowledge	Mathematics teaching methods	11	Relating mathematics to real life

PSTs' responses concerning PK included: (a) teaching skills, (b) classroom management, and (c) knowledge of students. Affirming perceptions of preparedness discussed above (Section 5.3.1.1), the majority of pedagogical teaching skills related to delivery or being skilled at direct teaching more so than responsive pedagogy. A performance based set of descriptor for teaching skills included: "knowledge about the importance of teaching and its purpose", "being acquainted with the stage's objectives", "diction skills", "writing skills", "observation skills", "analytical skills", "thinking skills", and "computer skills". In reference to lesson planning and preparation, skills included "applying the exact plan", "presenting the introduction", and "summarising the lesson"—representing a compartmentalisation of performance.

General teaching methods were noted by 31 respondents. Inclusion of teaching strategies that involved the ability to motivate and engage students, hinted at a sense that these teaching strategies might be different to traditional strategies that they might currently see in the classroom. Example responses included "inventing new methods of explaining the lessons", "diversification of learning strategies", "acquainted with modern instructional aids", "using technical tools in explanations of the subject", and "the ability to attract students' attention". Indeed, 18 responses explicitly referenced pedagogical skills related to relational pedagogies such as "communication skills", "listening skills", "the ability to use active learning methods with students", "cooperative teaching skill", and "opening an area of discussion and dialogue with students". Thus, while traditional pedagogies were to the fore, there was evidence that for some PSTs relational aspects of teaching were viewed as a mark of being a good teacher.

No matter what teaching orientation respondents preferred, classroom management in terms of time and behaviour management, and managing interactions with students was viewed as an important skill. Example responses included "the ability to maintain an organized classroom environment and excellent classroom management", "arranging enough time for every new idea that the students learn for the first time", "the ability to discipline students", and "knowing how to deal with students".

As part of teacher knowledge, 17 PSTs also noted that knowledge of students and students' learning was an important aspect for being a well prepared teacher. They claimed that a well prepared teacher should know about students' psychology, personality, thinking, and understanding. As well, the teacher should have knowledge of the individual student differences. These differences included references to affective matters that may mediate the learning experience including "taking students' psychology and mood swings into account",

“the ability to find out students’ fears of the subject and make students love [mathematics]”, and “the skill of instilling confidence and self-reliance in the students”. References to individual differences also concerned the ability to provide appropriate differentiated learning experiences through knowledge of “the characteristics of the age group”, “students’ intelligence”, “students’ progress”, and “the ability to deliver information to high- and low-achieving students”.

The importance of mathematical CK included the need for sound knowledge of mathematics in general, as well as knowledge of the curriculum. In describing curriculum knowledge, responses elaborated specific mathematics skills including: “skills in expansion in presenting different types of problem-solving and exercises”, “algorithm skills”, “arithmetical skills”, “algebraic processes of equations”, “skill in drawing geometric shapes”, and “physics”.

Only nine respondents listed PCK as part of their four responses. Examples related to knowing a variety of mathematics teaching methods: “ways that help with memorizing the multiplication table”, “the use of computer skills and modern technology to break the routine of boring mathematical subjects”, and “the ability to relate mathematics to real life and other sciences”.

The importance of teacher qualities for being a well-prepared teacher covered two categories: personality and professionalism. Personality attributes that were perceived as important included: patience, good manners, flexibility, confidence, and leadership. Teacher professionalism included references to passion (e.g., “showing enthusiasm” and “having a desire for teaching”), professional interest (e.g., “committed to staying up to date” and “takes counsel from those who are the most knowledgeable in the field”), behaviour, and integrity. As part of “being a good role model for her students”, four respondents noted that a well prepared teacher should be committed to the Islamic cultural concepts of the teaching profession values such as “honesty”, “trusteeship”, “faithfulness in providing teaching” (integrity), and “compliance with the provisions of Islam”.

5.3.1.3 Attributes of a good mathematics teacher

PSTs’ perceptions about what it takes to be a good mathematics teacher affirmed the preferences of skills listed as important to being prepared (section 5.3.1.2): teacher qualities, pedagogical skills, mathematical CK and expertise, and PCK (see Figure 5.3 and Table 5.15).

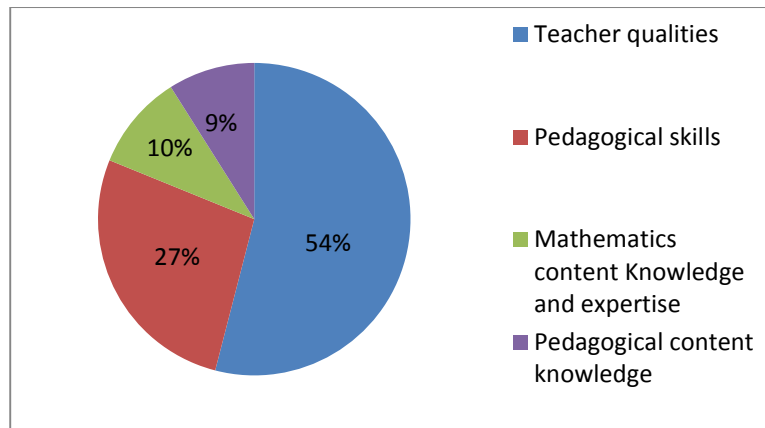


Figure 5. 3. *Attributes of a good mathematics teacher.*

Table 5. 15. Attributes of a good mathematics teacher.

Theme	Sub-theme	Occurrences	Example
1) Teacher qualities	a) Personality	108	Being charismatic and humorous to some extent
	b) Professionalism	127	The ability to enrich her knowledge through continuous self-development
2) Pedagogical skills	c) Teaching skills	59	Diversification of instructional aids and teaching methods that are appropriate for the curriculum and the nature of students
	d) Teacher's relationship with students	40	Developing a respectful relationship with her students
	e) Classroom management	19	The ability to create an effective environment in the classroom
3) Mathematical content knowledge and expertise	Knowledge of mathematics content and curriculum	43	Fully acquainted with all matters relating to the lesson in particular and mathematics in general
4) Pedagogical content knowledge	a) Linking mathematics to real life	11	Facilitates and simplifies information using the students' daily life
	b) Supporting students' positive relationship with maths and maths learning	28	An innovative teacher who uses tools to make students love the subject

Teacher qualities included both personal and professionalism characteristics. Personal characteristics included: being “patient”, “self-confident”, “kind”, “organized”, having “strong personality”, “charismatic and humorous”, “excellent communication skills”, “ability to convince others”, and “flexibility”.

Teacher professionalism was described as having a positive attitude towards the subject matter and teaching profession including having a desire to teach mathematics, and valuing the status of mathematics. Participants reported that good mathematics teachers should have a high degree of competence and proficiency reflected by being up-to-date on best practice and new teaching strategies through continuous self-development. Another element of teacher professionalism was viewed as mathematics teachers being good role models for their students in that they are disciplined, behave well, and have self-respect. Moreover, good mathematics teachers were described as committed to the Islamic cultural concepts of the teaching profession such honesty, trusteeship, faithfulness, the fear of God (being fair and equitable), dedication to work, and transparency.

In terms of teacher knowledge, participants put strong emphasis on the importance of pedagogical skills. Pedagogical skills included teaching skills, the teacher's relationship with students, and classroom management. Again, as in Section 5.3.1.2, planning skills was a frequently noted characteristic of good teaching skills. They also described a good mathematics teacher as a teacher with the ability to convey lesson content accurately via clear and simple explanations. In addition, a good mathematics teacher should have the ability to select and implement a variety of appropriate and new teaching methods, strategies, instructional aids and tools, and technology in order to adapt to students' abilities and understanding. As noted earlier examples of responsive pedagogy such as "giving a chance for students to ask questions and answering their questions freely", "the ability to debate with students", and "a good listener to the students and their ideas and questions", were noted, but with less frequency ($n = 6$).

In terms of the classroom relationships, PSTs reported that a good mathematics teacher should be able to establish rapport with students and build respectful relationships. Participants also believed that good teachers are able to understand their students' characteristics and their motivation to learn. They should have the ability to identify individual differences among students and take them into account, and support low-achieving students; for example, by reviewing lessons and supplying activities that promote understanding.

Surprisingly, PSTs did not place great importance on classroom management as being an important attribute of a good mathematics teacher, possibly indicating that good management was a given for a strong teacher. Sixteen participants listed classroom management in general, as well as organising the classroom environment, behaviour management, and time management. For example, descriptions included "the ability to create an effective environment

in the classroom”, “determine the classroom’s laws and read them to the students, plus posting them on the wall”, and “ending the lesson in time”.

Mathematical CK was described generally as having knowledge of the subject (mathematics), with a few PSTs (n=5) listing specific aspects of mathematics expertise such as “having numerical skills”, “always being precise in calculations”, “mathematical language”, and “exploring other unfamiliar methods that show problem solving”. Knowledge of mathematics curriculum was also mentioned by some PSTs and included “knowing many ways to simplify the solutions of mathematical problems”, “comprehensive familiarity with mathematical axioms”, and “having the ability to answer every question raised by the students”.

Unlike the first two open-ended questions (see Sections 5.3.1.1, 5.3.1.2), 29 PSTs reported the importance of PCK for being a good mathematics teacher. Aspects of PCK included: making mathematics relevant to the students’ daily life, so that students can understand and develop their imagination and thinking skills; supporting students’ to develop a positive relationship with mathematics; engaging students in learning and facilitating their enjoyment of mathematics by “making the lesson interesting so students do not feel bored by the curriculum”, “encouraging students to be innovative”, “using strategies and teaching games to make students love mathematics”, and “being tolerant with the students because some students like the subject because of the teacher and vice versa”, were also seen as marks of a good teacher.

In general, participants defined the qualities of ‘good’ mathematics teachers as being more related to the teacher as a person. Although PSTs considered both teacher knowledge and personal qualities to be important attributes of a good mathematics teacher, they appeared to place greater importance on personal qualities that supported students to engage with mathematics in a positive and productive way.

5.3.1.4 Summary

PSTs in this study presented quite different perceptions when they talked about the attributes of good mathematics teacher compared with their perceptions about being a prepared teacher. For example, only two PSTs mentioned building a relationship with students when discussing preparedness and none reported building a relationship with students as an important skill for being a well-prepared teacher. However, when they talked about the important attributes of a good mathematics teacher, a number of them described developing a good relationship with students. A possible explanation for this difference is that PSTs think a relationship with

students is something that can be developed later, when they are in the classroom, rather than something that their ITE can prepare them for. That is they might consider preparedness as knowledge acquired through ITE—a toolbox that they need as a beginner teacher (conceptualized knowledge)—and in contrast they see good teaching as something that they learn by doing—experientially learned and embodied knowledge. This would explain why the responses about preparedness focus on classroom management and having knowledge, matching their belief that it is possible to build the other aspects of teaching related to being a good teacher during teaching after having more experience in the classroom.

In general, it is evident from the PSTs' responses to the open-ended questions that their beliefs about the important knowledge and skills for being a well-prepared teacher and a good teacher are more related to having a variety of pedagogical teaching skills, rather than specific knowledge of the subject matters; CK and PCK. Interestingly, knowledge of assessment was rarely mentioned as an important aspect of being a well-prepared teacher, although it is listed in the graduating standards. In addition, the teacher's responsibility of establishing and maintaining relationships with the students' parents was not identified in the responses to the survey or the interview questions. This may be related to the PSTs' prior experiences as at this stage they are not yet in service and have not yet been given this responsibility.

5.3.2 Qualitative Phase 2: Interview

The 16 individual interviews with participants revealed rich data that allowed exploration of the factors influencing PSTs' sense of preparedness to teach, as well as responses to the open-ended questions focused on the definitions of preparedness and an ideal teacher. During the interviews, participants were encouraged to discuss their practicum experience and the influence of their ITE course at university in relation to their sense of preparedness.

5.3.2.1 Definitions of preparedness to teach

Four themes emerged from PSTs' perceptions about what "preparedness to teach" means or looks like: (1) pedagogical knowledge and skills, (2) specialised and curriculum knowledge, (3) feeling confident and gaining teaching experience, and (4) teacher attributes related to the 'good' teacher.

All respondents discussed a sense of efficacy in different aspects of pedagogical knowledge and skills when describing preparedness. The most common aspect to pedagogical knowledge and skills (mentioned by $n = 7$) concerned classroom management, namely time management

(e.g., “organizing the lesson to coincide with the class time”) and interactions with students and behaviour management. For example, PST11 reported that “it is important for the teacher to follow a method to manage the students and, at the same time, it is essential to have respect between the teacher and her students”. As noted in surveys, lesson planning and preparation, was the next more common skill noted in relation to preparedness.

As was noted in survey responses, interview responses focused on effective delivery included being confident and able to apply different teaching methods including the teacher’s ability to use teaching aids, and to motivate students and attract their attention. However, when PSTs elaborated, examples were linked to transmission of content with clear step-by-step explanations and illustrations of how to solve problems.

Having knowledge of mathematics content and curriculum—described as being “skilful”, “having a good understanding of the subject content”, or “the ability to apply multiple mathematical representations for problem solving”—was the second most common theme used to define preparedness (n=12). In contrast to frequent references to CK, PCK was rarely referred to as an example of defining “preparedness to teach”. Of the two aspects of PCK mentioned, one respondent, in her definition of preparedness, included “familiarity with the teaching strategies that are specific for mathematics because they are different from the teaching strategies related to the other sciences”.

Feeling confident and the importance of gaining teaching experience was referred to by seven PSTs. Examples of feeling confident included “self-confidence” and “prepared psychologically to be unworried by the students”. Increases in confidence or becoming ‘good’ at teaching were frequently related to positive experiences in their practicum. For example, PST4 noted that “being able to improve your teaching from the beginning of practicum period to its end”, meant she felt prepared. However, in contrast to other PSTs, PST16 noted that “reading lots of books” helped her feel prepared.

Other definitions of preparedness included examples of teacher attributes, such as “having a strong personality”, “strict”, “patient”, “not complaining about students’ questions because mathematics needs further explanation and clarification”, and caring about students by “avoiding choosing difficult questions to include in the exam questions that have not been presented, clarified or explained to the students previously in the lesson”.

The picture that emerges from this section of the interview is that in order to feel or be prepared, a mathematics PST needs to have sufficient PK and tools to help her know how to manage the classroom and therefore feel confident. The second most important aspect of preparedness was sound CK and familiarity with the mathematics curriculum, with PCK being less important for definitions of preparedness. This gives an indication on some of the areas that ITE could focus on so that PSTs can feel more prepared to teach, and move toward being like their picture of the ideal teacher (see below). However, as many of the interviewees pointed out, familiarity with the curriculum and a range of pedagogical tools usually only comes with experience, which highlights the importance of the practicum in ITE.

5.3.2.2 *The ideal mathematics teacher*

PSTs descriptions of the mathematics teacher they would like to be and beliefs about what makes a good mathematics teacher were grouped into three main themes: care for students (relational teaching strategies), teacher knowledge, and supporting positive mathematical identities. Interestingly in contrast to attributes of preparedness related more towards traditional teacher-centred transmission approaches (above and in the survey) the interview responses concerning an ideal teacher mainly revolved around having a student-centred approach.

Care for students was the theme that emerged most frequently in descriptions of an ideal teacher. Explanations about caring for students included a focus on adapting their teaching to their students' abilities. For some PSTs (n=3), they described this adaptation in terms of being able to answer students' questions, and "*being a patient teacher if the student does not understand*" (PST14). Also reflecting an ethic of care, three PSTs included consideration of students' feelings and understanding students' emotional well-being as it related to learning and doing mathematics. For example, PST16 reported:

I would like to be a teacher who cares about her students' psyches. For example, I noticed some students were too shy to come up to the blackboard, so I discussed with the students about why they were shy and they told me they were afraid to answer wrongly. Therefore, I tried to encourage them even if they did a mistake, to show them what the right answer is.

Building relationships with students based on balancing strictness and lenience was another important quality of the ideal mathematics teachers mentioned by four PSTs:

Dealing with the students very kindly and having a close rapport with my students, so they won't be scared of me. I do not wish to be a strict teacher. (PST6)

I want to be more interactive with the students; that is, to be close to them and to be more than just a teacher for them, and the students will not be afraid of mathematics or of the teacher herself. (PST13)

While still talking about caring, one interviewee believed that it is important that the teacher be strict; she should not be lenient with students, in order to be able to manage the classroom:

Firm and strict in my rules for the students and never be lenient with students, and being serious in teaching: don't have space for side conversations between students, and no space for them to play and waste the lesson time. (PST15)

The second most common theme that emerged in the interviewees' descriptions of an ideal teacher was that of teacher knowledge (n=13). On the whole, this knowledge tended to be mathematical CK (e.g., sound mathematics and curriculum knowledge) and pedagogical knowledge/skills (e.g., managing lesson time, good lesson planning and preparation, familiarity with the lesson, and loving mathematics), rather than PCK. For example, PST12 noted that this knowledge should be more than “*acquaintance with the scientific subject*”; it should involve “*knowing all the details of the mathematics curriculum that I teach and delivering it very well to the students*”. In addition, three PSTs noted that good mathematics teachers should have familiarity with the whole mathematics curriculum in order to take students' prior experience into account:

It is necessary for the teacher to have experience in the mathematics curriculum that she is teaching and the mathematics curriculum for the previous grade because every mathematics curriculum is linked to another. For example, in some lessons, I needed to go back to look at the previous mathematics curriculum. (PST10)

Interestingly, one PST described her ideal teacher as “an outstanding teacher”:

to be outstanding in everything: familiar with the lesson, reaching students' understanding as much as possible, having good lesson explanations, and using teaching strategies because the strategies help the students a lot. (PST16)

The theme of supporting positive mathematical identities overlapped with the themes of teacher knowledge and caring for students. In particular, responses focused on the ability to help students “*understand*” mathematics by providing clear explanations and adapting to students’ needs, as well as helping students to “*love*” mathematics. For some PSTs (n=7) this meant the ability to be able to adapt to students’ abilities by, for example, scaffolding learning with “the provision of clear, simple, and step-by-step explanations”. Others highlighted “using different methods of solving a problem” or “giving quizzes to prepare students for the final exam and setting easy and uncomplicated exam questions”. As PST10 noted, the goal was to make mathematics accessible to all students:

I hope to be a teacher who is able to deliver information to students no matter how difficult it is and simplify the solution of problems for the students. For example, the mathematics textbook shows the long way to solve mathematical problem. However, I discovered that instead of resolving the problem in a full page as in the textbook, I could resolve the problem in two lines in another way easier than in the textbook, which made the students enjoy the lesson more. (PST10)

In addition to the scaffolding, five PSTs believed that using a variety of new teaching methods and strategies (e.g., technology and real-life applications) would help them to facilitate students’ understanding, and engage students and motivate them for the lesson.

Supporting the students’ positive relationship with mathematics was another quality of the ideal mathematics teacher mentioned by four PSTs. Noting that mathematics is not loved by many students, these PSTs hoped to be teachers who have the ability to help their students love mathematics:

... because if students love a certain subject, they will love the teacher of that subject and they will love to study. Then they will be able achieve well in the subject. (PST1)

Related to this, one respondent described the ideal teacher as loving mathematics herself.

Overall, the picture that emerges from these PSTs’ definitions of an ideal teacher is of a teacher who is familiar with her subject and the mathematics curriculum. Student-centred in her approach to teaching, this ideal teacher is able to draw on a variety of techniques in order to help her students understand. Additionally, there was a strong sense that the ideal teacher is

one who supports students to feel comfortable in the classroom because they enjoy learning mathematics.

5.3.2.3 Sense of preparedness

Trajectory towards becoming an ideal teacher

The PSTs were also asked to describe similarities or differences between their vision of ideal teaching and their own teaching as experienced when on practicum in schools. Although most of the interviewees gave very similar descriptions of an ideal teacher, they differed as to how well they felt they were able to embody this ideal at this stage of their teacher education.

Six of the PSTs expressed confidence that their teaching during the practicum was quite similar to their ideal teacher's style of teaching. For another six respondents, although they thought their teaching was somewhat akin to ideal teaching, they recognised that they needed to try harder or get more experience in some pedagogical skills:

The similarity: I can explain the steps of solving a problem and use cooperative learning strategies. The difference: I need more experience in managing the students. (PST7)

Four of the interviewees indicated a sense of difficulty reaching their ideal teachers' ability (as measured against the cooperating teacher) to teach mathematics. These PSTs were aware that they needed to try harder or to develop their familiarity with the curriculum, using technology, lesson preparation, and classroom management:

My level of teaching was much lower than hers [cooperating teacher]; her teaching was very different. I need to work very hard to be like her. (PST3)

While not all felt they were like their ideal teacher at this point, overall, the majority of the respondents were confident they are prepared to be teachers with the qualities of their ideal teachers in due course. Seven of them were quite confident that they were very well prepared to be like their ideal teachers:

I am very well prepared; I found these qualities in myself when I was teaching. I have complete familiarity with mathematics. (PST14)

Another seven PSTs were also confident that they were prepared to be good mathematics teachers, but qualified their confidence with awareness that they were less prepared to teach in

certain aspects—such as teaching experience, mathematics and curriculum knowledge, lesson planning and explanations, representations of problem solving, answering students' questions, being a patient teacher, disciplining students, and understanding students' psychology:

I am 25% not prepared because I need more training and to gain more knowledge. For example, a student asked me a question from the textbook, but it was not related to the lesson because it just needs knowledge. I tried as much as possible to explain it in a simple way, so I find it necessary to have a high knowledge of mathematics that I can be able to answer any question directed to me. (PST16)

To be a good teacher, I needed more experience in studying the students' psychology, in order to make them more interested in study and I need to take training courses in how to apply multiple mathematical representations for problem solving. (PST7)

Only two PSTs had a sense of being unprepared to be like their ideal teachers. PST15 rated her level of preparedness as 50% prepared (in lesson preparation and explanations) and PST3 pointed out that she was less prepared in mathematics curriculum and integrating technology with teaching mathematics.

Thus, although respondents were generally confident and believed they are prepared to teach, about half thought that they still needed to spend more time studying to develop their knowledge of mathematics and its teaching methods, and other pedagogical skills. In addition, they indicated that they also needed to experience applying this theoretical knowledge in real-life mathematics classrooms.

Interestingly, and unprompted within the interview, three out of the 16 PSTs matched the description of an ideal teacher to the attributes and performance of their cooperating teacher. The attributes of these role models, as described by these interviewees, included a sense of efficiency, passion, and the proficient use of technology within the classroom:

She was diligent in the subject (mathematics) and loves the subject. She uses more than one method to deliver the curriculum to the students. She was committed to the curriculum's plan and does not like to be delayed. She uses technology such as a program in the iPad that chooses the names of the students to participate in solving a problem and assessment programs. (PST8)

Two PSTs also referred to previous teachers as role models. For example, PST6 hoped that she would like to be like her mathematics teachers:

... who taught me in the middle and secondary schools in their easy manner and uncomplicated lesson explanations, setting easy and uncomplicated exam questions, their ways of dealing with the students very kindly. (PST6)

Conversely, PST13 hoped she was not like her previous mathematics teachers who followed traditional teaching styles.

Aligned with the belief that practicum provided the necessary experience to move towards being a good teachers, several PSTs credited improvements towards their ideal goal of good teaching directly to the practicum experience.

In the beginning, my teaching was not similar to this vision, but with spending more time teaching and getting mentoring from the cooperating teachers, I have reached the desired level and have become a teacher who is able to attract students' attention by using teaching strategies. (PST5)

They noted, for example, that getting feedback and mentoring from cooperating teachers, and awareness of making mistakes and learning from them were all factors that supported their learning. For example, PST14's detailed response outlines the opportunity to develop her teaching:

My teaching in the first lessons I taught at school was different from this vision, because I made mistakes, but I learned from them and I could overcome these mistakes in the other lessons. For example, in the "mini lesson" that I presented in the university, I presented a lesson about right angles. In this lesson, my mistakes were that I did not use the ruler to draw the right angles. In addition, I did not use worksheets, but I used more the blackboard to illustrate the information. I did not use a variety of methods, activities and means. However, during the practicum period [after spending more time in teaching], I was able to overcome these mistakes. I used the PowerPoint presentation, worksheets, and geometric shapes. Each student had a worksheet and a certain geometric shape. The student was able to see and feel the geometric shape more than imagining it. In the worksheets, I

experimented with the students to find approximate solutions then I showed the correct solution on the PowerPoint slides. (PST14)

Likewise, another PST noted the value of experiencing what teaching like in real-life classrooms in supporting her goal to be a good teacher:

“Half and half”: because I learned some of these specifications after spending a period of practicum teaching. I have learned now how to deal with the students and take into account individual differences. In the past, I did not know these things because I did not practice them. For example, I’ve learned now that I should not allocate a very short time for solving a problem because some of the students are slow in writing. (PST16)

Two PSTs referred to student feedback or interaction as evidence of their sense of confidence:

I surveyed the students about how much they like mathematics. The majority of the students’ responses were that they love mathematics in my presence as their mathematics teacher. (PST1)

In contrast, not all interviewees received positive student feedback. Some expressed concerns about the students’ disrespect – noting that students treated them as a student and not a teacher. In this respect, PSTs felt that it was difficult to match the ideal teacher. As PST2 notes:

My teaching has been somewhat similar to this vision, but I think I need more to be that teacher. The difference is that students know that we are PSTs so they have some disrespect for us and they give us less attention, unlike when their main teachers are present in the classrooms. (PST2)

The suitability of university study was less likely to be linked to preparation than the practicum experience, and notably only mentioned by those who felt less prepared. For example, PST3 attributed her sense of being unprepared to be like her cooperating teacher to her university study; specifically to lack of opportunities to learn how to integrate technology with teaching.

Another PST attributed her difficulty to apply her ideal teacher’s (the cooperating teacher’s) style of teaching to the school environment:

I faced difficulty in adjusting to the classroom because the school was very old and dilapidated. The school building was small and included three different stages (Primary, Middle, and Quran schools). In addition, the classroom space was too narrow and crowded; there were about forty students in same classroom. (PST8)

Aspects of feeling confident or prepared

When asked to identify those areas that PSTs felt most confident or prepared in, five themes emerged: teaching methods and strategies, classroom management, lesson preparation and explanation, knowledge of mathematics and the curriculum, and self-confidence.

Feeling prepared about applying different teaching methods and strategies was the most frequent area, cited by half of the interviewees. These PSTs reported feeling of confident in using different teaching methods to deliver mathematical content to ensure students' understanding and using different teaching approaches to adapt to the abilities of diverse learners (e.g., by play-based learning, student-as-teacher role-play, and cooperative learning strategies). Through their teaching, they expressed confidence that they could support all students to participate in the lesson, support students' positive relationship with mathematics, and develop students' mathematical thinking skills by encouraging students to discover other mathematical representations for problem solving. In addition, some of them indicated a sense of confidence in their ability to use appropriate teaching aids such as concept maps, rulers and matchsticks, and providing worksheets after each lesson to check students' understanding. As was noted in surveys, confidence in relation to lesson preparation and explanation was a noted skill that included preparing lessons in advance, preparing and organizing the blackboard, delivering mathematical information to students, and using step-by-step explanations. Three PSTs also mentioned confidence with technology, however, these responses focused on the use of PowerPoint to present the lesson content and display sketches and images related to the lesson.

Just over half of the interviewees (n= 9) reported a sense of being prepared in classroom management—including classroom management in general, management of students' behaviour, and having a close rapport with students and dealing with them with respect and appreciation. Disciplinary management based on a reward and punishment system may reflect cultural expectations:

Using rewarding methods to manage the students such as giving gifts for the disciplined students and creating competition between the groups of students. Also using the style of punishment for the students who did not do their homework by deducting marks. (PST10)

Familiarity with the mathematics curriculum and CK, although mentioned in most definitions of preparedness, was another aspect that only a few of the PSTs (n=5) noted. However, expressions of confidence in mathematical CK might well be inferred from four PSTs description of themselves as a strong leader: “I am confident of my knowledge and the information that I have, and can offer it to the students”, and “I have strong leadership personality”.

Overall, although the PSTs indicated that they felt sufficiently prepared it was evident in their explanations that they were aware of their need to be more prepared in some aspects (i.e., classroom and behaviour management, using teaching strategies and technology, and linking mathematics to reality). For example, statements were made such as “I knew how to control some of students’ misbehaviour” and “I hope to be able to strengthen my strengths”.

Aspects of feeling less prepared

Within the category of feeling less prepared, four themes emerged: classroom management, mathematics and curriculum knowledge, lesson preparation and explanation, and integrating technology in teaching mathematics.

Classroom management was the most frequent area where the majority of PSTs (n=14) had a sense of being less prepared. Interviewees reported a feeling of being less prepared in classroom management in general, facing difficulty managing a large number of students, or adjusting the narrow and crowded classroom for implementing teaching strategies.

I am not prepared at all in classroom management, controlling/managing the classroom, and organizing the blackboard; I haven’t arranged it well at all. (PST15)

When a student asked me a question, I became distracted from the lesson and I lost control of the classroom. (PST14)

Others expressed a feeling of being less prepared in time management, particularly when attempting to enact student-centred teaching:

Most of the strategies that we have studied, such as the cooperative learning strategy and the exploration strategy, cannot be applied in mathematics teaching because the class time finishes, but the activity has not yet been completed. (PST13)

In addition, most of the PSTs indicated a feeling of being less prepared in the management of student behaviour. Specifically, a number of PSTs reported that they faced difficulty in being patient and controlling their anger with students:

I do not know how to deal with the naughty students and I have difficulty with that especially with middle school students, because I do not like to deal with them by screaming and giving orders. My ability to manage the classroom was very bad. (PST12)

Mathematics and curriculum knowledge was seldom provided as an area of concern when discussing preparedness (n=5). These PSTs felt that they needed to be more versed in mathematical CK in general, problem-solving strategies in particular, and be more familiar with the mathematics curriculum across grade levels.

Using teaching strategies was considered as an area of concern by only two PSTs. However, specific aspects related to lesson preparation and explanation were considered as an area of being less prepared by four PSTs. Lack of preparation skills were related to difficulties in explaining and delivering mathematics lesson for student understanding, and using mathematical expressions and mathematical symbols. Examples of these feelings included:

I need to be a bit more experienced in explaining the lesson and being able to deliver its content more easily without confusing the students. In addition, I faced difficulty in planning and arranging the lesson content, as I was unsure about what I should present first. (PST6)

I used to teach using the vernacular (informal language) during my teaching and did not use the mathematical expressions and mathematical symbols. (PST7)

In addition, two respondents indicated that a feeling of being less prepared to connect mathematics with real life applications:

I was trying as much as possible to connect mathematics with reality and other sciences, but I was afraid that the students did not understand. I could link the lesson sequences by flowing on to the results of scientific experiments in chemistry and physics. I could use that to motivate the students, but there were too many mathematics lessons that I could not link to the reality or to the other sciences.
(PST12)

Surprisingly, integrating technology into teaching mathematics was mentioned as a facet of being less prepared by only one PST. However, it was evident from the responses to the other interview questions that PSTs in general sought to be more prepared in how to use technology in the classrooms—moving to advance these skills from only how to use PowerPoint.

I faced difficulty integrating technology to teaching mathematics. It was not a weakness, I have not learnt how to integrate technology in teaching during my college study. We only learned about using PowerPoint presentations. (PST4)

Interviewees' responses concerning definitions of preparedness and how prepared they felt to teach highlights an alignment between pedagogical techniques and classroom management as areas necessary for feeling prepared, but also the areas in which the interviewees felt least prepared. Aspects of CK, regarded as being an important part of being prepared to teach, was noted by only a few as an area in which they were less prepared. This suggests that their ITE were enabling them to feel prepared in this respect.

The interviews highlighted that although PSTs knew about different teaching strategies that they could use in the classroom, they often found that when they tried to use these strategies in the classroom, they were unable to implement them properly because of constraints of time and physical space, and difficulties with behaviour management. The picture that emerges is one of PSTs who had gained knowledge of the various pedagogical tools for classroom management and of a number of teaching strategies, but found that application of these in classrooms with students was harder than expected. This highlights once again the importance of the practicum (and appropriate support/feedback within practicum) for helping PSTs to be and feel more prepared and thus improving the quality of their teaching when they enter the workforce as beginner teachers.

5.3.2.4 Factors that influenced pre-service teachers' sense of preparedness

Personal experiences and history as a learner

PSTs' memories of their personal experiences and history as learners included judgements concerning the efficacy of their previous mathematics teachers, particularly those from secondary school. Most of the PSTs (n=11) believed that their previous mathematics teachers had a positive influence on their sense of preparedness in the area of teaching styles and classroom management. They identified positive aspects of previous mathematics teachers' style and teaching methods as step-by-step explanations, good blackboard organisation, catering for individual student differences, enthusing and encouraging students to participate in the lesson through using teaching strategies and worksheets, and helping students love mathematics. In addition, classroom management skills were highlighted including being a strong leader, effective behaviour management and discipline, and a respectful relationship with students. For example, responses demonstrating recall of specific teacher characteristics that were influential in their learning the work of teaching included:

I followed my previous mathematics teachers in the middle and secondary schools style of teaching. For example, I print on the blackboard all the ideas and all the steps to explain how to solve a problem expressively before I write them mathematically. (PST1)

I learned from my previous teachers how to control/manage the classroom and how they dealt with the students. That makes me think whether the students will appreciate a certain way of dealing with them or not before doing it. (PST6)

Of note, two PSTs viewed that their own secondary teachers' expectations that students should provide mathematical explanations gave them a chance to experience teaching and increased their sense of confidence. For example, PST12 noted:

I played the role of the little teacher a lot and explained the lesson rather than my teacher, which gave me confidence in myself.

However, in contrast to positive experiences, three PSTs recalled ineffective experiences of learning, noting that they explicitly wanted to avoid emulating their teachers' traditional styles of teaching, bad classroom management, and poor relationships. As PST4 explained:

Some of my previous teachers did not have complete familiarity with the lessons or good ability to clarify and deliver information to the students, although they were good at mathematics. They did not have experience with the new teaching strategies. For example, they did not use a variety of teaching strategies; they used the same teaching strategies and teaching aids for each lesson. Also, they did not have the ability to manage the classroom. Therefore, I learned from these teachers' mistakes and I did not want to repeat them when I was teaching. In addition, I learned not to discriminate among students, but I need to maintain equality among them. (PST14)

Only one of the interviewees (PST4) believed that her personal experiences and history as a learner did not have an influence on her sense of preparedness. She explained that because she was not planning to be a mathematics teacher until she finished her school study she “was not aware” and it was not until she studied at university that she “focused more”.

Overall, the importance of their own experiences was a significant influence on PSTs' sense of preparedness. Many explained how they were influenced by their early experiences in the classroom both positively and negatively, and they used the behaviour of their earlier teachers as example of what to do and what not to do.

University study

Perceptions about the impact of university study on one's sense of preparedness fell into two categories: (1) the influence of the specialist mathematics courses and (2) the influence of their mathematics methods courses.

The influence of the specialist mathematics courses

Half the PSTs (n=8) felt that the coverage of mathematics content in their university study helped them to deepen their knowledge of mathematics. However due to a disconnect between the mathematics content they studied at university and the mathematics content they taught in the schools, most also indicated that those mathematics courses had not helped them feel prepared to teach mathematics. For several PSTs (n=5), this mismatch resulted in difficulties in lesson preparation. For example, PST8 explained that:

Specialization [mathematics] papers, of course, never helped me to feel prepared to teach because the mathematics curriculum at the university was very complex,

whereas the curriculum for the middle school, which I have taught, was very simple and easy.

However, one of the eight PSTs noted the benefits of including statistics content, an area that is less familiar to many of the established teachers:

...because of my study of statistics and probability theory at university, I've become more of an expert in these lessons. When a student asked me a question about solving a problem that I had not looked at previously, I was able to solve that problem because I studied it during my studies at university and schools. (PST1)

Six PSTs specifically noted the role of the lecturers of mathematics. For example, PST14 stated:

The professor explains the information, repeats and formulates it more clearly to clarify the information. In addition, he draws a scheme to link the [different pieces of] information so that they are clear. I used this method when I teach because I know it will make it more clear and easy for the students to understand the information. (PST14)

Six others did not explicitly identify lecturers of mathematics courses as a factor that influenced their sense of preparedness and four stated that the mathematics lecturers took no role in their sense of preparedness (n=4). For these PSTs, lessons were described as simply conveying mathematics content through PowerPoint slides. The cultural constraint of having male lecturers was noted by some PSTs in terms of limiting the impact of these lectures in terms of providing teaching models:

Unfortunately, most of the mathematics papers are taught by males and there was no direct contact with them, but we communicate with them through the TV screen. Therefore, there was no effect from these papers at all. (PST13)

In summary, it appears that these PSTs felt that although their university-level mathematics courses had supported their mathematical knowledge, the focus on advanced mathematics in university courses was in many areas unconnected with some of the more basic mathematical concepts that they would be teaching, especially in middle school level. Nevertheless, some of the interviewees felt that having a deep mathematical understanding had helped them be more

flexible in the classroom and to respond to students' questions better. However, it was more the content of these courses rather than the lecturers' interactions or mode of teaching that had helped these PSTs feel prepared to teach.

The influence of mathematics methods courses

Although the PSTs did not often mention PCK in relation to preparedness, they nevertheless felt that mathematics methods courses (which teach PCK) played a large role in their sense of preparedness. The majority of PSTs (n=13) were very satisfied with their mathematics methods courses and noted the significant influences those courses had in preparing them for teaching mathematics in schools.

If I had not studied the teaching method course, I would not be able to stand bravely in front of the students and I would not be able to teach them and deliver mathematical information to them. (PST2)

Frequently mentioned aspects of the methods course were lesson planning and designing, teaching methods and strategies, classroom management, and lecturers' teaching methods and styles.

Instruction in lesson design and development was noted as particularly influential. For example, PST8 stated:

[During the practicum] I always go back to the "lessons design" papers to benefit from the ready templates for lesson design [that] contain goals and the content of the lesson in preparing my lessons.

Presenting a "mini lesson" to peers (microteaching), as part of the lesson design was noted as beneficial, in that PSTs believed that practicing teaching through preparing and explaining the 'mini lesson' helped them to prepare for the practicum. Having more experience in teaching, blackboard work, using teaching strategies, and interacting with students helped develop self-confidence and alleviated fears and nerves. As one PST noted:

'Mini teaching' helped me so that I did not face difficulty in practicum teaching in the school. I have applied the same style that I used in the 'mini teaching' and there was no difference, except that the students are different. (PST10)

Lesson design and development models were also viewed as supporting PSTs development of teaching approaches such as: ‘student-as-teacher role-play’, ‘think, pair, and share’, the ‘induction strategy’ (where students deduce how to solve a problem), and cooperative learning.

Classroom management was rarely mentioned by the PSTs as an aspect that their methods courses had prepared them for which may be why a number of the PSTs (see Section 5.3.2.3) mentioned classroom management as an area of concern.

Although all PSTs were also studying general pedagogy courses, the positive influence of this was noted by only three interviewees. Specifically, these PSTs felt that these courses supported preparation in terms of other aspects of classroom management, namely dealing with the different natures of students (i.e. noisy or quiet and shy students), and punishment and reinforcement.

The lecturers’ teaching style and methods were identified by six PSTs as positively influencing their sense of preparedness. For example:

When the students see their lecturers themselves using new and creative methods, working hard at teaching, and using [different] methods to deliver the information to the students, the students may take this lecturer as a role model when they begin practicum teaching and try to use different methods to be able to deliver information to students. (PST13)

A week before the practicum teaching began, I attended a workshop held at the university. The lecturer of this workshop’s style and the manner of her speech was very nice. The workshop was not just a lecture, but we had a talk and a discussion. I learned from this workshop about the teaching strategies and their importance, whereas previously, I did not know that teaching strategies are so important. It was very useful and gave us a strong incentive to progress. After attending this workshop, I’ve had the feeling that I am well prepared to teach. However, before attending this workshop, frankly, I did not feel like I was prepared to teach. (PST16)

Commenting on the different course offerings, three PSTs felt there were no or limited benefits from the methods courses. One of them stated: *Frankly, they did not give me a sense of preparedness. I do not feel that I have benefited from these courses.* While not so quick to

dismiss the impact of these courses, two other PSTs indicated that the influence of the methods course on their sense of preparedness was less than that of other factors. For example PST16 elaborated on the transferability of knowledge as follows:

There were some strategies that we did not use and even the strategies that we studied during this course – I knew them before studying this course from my previous secondary mathematics teachers.

Likewise other PSTs (n=5) also commented on the disconnect between theory and practice, noting that they felt unable to apply in practice some of the skills they learned from the teaching methods courses:

During the practicum experience period, I was trying to apply what I had learned in these courses in my teaching, but I was not able to do so well. For example, my lesson planning was sometimes incomplete and my teaching was only somewhat good. (PST15)

We learned that the teacher does not present the main point of the lesson to the students, but the students themselves explore the point of the lesson through playing a game or reading a story related to the teaching point. However, in some mathematics lessons, whatever I tried with the students, it was difficult for them to discover the point of the lesson. (PST13)

The disconnect between theory and practice was attributed to the theoretical nature of the methods courses and the final exam which focused on memorisation of the curriculum. In particular, PSTs commented on the lack of practical applications in the teaching methods courses:

Teaching strategies were presented theoretically and we read them from the textbook. For example, in an example of solving the problems that the PST may face, we just read it from the textbook and we learned the definition, advantages, and disadvantages. There was no practical application. (PST12)

This disconnect was also attributed to studying general teaching methods courses that were not related to their specific subject (mathematics). This was explained by PST12 who was struggling to implement the more theoretical teaching strategies in her teaching during the

practicum, and relying on searching the Internet to learn how to apply teaching strategies in her teaching:

The lecturer presented examples of teaching strategies, but all of them were related to teaching Arabic literacy. In addition, some of the lecturers asked us to do a task to prepare and design a lesson, but since the supervisor is a specialist in General Educational Science and not a specialist in mathematics, she only looked at my design for the lesson and whether I used a teaching strategy and told me that it was good without assessing my familiarity with the lesson.

Moreover, PSTs argued that not all of the teaching strategies presented in the courses were suited for use in teaching mathematics. For example, PST13 claimed that in her experience:

There are some strategies which were difficult to be use with the students even if the school environment was prepared for that. For example, the role-playing strategy, especially in mathematics, it's difficult for a student explain a new lesson or a new way to solve a problem to her classmates. In some lessons, it is possible to let my students play the role of the teacher and explain the lesson, but it can be difficult to do so in other lessons, especially if it contains information when it is the first time for the students to know this information. (PST13)

To add to their concerns about applicability PSTs also identified the school environment (classroom space and class size), and time constraints as hindrances to implementing the teaching strategies they studied in the methods course in practice:

It is difficult to study the psychology of each student to determine the individual differences and identify the student's weakness because lesson time is not enough for doing that. I have been able to identify some of the individual differences among students in terms of their ability in the mathematical calculations such as multiplication, but I could not identify all the differences. (PST7)

Overall few PSTs (n=3) mentioned mathematics or linked it to teaching strategies, teaching methods, lesson design, etc. in their perceptions about the role that the mathematics methods course had in their sense of preparedness. Interestingly, when asked to define preparedness (see Section 5.3.2.1) few PSTs mentioned PCK in their definitions. This may be linked to the finding that many PSTs (n=13) did not reference receiving instruction in PCK or the application

of different teaching strategies to mathematics. PSTs in the current study seemed neither to be aware of PCK nor to have had much specific instruction that supported their development of PCK. Nevertheless, it is clear to see that the training in lesson design and the use of teaching strategies was useful in helping these PSTs feel prepared to teach.

The majority of the PSTs (n=14) reported earning good grades in their final exams in both mathematics and methods courses—and this engendered feelings of confidence and perceptions of themselves as being well prepared to teach. Of the two who indicated that they had not done well in their final exams, one explained that her lower grade was the result of not working hard in the last semester, while the other attributed her poor grade to the lack of applicability and relevance of the teaching methods papers to mathematics.

Practicum experience

Responses from the PSTs indicated that the largest influence on their perceptions of preparedness was the practicum experience. PSTs' perceptions about the role that the practicum experience had on their sense of preparedness were categorised into four themes: importance and usefulness, challenges, negative impact, and improving teaching efficacy. Note, that the influence of mentoring and feedback is discussed in a separate section.

In expressing views about the importance of the practicum, the PSTs' views were closely related to their discussion of factors that influence their developing sense of preparedness. Practicum experience was regarded as very useful and interesting; it helped them to experience what 'real' teaching was like, providing opportunities to practise applying a variety of teaching strategies.

Practicum also provided the opportunity to observe expert teachers and learn from their experience in delivering mathematics content, managing classrooms, attracting the students' interest, and helping their students love mathematics. Most PSTs reported that observations were enhanced by one-on-one conversations and mentoring. In the following response, PST3 notes the value of these additional opportunities to learn from her cooperating teacher:

Although PSTs should observe cooperating (expert) teachers' teaching for two weeks only, I have observed my cooperating teachers' teaching for the whole semester. When I had free time, I attended her classes to observe her teaching. She told me about herself, her ways of teaching, and how she deals with problems. I have benefited so much from my cooperating teacher; I've got much of her teaching

style. When I faced any problem, I asked her assistance and she directed me to the best solution.

Some PSTs indicated that the practicum experience prepared them psychologically by experiencing what it *feels* like to be a teacher, which in turned helped them gain more confidence in their teaching role:

It prepared me psychologically for teaching as a profession. If I did not have a practicum experience, I would face difficulty in teaching. (PST11)

Although the majority of PSTs had a positive view of their practicum experience, they also noted that they encountered numerous challenges during their practicum teaching (n=14). These challenges included: (1) the attitude of students, cooperating teachers, and school administration towards PSTs; (2) students' interest in and performance of mathematics; (3) the school system; (4) the school environment; (5) time constraints; and (6) fear and low self-confidence.

A key theme represented by PSTs was dissatisfaction related to the attitude of students, cooperating teachers, and school administration towards PSTs. Eight PSTs reported experiencing students' disrespect. As noted by PST12 in the following description this disrespect was linked to her teaching efficacy:

The middle school students told me that they did not like the proofs and reasoning lesson and I am a boring teacher, and they left the classroom. That may be because I was a little bit strict with them. The students in this classroom were very terrible. They weren't curious and dealt very badly with me, and they refused to respond to me when I asked them to read the mathematical expressions. That may be because they weren't satisfied with university students teaching them. (PST12)

While the ability to manage student behaviour appeared to strongly impact on one's sense of preparedness, two PSTs attributed the lack of control of students to the administration and their lenient attitude towards undisciplined students:

The school administration has a big role in the school, but it was very bad. The principal was about to retire and she did not care about the students, and the vice-principal was always in conflict with the teachers. So no one cared about the

students. Therefore, if I punished a student by sending her to the office, she wasn't afraid, because she knew no one would punish her. (PST3)

PSTs also believed that students' responses, interactions, and performance was the factor in determining a sense of preparedness with five PSTs providing explicit examples of how students' low performance and disinterest and unwillingness to study and learn mathematics contributed to a sense of being less prepared. In addition, PSTs noted concerns about differences in the cooperating teachers' curricula expectations and their own. In particular, PSTs claimed that the students were unfamiliar with deductive thinking because their teachers themselves had excluded proofs and reasoning lessons and did not include this type of problem solving in the homework tasks. As PST12 noted, students' disinterest was topic-based:

Middle school students refuse completely to study proofs and reasoning. When I asked one of the students to use deduction to solve a problem, she refused and said, "I do not want to deduce; why do you ask us to do that?"

In discussing her concern with lack of opportunities to develop students' thinking skills PST1 argued that her cooperating teachers' teaching was too focused on memorisation as follows:

My cooperating teacher asked me to write a review of the mathematics curriculum that I taught to the students, summarize the mathematics textbook in one page only, and give it to the students to study for the final exam. I was not satisfied with that because it is a very negative method and it will affect students' futures. I did not agree to do that because it was a waste of my effort and the role that I have done throughout this semester. Mathematics differs from other subjects that rely on memorization, as mathematics needs understanding.

Accommodating the school system proved challenging for some PSTs (n=6). For example, PST10 explained how she felt that the school examination policy undermined teachers' rights. She believed that because of the unfair system, students were privileged and teachers were "persecuted":

Some students were absent deliberately on the exam day in order to get the exam questions from their classmates and then come another day and do the exam and get full marks easily. It is unfair for us also that the teacher is forced to give the students improvement exams – the "improving achievement level strategy" – more

than once until the student got a good grade, although this student didn't deserve this grade, as they did not adhere to class [rules] and didn't bring the textbook.

Opportunity to benefit from practicum experience was for some PSTs also affected by lack of school administration policies and systems related to the PSTs' experience. As PST4 noted:

The practicum was the most difficult thing that I've faced in my life.It was the first time for the vice-principal working in the school administration and first time for her working with PSTs, so she did not know how to deal with us and she did not know the instructions for PSTs' assessment. At the same time, PSTs should receive mentoring from mathematics teachers. However, all the mathematics teachers in my school refused to be cooperating teachers for us, because they did not know what they had to do for PSTs. Therefore, there was no cooperating teacher working with me, and all the onus was on me; I had to learn by myself.

Moreover, the physical environment of practicum schools was noted as a hindrance to the development of PSTs' teaching skills. PSTs reported working with limited classroom space and crowded classrooms, a lack of private room or office space, and a lack of teaching resources (e.g., smart boards). Several PSTs (n=7) noted these conditions were detrimental to their sense of preparedness:

The environment of the school of practicum and its construction was bad and not prepared tidily: there was no place provided for PSTs to sit in, but we were sitting in the housekeeping room, which was not an appropriate environment to help us in preparing for teaching well. (PST15)

The school building was very old, dilapidated, and small. In addition, the classroom space was too narrow and crowded by the students; there were about forty students in same classroom. (PST8)

Specifically, ineffective technology was linked to poor lesson delivery:

I planned to use a projector to view the lesson content including the concepts and definitions. The lesson contains a lot of theories; therefore, to save the class time and so the students don't get bored when I spend long time writing on the blackboard. However, the projector was broken. Consequently, I felt I lost a big

thing that I was relying on, which made me confused and I had to write on the blackboard. So, the blackboard was messy. (PST12)

Another theme was the feeling of time pressure. Managing class time while still trying a range of teaching strategies and technology (e.g., displaying a video) was noted as an ongoing challenge by many (n=7):

At the beginning of the practicum, I was less prepared. I was not able to deliver the lesson as I wanted and I was not able to adjust the lesson time. I was so busy that the class time would end before I finished the lesson and offered the strategies I chose for study as being possible to do in the class time. (PST13)

Furthermore, some PSTs (n=2) believed that the duration for practicum provided insufficient experience of teaching mathematics. These PSTs noted feelings of adequate but not complete preparedness as follows:

If I were to assess my teaching, I would give myself a mark of 80% experience in teaching. Of course, I am prepared to teach, but, surely, I needed more experience because the practicum period is too short, so it is impossible to give me enough experience. (PST10)

Self attributes based on confidence and demeanour were also factors that came to play in the practicum experience. For example, most of PSTs (n=8) reported that they experienced feelings of fear and nervousness about standing in front of students and cooperating teachers and their reactions to their teaching efforts. In contrast, feelings of self-confidence were the most influential factor contributing to two PSTs' sense of preparedness:

My self-confidence is the factor that helped me feeling prepared the most. I was not scared to have a supervisor or cooperative teacher with me to observe me during my teaching. In addition, when they criticized me about the mistakes that I committed during the lesson, I accepted that and I told them myself about the other mistakes that I think I committed. (PST12)

Overall, the variety of experiences and opportunities afforded within the practicum mediated PSTs' perceptions of the role—be it positive or negative—that practicum played in their sense

of preparedness. Some (n=3) reported that the above challenges gave them the sense of being less prepared.

Although it was an interesting experience, it gave me the feeling that I am less prepared. In the first lessons I taught, I made too many mistakes and I was too scared to stand in front of the blackboard. Also, dealing with the students was difficult. (PST15)

Moreover, one PST reported that the numerous challenges she faced during the practicum experience affected her desire to be a teacher in the future:

These difficulties made me sometimes think that I only wanted to finish my practicum period and get the certificate, and that it was not necessary to get a job, since this school and its administration system had a bad status. (PST1)

However, for the majority of PSTs (n=10) the challenges they faced in their practicum experience had a positive impact on their sense of preparedness. These challenges made the PSTs aware of their weakness, so they learnt from them and worked harder to build their professional expertise. In particular, PSTs believed challenges helped them in becoming teachers who were more confident and able to teach:

At the beginning, I felt that I did not have the ability to teach, then at the end, my feeling started to change; I felt I have the ability to teach. I believe that as much as you teach, you will gain more experience and become better. Now I am feeling I am prepared for teaching. (PST3)

In addition, PSTs were aware of changes as the practicum evolved in terms of professional and efficacy development:

Many changes have occurred. I was very afraid that I will never succeed in being a teacher. I was wondering if students will like me. I was afraid that the students will laugh and mock me and I cannot do anything. I was wondering how I will start the lesson. However, in contrast to all these fears, I have gained a strong personality. (PST1)

As practicums proceeded, PSTs reported that they gained confidence in managing students and balancing behaviour management between strictness and lenience. They also felt that they

became more able to convey the lesson content, explain and clarify information, and adapt to the class time.

After the first lessons and the strategies I implemented, I became able to adjust the time, [I was] able to control myself under stress and able to cope with students in the classroom and [knew] how to deal with annoying and naughty students.
(PST13)

Overall, the practicum played an important role in developing a sense of preparedness. The challenges helped PSTs know how to apply what they had learned through their ITE courses, and to develop their skill in teaching. As well, PSTs also benefitted from interacting with and observing cooperating teachers, although in a few cases, this experience was curtailed because of the school environment. It was significant that half of the PSTs felt that the school was not sufficiently prepared to support PSTs' learning, and that the students often lacked respect for PSTs. For some PSTs, these negative experiences influenced their preparedness; however, for others they reasoned that these problems would be dissipated when they became beginner teachers.

Feedback and mentoring

Feedback and mentoring was a significant influence on PSTs' sense of preparedness. As PST6 noted:

Feedback from students, teachers, and professors: their opinion about my teaching – that is, my teaching is excellent – was the most important factor that has a positive effect on my sense of preparedness.

In particular, PSTs noted that positive feedback from peers³ increased their sense of preparedness. For example:

My peers told me that I am amazing in how I could give examples that are not found in the textbook. For example, when a student faced difficulty in understanding how to solve problem, I created an example and explain it to the students. In addition, some of my peers were having difficulty in understanding the lesson, but after they

³PSTs completing practicum at the same school will often observe each other's' teaching as part of their learning experience.

[attended my class and] observed my teaching for the same lesson, they understood the lesson well. (PST12)

Feedback from peers that highlighted weaknesses and provided practical suggestions for improvement in the next lessons was particularly valued:

My peers' feedback was given after I finish the lesson so I could improve my teaching in the next lesson. For example, the lesson time ended and there was a point that I couldn't finish or I spent too long explaining something. (PST13)

Only one PST felt that the feedback she received from her peers was a negative impact on her sense of preparedness. She described the critique from her peers as a discouragement to continue teaching:

When I wake up in the morning and prepared myself to go to the school, I remember them [peers] told me all my bad points. I became frustrated and think why should I go to school for teaching. (PST3)

PSTs reported receiving both positive and negative feedback from their students. Positive feedback received concerned the use of good and simple explanations, ensuring that all students understood, improvement of students' achievement, providing work sheets after each lesson, providing lots of in-class practical work, using concept maps, not needing to study at home, and allowing dialogue between the teacher and student. In the following response we see that PST4 actively recruited student feedback:

I asked my students to write my pros and cons, and most of them wrote pros. The pros were things like I made them understand mathematics more, and they enjoyed my teaching because I use teaching strategies.

Negative student feedback included criticisms about teachers becoming angry, not using effective teaching strategies, giving worksheets, and inability to manage undisciplined students. Students reported feeling bored, not being able to understand the lessons, not liking the lesson, and dissatisfaction with grouping practices.

In addition to student feedback, cooperating teachers' feedback was likely to influence PSTs' sense of preparedness. Feedback about being an expert teacher, having a good teaching style, lesson preparation, classroom management, and having the ability to interact with students

were some examples of the positive feedback that PSTs received. In some instances, PSTs attributed feedback directly to improvements in teaching, especially when cooperating teachers identified aspects that PSTs need to be more prepared in (e.g., lesson preparation, worksheet design, lesson conclusion, blackboard presentation, controlling nerves, inconsistency in using mathematical expressions, lesson pace, motivating students, and classroom management).

Although most PSTs were satisfied with their cooperating teachers' feedback, others (n=5) felt that the feedback was unfair or unjustified. In the following response, PST8's disagreement with her cooperating teachers' advice is based on her own vision of good teaching:

... feedback was that I need to try as much as possible to manage the classroom and get the students to be quieter, but I told her that in the mathematics lesson, it's not necessary to have a quiet classroom and have the students sitting in their chairs, but it has to be more active; that is, the students are excited about participating. (PST8)

In addition to disagreements, some PSTs were concerned about the quality of the feedback received from some cooperating teachers in terms of descriptions of specific strengths and weakness and suggestions for improvement. For example, in the following response PST16 argues that the surface nature of feedback was of limited impact:

The cooperating teacher observed my teaching three times. In the three lessons, she commended my teaching and told me that I did not have any weaknesses. I asked her twice if I had made any mistakes, to improve my teaching, but she replied that I did not have any weaknesses at all. I was surprised that I have no weaknesses. I would like to know what my mistakes were so that next time, I can avoid doing them again.

Most concerning, was reporting by six PSTs of a lack of feedback and/or lack of lesson observations. Three PSTs reported that they did not receive any feedback from their cooperating teacher and six PSTs indicated there were no cooperating teachers observing their teaching, or they only observed the PSTs for a very small part of the lesson in order to be able to complete assessment requirements. PST4 noted the impact on her learning as follows:

All the onus was on me; I had to learn by myself. I was asking other PSTs what happened with them and what I must do and must not do. In addition, I observed

mathematics teachers while they taught in the first two weeks, but it was merely about introducing the students to us and how to explain the lessons. (PST4)

Similar to the influence of cooperating teachers' feedback, PSTs reported that feedback from their supervisors⁴ had a role in their sense of preparedness. A group of PSTs felt that the positive feedback they received from their supervisors, and how they gently advised them, gave them a feeling of being on track to being a teacher:

My supervisor was very kind when she told us about her feedback. She did not make us feel we were failing, but, on the contrary, she gave us the feeling that we were able to carry out the lesson well. (PST13)

PSTs also noted the value of supervisors highlighting areas—most frequently related to classroom management—in which they needed to be more prepared. Another area of significant was using teaching strategies and time management.

I punished some naughty students by making them spend a period standing up and I then let them participate in solving a problem, and then I ended the punishment. However, the supervisor told me that this was wrong, and I should let them spend all the class time standing up and not give them a chance to participate. (PST1)

My supervisor criticized me telling me I need to adjust the lesson time a little bit because the class time finished but I could not demonstrate an important part of the lesson. (PST10)

Although most of the PSTs were satisfied with their supervisors' advice, two PSTs disagreed with their supervisors' views. They felt the feedback they received was unjust or unfair

The supervisor's feedback was that I did not give the students sufficient homework. She thinks that it is essential to give the students a lot of homework in order to help the students become well versed in mathematics. I disagree with her view. It is right that practicing with homework will enable the students to be better in mathematics, but I think this may result in a student hating mathematics. Frankly, I am not satisfied with the supervisor's feedback because I think it's an injustice to criticize

⁴ The supervisor is a university-based education person who views lessons with the aim of making a teacher assessment of the practicum experience

me on the amount of homework because I gave the students sufficient homework and even more homework than the cooperating teacher gives them. (PST10)

My mentor, in each lesson, gave me the same criticism about the volume of my voice and managing the classroom. I think her criticism was unfair. I expected to get better feedback because some of the PSTs who were with me in the same school had worse teaching efficacy level than my level. (PST15)

PST15, dissatisfied about the feedback, reported that supervisor's way of giving her feedback was the most significant factor affecting her sense of preparedness:

My supervisor was very despotic and demanding. She criticized me very badly, which had a psychological effect on me.

Another three PSTs felt that the feedback they received from their supervisors was inadequate; they wanted to have more detailed feedback that enabled them to improve their teaching performance.

My supervisor's feedback put more emphasis on the use of strategies and managing the classroom. These two things were the most important things in explaining the lesson because this supervisor taught us a psychology paper and was not one of our professors for the mathematics teaching methods papers, and she didn't care about the content of the lesson itself. I was hoping to speak more about other aspects, and not just these two points, but from the beginning the supervisor told us that "The most important thing is to use strategies and manage the classroom and anything else is not important". (PST13)

In addition to concerns about the nature and quality of feedback, a group of PSTs reported concerns about the frequency of mentoring from supervisors. Five PSTs mentioned that there was no supervisor who came to observe their teaching. Three of them attributed this to the long distance between the practicum schools and the universities.

In summary, peers, supervisors, and cooperating teachers who observed the PSTs, for the main, helped to increase the PSTs' sense of preparedness, especially when they provided positive feedback and pointed out areas that could be improved. Given the importance of feedback in developing preparedness, it was of concern that several of the PSTs reported that they received

little or no feedback from supervisors, and that in some cases, their supervisors did not observe them at all.

Other factors

PSTs were asked to discuss any other important factors they felt had influenced their sense of preparedness. While most of the factors that the participants mentioned were linked to the categories discussed above PSTs also noted the influence of a positive attitude towards mathematics and teaching and learning from others' experience via the Internet. Both of these factors were seen as having a positive influence on the PSTs' sense of preparedness:

Mathematics and my love of mathematics influenced my sense of preparedness: I really like to teach mathematics and at the same time, I love the teaching profession. (PST11)

The most significant factor gave me a sense of preparedness is that I am acquainted with the subject and use more than one way to explain the lesson. I learned about those ways through the internet, like on Instagram (Apps program). That is, I benefited from the experience of others via the Internet. (PST8)

In addition, there was an open-ended question at the end of the survey for the participants to mention any other important factors they believed had influenced their sense of preparedness that were not on the list of factors provided as Likert-scale items. The analysis of this question yielded two categories of factors. The first category covered the factors that had a positive influence on the participants' sense of preparedness, while the second category included the factors that had a negative influence. As seen in Table 5.16, nine factors had a positive influence on the participants' sense of preparedness.

In contrast, five factors were mentioned as creating a feeling of being less prepared. These included challenges during the practicum experience, lack of self-confidence, lack of intensive courses for teaching mathematics, the difficulty of the teaching profession, and the poor status of the teacher and not giving them their rights, neither morally nor socially. Those factors had only one occurrence each, aside from the challenges during practicum experience, which are described in more detail on Table 5.17.

Table 5. 16. Positive factors.

Factors	Frequency (N= 105)	Examples
1. Making a difference in students' performance	7	When I see my teaching efforts is reflected on the students and their superiority
2. Ability to change students view about mathematics	2	Deliver a good idea about mathematics for the students
3. Students' love for the teacher	1	Students love me because I am collaborator
4. Ability to deal with students	1	I know how to deal with secondary school students
5. Encouragement from other people	6	Support for PSTs from school and university administrations
6. Others' teaching experiences	6	Previous PSTs' experience who I had a close relationship with them
7. Own teaching experience	1	My teaching to my relatives in the family
8. Self-confidence	2	Teacher's self-confidence
9. Liking mathematics and teaching profession	3	Most important factors are love, liking mathematics and liking teaching profession

Table 5. 17. Challenges during the practicum experience.

Factors	Frequency (N=105)	Examples
1. Difficulty in dealing with students	2	Problems that arise between students, students pretending understanding and sometimes misunderstanding.
2. Careless parents	1	Parents' careless of their children study
3. The intensity of the mathematics curriculum	1	The intensity of mathematics curriculums has negative impacts on my sense of preparedness.
4. Lack of school administration policies and systems related to the PSTs experience	1	Treating PSTs as in-service teachers and not trainees. The failure to provide a suitable place for the PSTs to sit in.
5. School environment and infrastructure	3	The school building is small and each classroom has 40 students.

In summary, the responses to the open-ended question matched the findings of the interviews, but also revealed some other factors that had an influence on having a sense of preparedness, such as a love of mathematics and being able to make a difference in students' performance. The importance of feedback was emphasised once again, and also highlighted some of the practical problems faced by some PSTs in some schools that are not properly prepared for PSTs during the practicum.

5.4 Overall summary of findings

In the interviews and in the responses to the open-ended questions, the PSTs revealed a consistent picture of what it means to be prepared to teach and what it means to be a good teacher. The interviews provided further details that related to the practicum experience and its role in shaping feelings of preparedness and good teaching, as well as helping to highlight the different factors that help to shape a PST's sense of preparedness.

Although the results of the qualitative and the quantitative arms of the study tended to agree overall, a few contrasts emerged. The survey results showed that about one-third of the participants agreed with the statements "I wonder if I have the necessary skills to teach mathematics" and "Even if I try very hard, I will not be able to teach mathematics effectively". However, the qualitative findings showed that many PSTs felt they were capable of being a good teacher (i.e. a sense of teaching efficacy). In addition although the qualitative findings reported that prior experiences as a student were a very important influence on feelings of preparedness, the quantitative results indicated that this factor was only moderately important. However, in general, the interviews and the responses to the open ended questions tended to confirm the results of the survey.

In both the interviews and the responses to the open-ended questions, the PSTs defined being prepared to teach mostly in terms of knowledge, especially mathematical CK and PK. Interestingly, PCK was very seldom mentioned in either the interviews or in the responses to the open-ended questions. The qualitative findings showed that the PSTs felt confident about their CK and in most areas of PK, apart from their ability to work with parents and families to better understand students. The interviews revealed that mathematical CK was one area in which the PSTs felt adequately prepared. However, although they had studied PK and skills at university, they found that during the practicum, they were not able to apply that knowledge as well as their ideal teacher. The area of classroom management was a theme that appeared frequently in this discussion. The results revealed a theory/practice divide that led to the PSTs finding the application of teaching strategies in the classroom during the practicum was much harder than expected, especially if student behaviour disrupted the lesson when the PSTs were attempting to use a new strategy. In addition, both the qualitative and quantitative findings indicated that some PSTs felt less prepared about using technology in the classroom.

The interviews and the open-ended survey questions also revealed that characteristics of the teacher other than having knowledge were needed in order to be adequately prepared and/or a good teacher. These characteristics and attributes related to feelings of confidence as well as the ability to relate well to students. Many of these attributes tended to reflect a more student-centred approach to teaching rather than the more traditional teacher-centred approach. For example, in their definitions of the ideal teacher, the interviewees frequently discussed care for students and helping students develop a positive mathematical identity.

The interviews highlighted the importance of the practicum in helping mathematics PSTs develop a sense of preparedness. In many cases, the practicum helped many PSTs gain experience in preparing and presenting lessons and using a variety of teaching strategies to deliver the lesson content to the students. Nevertheless, the PSTs also explained how at times, the practicum made them feel less prepared, especially in the area of behaviour management and classroom management. However, as explained by some interviewees, some of their problems arose from their students not treating a PST as a “real” teacher or respecting them.

As a result of their practicum experience, many of the PSTs felt that they had become more aware of their mistakes and had been able to learn from them and improve their skills. This, in turn, helped them to feel more prepared and more like their picture of the ideal teacher.

However, despite the value of the practicum in helping PSTs develop a sense of preparedness, there were some problems that arose from the attitudes and behaviours of the host school and the university. For example, some PSTs reported that the university did not send anybody to observe their lessons, while others reported that they were asked to act more or less like relieving teachers rather than PSTs. In addition, the qualitative findings showed that some PSTs did not receive appropriate feedback from their cooperating teachers.

6. Discussion

6.1 Introduction

The objective of this research was to explore Saudi female PSTs' sense of preparedness to teach through an exploration of their understanding of preparedness and their beliefs about their own level of preparedness as they near the end of their ITE, delving into the nature and origins of that 'sense'. This chapter, therefore, reflects on key aspects of the findings in relation to the main aim of the study and the research questions guiding this study, and discuss these with reference to the literature. The three research questions that guided this study are as follows:

1. What beliefs do PSTs hold about 'preparedness to teach'?
2. What perceptions do PSTs have about their levels of preparedness?
3. What are the factors influencing the formation of mathematics PSTs' perceptions?

The data collected via the questionnaires and interviews are integrated and discussed with a particular focus on the themes that emerged. These themes are discussed alongside relevant findings in the literature.

Section 6.2 discusses the findings in relation to the participating PSTs' beliefs about 'preparedness to teach'. This includes an exploration of PSTs' definitions of 'preparedness to teach', and what kinds of knowledge and skill PSTs regard as necessary to be an effective mathematics teacher, along with their perceptions of a 'good' mathematics teacher. Section 6.3 investigates PSTs' sense of preparedness including their perceptions of their personal preparedness to teach and their self-efficacy beliefs about teaching mathematics. Finally, section 6.4 discusses the factors that have had a significant influence on mathematics PSTs' perceptions concerning preparedness, namely prior experience, ITE, and the practicum experience.

6.2 Pre-service teachers' beliefs about preparedness

6.2.1 Defining preparedness

In the current study, PSTs related being “prepared to teach” to efficacy to carry out teaching tasks (teaching efficacy), having ‘good’ knowledge for teaching, having a sense of preparedness (being psychologically prepared and self-confident), and professionalism. This aligns with the findings of Kraut (2013) where middle and secondary PSTs in the U.S. related being prepared to teach with having the appropriate knowledge and skills, being equipped with a variety of teaching strategies, being confident in one’s own ability to teach, and being mentally prepared to teach.

The PSTs definitions and descriptions of the knowledge for teaching required to be prepared focused mostly on mathematical content and pedagogical knowledge (PK), with few explicit references to pedagogical content knowledge (PCK). This aligns with the findings of earlier studies related to teacher preparation (e.g., Anthony et al., 2008; Buehl & Fives, 2009; Clark, 2009; Kraut, 2013; Leong, 2012; Rodie, 2011). However, the findings of the current study contrast with the findings of Balatti and Rigano (2011), which found that PSTs (in Australia) did not consider content knowledge (CK) to be important for being prepared to teach. It is possible that the primary and secondary mathematics PSTs in the study by Balatti and Rigano (2011) took adequacy of CK for granted, and thus neglected to include this in their definitions.

In the current study, many of the survey responses concerning PK indicated that such knowledge was aligned to the ‘delivery’ of the content suggestive of direct teaching, as opposed to the more responsive pedagogy advocated in reform mathematics initiatives (NCTM, 2014). While a few PSTs mentioned the importance of developing rapport or a relationship between students and the teacher, the majority of responses reflected the more traditional ideas of ‘delivering’ mathematical content, rather than a focus on supporting and engaging learners. For example, when discussing important knowledge for teaching, the survey respondents often mentioned having knowledge of general teaching methods and strategies and being skilful regarding the performance aspects of teaching such as the skill of writing on the blackboard in a clear manner, speaking fluently, and appearing confident.

Despite the preponderance of equating preparedness with more traditional direct pedagogies, there were some instances of PSTs linking preparedness with more responsive pedagogies. For example, in the interviews, several PSTs provided responses aligned with participants from the

study by Balatti and Rigano (2011) that defined ‘preparedness to teach’ in terms of confidence and the ability to build rapport with students. However, when probed, discussions about the importance of knowing how to motivate and engage students were more likely to be in relation to general classroom and behaviour management, rather than in relation to learning. These findings are similar to Alqahtani et al.’s (2016) study of Saudi teachers’ beliefs about motivating and interacting with students where classroom management and disciplining students were considered a high priority for effective teaching.

The seeming contradictions about what pedagogies defined preparedness was most likely a consequence of the reported difficulties of applying their ITE pedagogical knowledge theory in practice during the practicum. Well aware that they were more likely seeing traditional teaching during practicum, for some PSTs, preparedness *ideally* included knowing how to enact more student-focused practices. Indeed, the responses from the open-ended questions in the survey indicated a sense that PSTs were looking to know more about the use of novel teaching strategies, described as modern methods that involved teaching strategies (such as using inquiry classroom discourse) that might be different from the more traditional strategies that they typically saw in many classrooms. While the Saudi Arabian Ministry of Education (2000) acknowledge that traditional Saudi mathematics classrooms have tended to be dominated by teacher-directed learning opportunities, it appears that some PSTs, through the influence of their ITE programs, are seeking preparation that supports a more student-centred approach to teaching.

That PSTs’ perspectives of preparedness are affected both by the traditions of the past and the new reforms which has created a contradiction in the form of a tension between what PSTs think preparedness means and what they feel they need to be a good mathematics teacher. This tension appears to directly reflect the partial nature of ITE reforms. As argued by some Saudi researchers, although mathematics teaching has been reformed in order to help develop and improve the quality of education in Saudi Arabia, including ITE (Al-Eisa & Sahab, 2006; Darandari & Ward, 2011), more remains to be done (El-Maghraby, 2011).

The PSTs’ feelings of preparedness in terms of affective aspects (e.g., feelings of confidence and control, and the ability to form relationships with students) also reflected a desire to follow a student-centred rather than a teacher-centred approach to teaching and learning. Despite a range of feelings of preparedness, with some feeling very prepared and others less so, most PSTs expressed the opinion that they would be able to improve in this area in the classroom

when teaching professionally full-time. As such, these affective aspects of PSTs' feelings of preparedness, noted in expressions of confidence, control, and ability to form relationships with students, remind us that knowledge exists in a "dynamic relationship between social, psychological, material, and embodied realities" (Ord & Nutall, 2016, p. 357).

Some elements missing from the discussions of preparedness and being a 'good' teacher included professional responsibility, and methods and tools of assessment. Knowledge of assessment tools and methods was seldom mentioned as an important aspect of being well prepared in the responses to the open-ended questions; neither was this aspect discussed in the interviews. These findings are, however, in line with a recent Saudi study (Alqahtani et al., 2016) which found that expert teachers considered monitoring student progress (homework, providing feedback, and using assessment) as the least important factor for defining effective teaching. Possibly these findings reflect the limited attention to assessment within ITE curricula and the lack of opportunities given to the PSTs to practice their knowledge of assessment while on practicum.

Likewise, there was limited discussion of professional responsibility even though this is one of the Saudi graduating standards. Again, this reflects the limited opportunities to collaborate with mentors and teaching colleagues while on practicum (see Section 6.4.1). Although several PSTs mentioned collaboration with their peers through opening up one's class for peer observation– this practice was instigated by PSTs themselves to compensate for insufficient opportunities for collegial collaboration within the school setting. These findings are contrary to the findings of Kraut (2013), who revealed that PSTs in the U.S were aware of the importance of collaboration for successful teaching, including professional development teams and classes as well as the need to get along with other teachers in the staffroom.

A related area missing in both responses to the open-ended questions and interviews was the teacher's responsibility for establishing and maintaining relationships with the students' parents. This might be because PSTs had not yet been given this responsibility; as they are not yet in-service and these responsibilities were not part of the practicum. Given that prior research has shown that a PST who is well prepared should be willing to collaborate with her colleagues, as well as the students' parents and the wider community, to provide the best learning opportunities for students (AMTE, 2017; TEMAG, 2015) there is potential for ITE to increase the focus on these areas.

Overall, these findings suggest that PSTs need to have clarity and greater support to develop a vision of teaching that is consistent across both ITE and practicum, in order to help PSTs feel more secure in their understanding of preparedness to teach. While several of the interviewees discussed that familiarity with the curriculum and with a variety of effective pedagogical tools is gained through hands-on classroom experience, they *needed and wanted* this classroom experience to support and align with responsive pedagogies. Similar to the findings of Allen and Wright (2014), Smith and Lev-Ari (2005), and Wilson et al. (2002), the PSTs in the present study used the practicum as an opportunity to apply the theoretical and content knowledge they have gained in their other ITE courses.

However, while valuing the opportunity to learn by putting ideas into practice (Smith & Lev-Ari, 2005), the reality of the theory–practice divide made this problematic for some PSTs. Understanding how what is taught at the university applies to the reality of the classroom, was an ongoing issue for these PSTs. Indeed, for some “theory which is not clearly directed to such practical ends [was] a burden” (McIntyre, 1995, p. 378), in terms of defining preparedness. As noted by Lampert (2010) tensions between theory and practice arise from an assumption that “theory and practice are different from each other and that in the organization of learning teaching, there is a ‘gap’ to be ‘bridged’” (p. 31). While practice-based reforms in ITE challenge this notion (Hunter & Anthony, 2015), the belief that university course work is theoretical and the practicum experience covers the practical side of teaching and that the two are separate (Grossman et al., 2009) appears to strongly influence PSTs participants’ beliefs about preparedness.

6.2.2 Beliefs about a good mathematics teacher

The teacher qualities described by the PSTs as necessary for being well prepared covered two main categories: personality and professionalism. The category of professionalism included knowledge as well as other aspects of being a professional teacher such as teaching skills. Similar to the findings of the previous section, when the PSTs discussed the knowledge that characterises a good mathematics teacher they most frequently mentioned PK and mathematical CK. However, unlike their descriptions of important knowledge and definitions of ‘preparedness to teach’ they also mentioned PCK.

PSTs’ descriptions of the PK of a ‘good’ teacher focused largely on general teaching skills (e.g., use of different teaching strategies) alongside knowing how to build a relationship with the students. That PSTs considered the use of a range of teaching strategies to be a characteristic

of a ‘good’ teacher is similar to the findings of other studies (Bryan et al., 2007; Dayal, 2013). Drawing on the Saudi context, Alqahtani et al. (2016) also found that Saudi secondary mathematics and science teachers’ definitions of effective teachers included the ability to use a variety of teaching strategies.

Some respondents mentioned the ability to use responsive pedagogy, although these were in the minority ($n = 18$). Similar to these findings, PSTs’ perceptions of good mathematics teachers in Balatti and Rigano’s (2011) study also revealed that PSTs value being able to relate well to students, and have strong communication and organisation skills. However, like the secondary PSTs in Cabaroğlu’s (2012) study who revealed that before and after their practicum experience they were worried about their ability to communicate well and establish rapport with their students – these skills were largely aspirational.

In this current study, although classroom management was mentioned as being part of the PK needed to be a ‘good’ teacher, these skills were somewhat lower in priority. This finding is a somewhat surprising outcome given the findings of the previous sections—and may be a result of the emphasis put on the personal characteristics of the teacher in the PSTs’ definitions. It seems that the PSTs perceived classroom management skills as relating more to knowledge and capability rather than personal teacher attribute associated with care for students.

In line with definitions of preparedness, there was limited reference to knowledge of assessment methods and tools in the definitions of a ‘good’ teacher, and neither was the ability to establish and maintain a relationship with the parents of the students identified, although these attributes are both included in the graduating standards (see section 2.2). As noted above, this is possibly because the PSTs had yet to take on these responsibilities, and thus may be less aware of the importance of these aspects of professionalism. This is in line with the findings of several studies (e.g., McCoy, 2011; Stuart & Thurlow, 2000) that noted that PSTs, at least at the start of their ITE courses or before they begin their teaching career, tend to have narrow notions of what is necessary to be a successful teacher, believing instead that teaching mostly involves the delivery of information.

While professionalism, inclusive of teacher knowledge, was seen as a key attribute of the good mathematics teacher, open-ended responses in the questionnaire indicated that the personal characteristics of the good mathematics teacher were also viewed as being important (25% of attributes of good teachers referenced personality). This is similar to the findings of Balatti and

Rigano (2011), Prescott and Cavanagh (2006), and Dayal (2013), who also found that PSTs tended to list personal characteristics alongside knowledge-related items when describing a ‘good’ teacher. Themes relating to the teacher as a person covered aspects such as care for the students and the ability to support a positive mathematical identity (often described as “helping students love maths”). These personality traits of an ideal teacher centre on a more student-centred approach to teaching and learning. For example, in the interviews, the PSTs defined a caring teacher as one who can tailor their teaching to their students’ abilities, was considerate of students’ feelings, understood students’ psychology, and had a good balance between strictness and lenience. The skill to adapt to the needs and abilities of students was also related to building or supporting a positive mathematical identity, along with attributes related to teaching performance and knowledge, such as using clear explanations and a range of teaching strategies.

The findings of the current study parallel other studies into how ‘good’ teaching is defined by PSTs (and sometimes experienced teachers and beginning teachers) in non-Western contexts. For example, Bryan et al. (2007) found both PSTs from Western and Eastern (China and Hong Kong) education ITE programs listed clear communication, the ability to capture the interest of students, and the use of a variety of teaching strategies as being characteristics of a ‘good’ teacher. Like the PSTs from Australia, China and Hong Kong in Bryan et al.’s (2007) study, the current findings show that PSTs considered sound mathematical CK to be an attribute of being ‘good’ teacher.

The findings are also in line with the definitions of effective teachers provided by Saudi female secondary mathematics and science teachers in Alqahtani et al.’s (2016) study. Hallmarks of a ‘good’ teacher, for teachers in this study, included having a caring nature, respect for students, interacting positively with students, the use of a range of teaching strategies, and good lesson planning skills. In addition, the teachers surveyed by Alqahtani et al. included attributes of good classroom management skills, fairness, dedication to teaching, reflection and self-evaluation, and enthusiasm. The more detailed list compared with the list of attributes revealed in the present study may be related to the sample pool, as the present study focussed on PSTs but Alqahtani et al. considered in-service teachers with more classroom experience.

Interestingly, the PSTs’ discussions of the attributes of a ‘good’ teacher revealed a cultural dimension. When discussing the elements of teacher professionalism, good mathematics teachers were described as committed to the Islamic cultural concepts of the teaching

profession such honesty, trusteeship, faithfulness, the fear of God (being fair and equitable), compliance with the provisions of Islam, dedication to work, and transparency.

Overall, the results highlight that PSTs appear to perceive a difference between being a good mathematics teacher and a well-prepared mathematics teacher. It appears that in order to be well prepared, the PSTs feel that they need to acquire knowledge (mathematical CK, PK, and PCK) through their ITE and practicum. A ‘good’ teacher, they felt is something that comes with experience in the classroom, is linked to more personal attributes, and is developed over time.

6.2.3 Comparison with graduating standards

It is interesting to compare the definitions of ‘preparedness to teach’ and the definitions of a ‘good’ teacher provided by the PSTs with the standards outlined in the national qualifications framework of Saudi Arabia (see Chapter 2).

The national standards cover four main domains, namely professional knowledge, promoting learning, supporting learning, and professional responsibility (NCAAA, 2013). In their definitions of ‘preparedness to teach’ and of what makes a ‘good’ teacher, the PSTs responding to the open-ended questions and the interviews tended to mostly focus on two of these areas, namely professional knowledge and supporting learning, with only a few mentions of promoting learning and professional responsibility. Professional knowledge relates to mathematical CK, knowledge of the curriculum, lesson design and planning, and pedagogical skills/knowledge, which were often mentioned in the definitions of ‘preparedness to teach’ and of a good or ideal teacher. Supporting learning covers themes relating to establishing a good and appropriate relationship with the students and managing the classroom.

Promoting knowledge as represented in the framework includes assessment. While PSTs would have had little opportunity during the practicum to engage in formal assessment activities, assessment as a tool to support learning was largely missing from responses. A few PSTs touched on activities that they had undertaken that might be considered to be part of these standards, such as giving their students a quiz to see how well they had understood a topic (mentioned by a few interviewees in their definitions of a good or ideal teacher, or a teacher whom they had used as a role model).

Professional responsibility was not mentioned in definitions of preparedness, probably because, as explained earlier, the PSTs have not yet been given these responsibilities and have had limited opportunities to develop productive relationships with their colleagues in the school. Indeed, of concern was reports of less than productive relationships with associate teachers in schools. PSTs' lack of awareness of the importance of professional responsibility in quality teaching, possibly also reflects the lack of opportunities for PSTs to engage in a community of learners within their ITE program.

6.3 Pre-service teachers' sense of preparedness

6.3.1 Level of preparedness

In both the surveys and the interviews, the majority of PSTs reported that they felt well prepared to begin teaching mathematics. They felt particularly well prepared in aspects of mathematical CK such as using mathematical problem-solving processes in teaching, and in areas relating to PK and PCK such as supporting students to engage in mathematical discourse, using a range of teaching strategies, and in teaching mathematical knowledge and skills. However, while expressing an overall sense of preparedness, some of these PSTs reported that they felt only "somewhat prepared" or "not at all prepared" in specific areas: using technology in teaching, taking students' prior conceptions about mathematics into account when planning the curriculum and instruction, and supporting students to engage in mathematical discourse.

PSTs' high levels of preparedness tended to be linked to feelings of satisfaction about their ITE experience, and this was aligned with agreement that their ITE programs had helped them acquire the skills needed to become good and/or effective teachers. Feelings of being well prepared align with other studies (e.g., Darling-Hammond, 2006; Kane & Fontaine, 2008; Ogden, 2012) that show that most graduates from ITE programs feel adequately prepared, believing that their ITE experiences have effectively prepared them to teach.

Although the majority of PSTs felt prepared to teach, most felt that they needed to have more time in the mathematics methods course as well as extra time in the practicum to practise how to teach mathematics. The older PSTs in the study (26 years or older) were more likely to agree that they needed more time in the mathematics methods course or in the practicum or both, in contrast with PSTs aged 21–25. While this aligned with the older PSTs feeling less prepared, this association between age and feelings of preparedness should be explored further in subsequent studies to verify and understand possible reasons for this difference—reasons such

as maturity levels (e.g., older people may have lower feelings of self-efficacy (Maurer, 2001)) or sociocultural factors (e.g., older PSTs may be less familiar with the use of technology or less familiar with reform mathematics teaching approaches). The feeling that more time in the classroom was desirable was also expressed by PSTs in other studies (e.g., Hudson, 2009; Rodie, 2011), including a study carried out with female teachers in Saudi Arabia (Alghamdi, 2015).

In the area of knowledge, the PSTs in this study felt most confident with their CK and PK rather than PCK. This is in line with the findings of Anthony et al. (2008) study of secondary-level PSTs in New Zealand. However, perceptions may be different to reality, with earlier studies (e.g., Al Nazeer, 2004; Ben-Motreb & Al-Salouli, 2012; Khashan, 2014) from Saudi Arabia concluding that many PSTs lack the mathematical CK needed for ‘good’ teaching. These earlier studies found that most novice teachers and experienced mathematics teachers (both male and female) in Saudi Arabia had basic rather than deep understanding of mathematical concepts and procedures. However, the level taught by the teachers in these earlier studies needs to be borne in mind. Both Khashan (2014) and Ben-Motreb and Al-Salouli (2012) studied elementary-level teachers. The secondary-level male in-service teachers in the international study by Alshehri (2012) were more likely to perceive that they had strong CK, PCK, and PK, as indicated by their responses to a Likert-type questionnaire.

While the PSTs in the present study expressed a sense of preparedness in some areas of PCK—such as the ability to engage students in collaborative group-based activities—they felt less prepared in many aspects of PCK. These included being able to make links between theory and the practice of teaching in the classroom, being able to select effective teaching approaches to illustrate difficult mathematical concepts, the ability to relate classroom learning to the real world, conducting whole-class mathematics discussions, engaging students in collaborative group-based activities, and applying questioning and explanation skills well in teaching. Moreover, the PSTs expressed feelings of being unprepared or poorly prepared in applying multiple mathematical representations for problem solving and making mathematical connections with problems outside mathematics. This is in agreement with other studies of mathematics teachers such as Ben-Motreb and Al-Salouli’s (2012) study that reported that Saudi PSTs struggled to illustrate how mathematics related to everyday life. Applying mathematics in everyday settings plays an important role in the development of students’ mathematical thinking and disposition (Anthony & Walshaw, 2009; Stuckey, Hofstein,

Mamluk-Naaman, & Eilks, 2013), and thus highlights a key area of focus for reforms in the Saudi ITE context.

A pertinent finding relating to the use of technology was that the PSTs in this study felt less prepared to use technology in the classroom beyond PowerPoint software to present material. This is similar to findings from other developing non-Western nations, which have also revealed that PSTs often feel poorly prepared to use computer technology to teach mathematics, usually because of a lack of infrastructure, unfamiliarity or low accessibility to technology (Agyei, 2012; Ng'eno et al., 2013).

Another area in which PSTs felt less prepared related to professionalism, namely their ability to work with parents and families to understand the students better and support their learning. This is consistent with the findings of Anthony et al.'s (2008) finding that a significant number of PSTs (across all disciplines) did not feel that they were prepared regarding their ability to work with parents. However, it contrasts with the study of Clark (2009) who found that PSTs in the U.S felt most confident in their abilities to work with parents and families to help them understand and to support student learning.

Earlier studies have claimed that PSTs often struggle to apply what they have learned in the theoretical ITE courses to actual classroom experience (e.g., Biza et al., 2015; Kraut, 2013), and that aspects of PK such as classroom management and behaviour management were an area where they were less confident (Anthony et al., 2008; Koehler et al., 2013; O'Neill & Stephenson, 2012b). This was confirmed in the present study, where the PSTs reported that although they wanted to use more innovative student-centred teaching strategies, classroom management issues (e.g., handling disruptions; establishing rules and routines; setting up or arranging desks for group work and discussions) made these impractical and difficult to apply. Other studies that found that classroom management issues can hinder PSTs from applying the theory learned through ITE (Lazarides et al., 2018) suggest that this often leads to PSTs feeling less efficacious in classroom management and thus concentrating on this rather than other aspects of teaching during the practicum (Boni; 2014; Cabaroğlu, 2012; O'Neill & Stephenson, 2012b). For example, although PSTs in Biza et al.'s (2015) study aspired to establish classrooms that engage students with mathematical challenge and metacognitive discussion they often missed these opportunities as they focused on behaviour management. In the interviews in the current study, the majority of PSTs felt that classroom management was an aspect of teaching in which they felt least prepared. Moreover, those PSTs who expressed

confidence and felt prepared about some aspects of classroom management also indicated an awareness that they needed to improve in this area.

6.3.2 Embodying the Ideal teacher

The interviews revealed that while some PSTs felt confident that they would be able to embody their ideal teacher, others felt less confident. Among those who felt less confident, some believed that they would be able to embody the ideal teacher with more experience or effort, whereas others felt that they were far from embodying the ideal, particularly in the areas related to knowledge of the curriculum, using technology, lesson preparation, and providing representations for problem solving. In line with the perceptions of PSTs in Koehler et al.'s (2013) U.S. study who did not feel well prepared about classroom management and meeting their students' psychological needs, PSTs in the present study felt less confident in areas related to gaining practical experience such as understanding students' psychology, classroom management, disciplining students, developing patience, and answering students' questions.

The PSTs in this study felt particularly well prepared in CK, however, they shared uncertainties around answering students questions, this conflicts with Hill et al.'s (2008) finding that mathematics teachers with a high level of CK are more likely to respond to students' questions well. It is possible that the PSTs in the present study felt less confident about their ability to answer students' questions due to their sense of being less prepared in many aspects of PCK. As indicated by Kilic (2011) sound PCK will help a teacher know the best way to respond to students' questions, highlighting the importance of a combination of both CK and PCK for feelings of preparedness.

The interviewees did not commonly report personal characteristics when discussing whether they embodied their ideal teacher, except in the area of being (or needing to be) patient. However, many of the PSTs interviewed felt that they already had these personal characteristics (e.g., friendliness, care, respect, enthusiasm for mathematics) but the practical and knowledge-based aspects of teaching were the ones in which they felt that needed to improve. Overall, PSTs' feelings of *not yet* embodying the ideal teacher matched with the areas in which PSTs felt less prepared to teach.

6.3.3 Self-efficacy beliefs of PSTs and the locus of responsibility

In general, the PSTs in this study expressed moderate levels of mathematical teaching efficacy—a measure of their sense of preparedness—although participants aged 26 years or

more indicated lower levels of efficacy. Similar to Darling-Hammond et al. (2002), who found that PSTs who felt better prepared were more likely “to believe they could reach all of their students, handle problems in the classroom, teach all students to high levels, and make a difference in the lives of their students” (p. 15), most PSTs expressed a high sense of efficacy regarding their ability to enhance students’ learning. Feeling positive that they could engage and motivate students, improve students’ academic achievement, and encourage students to believe they can do well in mathematics was also supported by the qualitative results.

The areas in which the PSTs felt less efficacious related to their ability to help students value learning, using assessment to enhance students’ learning, motivating students with a low level of interest, improving the understanding of students who are failing, and helping students think critically and solve problems. Importantly, these are all areas related directly to supporting students as learners and matches the areas in which they felt least efficacious—helping all students achieve high academic standards and improving students’ retention of information.

PSTs’ reports of moderate teaching efficacy, and associated sense of preparedness, conflict somewhat with Darling-Hammond’s (2006) study where well-prepared PSTs reported high general teaching efficacy (GTE). However, as found by Tsouloupas et al. (2014), less experienced teachers such as PSTs are more likely to have feelings of lower efficacy and confidence in general. Furthermore, as suggested by Çakiroglu et al. (2005), PSTs from different cultures may express different levels of efficacy, possibly influenced by the features of individual cultures. In Saudi Arabia, the impact of societal changes (e.g., increased career opportunities and more freedom and the ability to drive for women), and the associated moves to accord student agency as part of reforms in mathematics education, challenge long-held expectations for the role of women in Saudi society. Growing up prior these reforms, and now caught in the middle of reforms, may be one reason why the PSTs felt diffident and somewhat less confident about helping students be successful in student-centred approaches versus direct teaching.

The PSTs indicated a mixed (i.e. shared) locus of responsibility for student outcomes: most respondents believed that the teacher is responsible for students’ academic success and that if students underachieve in mathematics it is most probably because of ineffective mathematics teaching. However, one-third of PSTs expressed the belief that the teacher is not responsible for students’ failure. For mathematics, the majority of PSTs believed that the teacher is responsible for students’ academic achievement, but noted that students themselves and their

home environment have a strong influence on student outcomes. These results suggest a belief in the shared locus of responsibility. This is line with the findings of Kurt (2013), which indicated that Turkish science teachers felt that they should not be held completely responsible for student failure, while also believing that they were responsible for students' academic success.

Several studies have found a link between feelings of efficacy and an internal locus of responsibility (e.g., Adu & Olantundun, 2007; Akiri & Ugborugbo, 2009; Atkas et al., 2013; Flegg et al., 2013; Hoy & Spero, 2005; Kurt, 2013; Lin & Gorrell, 2001). The present study shows the corresponding link between lower feelings of efficacy and a more external locus of responsibility. Where Darling-Hammond et al. (2002) found that PSTs who felt underprepared were "more likely to believe that students' peers and home environment influence learning more than teachers do" (p. 15), the findings of this study also indicated that PSTs who felt a moderate level of efficacy believed in a shared locus of responsibility. As suggested by Tarman (2012), cultural context and social norms may influence the link between efficacy and locus of responsibility, such that PSTs from Western nations may hold beliefs that are different from those of PSTs from non-Western nations. Çakiroglu et al.'s (2005) finding that Turkish PSTs expressed lower efficacy than their US equivalents, but were more likely to agree that the teacher is responsible for student success matches the findings of this current study.

6.4 Factors that influenced pre-service teachers' perceptions

6.4.1 The practicum

As reported in previous studies (Aydin & Woolfolk Hoy, 2005; Brown et al., 2015; Carter, 2006; Darling-Hammond, 2005; Hoy & Spero, 2005; Kee, 2012; Kraut, 2013; Ord, 2010; Pendergast et al., 2011; Zientek, 2007), responses from both the surveys and interviews highlighted that the practicum experience had the strongest influence on the PSTs' feelings of preparedness and levels of efficacy. Some PSTs indicated that the practicum experience prepared them psychologically by experiencing what it *feels* like to be a teacher, which, in turn, helped them gain more confidence and feel more prepared.

However, interviews revealed the extent of mixed practicum experiences. Many PSTs had encountered a range of challenges during the practicum that lowered their feelings of preparedness and efficacy. These included the attitude of students, cooperating teachers, and

school administration towards PSTs, students' interest in and performance of mathematics, the school system, the environment in the school where the practicum took place, and time constraints.

At times, feelings of low confidence and efficacy (e.g., fear and low self-confidence about standing in front of students and cooperating teachers) made the practicum experience challenging and/or negative in terms of developing feelings of efficacy and preparedness. Other studies also warn of the impact of negative practicum experiences (Caires et al., 2012; Darling-Hammond, 2006; Leung et al., 2013; Wilson et al., 2001). In particular, concerns about confidence to stand in front of a class were noted in Alghamdi's (2015) Saudi study. Although Rodies (2011) reported that some PSTs felt less confident addressing a class if they felt their CK was insufficient, the PSTs in the present study reported high levels of confidence in their CK. This suggests that a cultural factor that encourages females to keep silent and subdued in public settings may be at play here. It is likely that the practicum experience was the first time that these female PSTs had publicly addressed a large group of people in the role of an authority figure.

Given that the practicum provided the opportunity for many PSTs to gain experience in presenting lessons and use a variety of teaching strategies it is not surprising then that the PSTs describe the practicum as the main way of supporting them to feel more prepared and efficacious. Nevertheless, the PSTs also explained how at times, the practicum made them feel less prepared, especially in the area of behaviour management and classroom management. This is in line with the findings of Kraut (2013) and Anthony et al. (2008) who noted that classroom management issues were the main concerns for the majority of beginning teachers at secondary school level. However, as explained by interviewees in the current study, some of the problems experienced by the PSTs in this study arose from their students not treating a PST as a "real" teacher, and they expressed the belief that these problems would not occur when they became "real" beginning teachers.

Other difficulties experienced during the practicum related to organisational factors of the host school and the university. For example, some PSTs reported that the university did not send anybody to observe their lessons, while others reported that they were expected to be more like relieving teachers than PSTs. In their view, this made the practicum experience less valuable and more likely negatively influenced their sense of preparedness. As found in other studies, the practicum may not be always be implemented to support PSTs development of feelings of

preparedness and efficacy (Beck & Kosnik, 2002; LaBoskey & Richert, 2002). Indeed in the present study, half of the PSTs felt that the school was not sufficiently prepared, nor sufficiently resourced (Alghamdi, 2015) to support PSTs learning the work of teaching.

In the survey results, feedback received from the cooperating teacher during the practicum was identified as one of the least significant influences. However, we know from the other studies that the role of the cooperating teacher is extremely important in supporting the PSTs' learning (Brown et al., 2015; Knoblauch & Woolfolk Hoy, 2008; Lim, 2011). The contrast between these findings and findings from the current study may be partially explained by the research of Hoy and Spero (2005), who found that the factors that made the practicum rewarding or valuable included the support from the cooperating teacher. Whilst several PSTs in the interviews were able to identify how positive feedback had specifically helped increase feelings of preparedness and efficacy, concerns regarding a lack of lesson observations and feedback highlight an area that could be improved in future for helping PSTs to develop a better sense of being well prepared. One way that PSTs reported adapting to limited feedback and observation experiences was by inviting and supporting peers to be present in their classroom teaching lessons—a phenomenon not noted in existing literature. Supporting Saudi cooperating teachers to provide good feedback to PSTs during practicum was also recommended by Alghamdi (2015).

Despite the mixed nature of the feedback received while on practicum, overall, PSTs reported the benefits of interacting with and observing cooperating teachers for increasing feelings of preparedness and efficacy. The majority of PSTs believed that the challenges encountered during the practicum helped them in becoming teachers who were more confident and able to teach.

6.4.2 The ITE program

The second most influential factor for preparedness indicated by the quantitative data was the ITE program. This was verified by the interviewees, who reported that their mathematics methods courses played a large role in their sense of preparedness. Courses related to lesson planning and designing, teaching methods, and classroom management, were felt to have had a significant positive influence, alongside the ITE lecturers' teaching methods and styles demonstrated during lectures. This is in line with the study of Rodie (2011), who reported similar findings regarding PSTs' perceptions of teaching methods courses.

However, the quantitative results indicated that the factors that had the least influence on feelings of preparedness included the professors in the general teaching methods course. Given the findings above regarding the role of the teaching methods and styles demonstrated during lectures, we may assume that the lectures and classes felt to be influential were mathematics methods courses, although this was not clear from the survey results. Findings related to the influence of professors aligns with Kraut's (2013) findings that university supervisors played limited role in influencing pre-service teachers' feelings of preparedness to teach.

Despite the PSTs' perceptions about the importance of the ITE courses, there was considerable disquiet in respect to the perceived disconnect between theory and practice. PSTs noted that the theoretical nature of the general teaching methods courses (as opposed to mathematics methods courses) made it difficult to apply the knowledge gained during ITE in the classroom during the practicum. This is not a new issue for ITE in Saudi Arabia. Alsharif (2011) reported that the methods promoted in ITE programs did not always match current Saudi classroom practice. Alghamdi (2015) also noted that many ITE programs in Saudi Arabia over-emphasised theoretical knowledge in the area of PK and often overlooked PCK. Furthermore, Alzaydi (2010) and Alaqail (2005) reported that much of the emphasis during university-based courses is on rote learning of theory rather than practical skills and knowledge. Rote learning and a strong focus on theory widens the theory–practice divide—a common theme in research on ITE (Lampert, 2010; Ord & Nuttal, 2016)—and ultimately adds to the gap between the content of the ITE courses and the realities faced by PSTs in the classroom during the practicum (Gravett & Ramsaroop, 2015). This gap, as noted above (section 6.2.1) played out in the contradictory tensions of what preparedness meant for the PSTs.

The interviewees in this study also expressed a desire for more time developing and studying mathematical CK and PCK to improve feelings of preparedness; a recommendation also noted by Alghamdi (2015). Even though other studies (Ball & Forzani, 2010; Ball et al., 2008; Darling Hammond, 2000; Flake, 2014; Lotan & Marcus, 2002; Rosas & West, 2011) have found PCK to be an important part of preparedness and teacher efficacy, PSTs in the current study expressed limited awareness of the role of PCK. Very few of the PSTs discussed receiving instruction in PCK or how to apply different teaching strategies to mathematics, and this may explain why so few PSTs defined 'preparedness to teach' or 'good' teaching in terms of PCK (see Section 6.2). It appears that Saudi Arabia is not alone in needing to focus on PCK, with a U.S. study (Wilson et al., 2001) claiming that PSTs often do not have adequate training

in PCK, particularly if the aim is to support a shift from the teacher-focussed approaches applied when PSTs were themselves school students.

The issue of the length of the ITE courses has been debated in the literature. Housego (1990) contends that one-year teaching methods course are sufficient to develop feelings of preparedness especially regarding aspects of general PK such as classroom management. In contrast, other researchers (Borko et al., 1992; Rodie, 2011) have found that PSTs often felt that there was not enough time in the courses to develop CK and PCK adequately. In Saudi Arabia, Almazroa (2014) found that the ITE courses for Saudi science teachers do not have enough time to cover the full range of knowledge and skills needed for PSTs to feel adequately prepared, and it is reasonable to assume, given the interview results of the present study, that the same applied to the mathematics ITE courses.

In the interviews, the PSTs agreed that they knew about different teaching strategies that they could apply for teaching mathematics, but they also reported that they were unable to implement them properly in the classroom during the practicum because of issues related to time and space. It appears that even if PSTs learn about different pedagogical tools for classroom management and teaching strategies during their ITE program, applying these in the classroom was more difficult than they expected (see Section 6.4.1). This again, highlights the importance of the practicum for developing a better sense of preparedness in PSTs.

6.4.3 Other factors: University mathematics courses, grades, and prior experience as a learner

The PSTs reported that their university-level mathematics courses had given them a thorough understanding of mathematical concepts, but thought that some of the advanced mathematics taught at university were too distant from the basic mathematical concepts that they would be teaching, especially in middle school level. Other studies have also shown that many PSTs perceive a disconnect between the higher level mathematics taught at university and the mathematics they had to teach in schools (Ma et al., 2008; Toh et al., 2013). Nevertheless, some of the interviewees appreciated that having a deep mathematical understanding had helped them to be more flexible in the classroom and to respond to students' questions better, thus making them feel better prepared and more efficacious.

Receiving high grades in both mathematics and methods courses was not mentioned as having had a strong influence on feelings of confidence to teach. Similarly, Darling-Hammond (2006)

reported that receiving high grades in teaching methods courses was not always linked to PSTs' high levels of efficacy.

In relation to prior experiences as a student, the survey indicated that these had a very important influence, but the interviews suggested that this factor was only moderately important. It is possible that the interviewees' sense of preparedness may have been influenced by prior classroom experience, as suggested by Goodwin (2010) and Kraut (2013), but they were not consciously aware of this factor within the mix of ITE influences. However, for interviewees who discussed their own experiences and history as a learner as being a significant influence on their sense of preparedness, influences could be either positive or negative, meaning that they used their earlier teachers as example of what to do and what not to do. As suggested, beginning teachers and PSTs often use the methods and strategies used by their own teachers (Goodwin, 2010; Kraut, 2013).

6.5 Chapter summary

This chapter discussed the findings from the survey and interviews to examine how PSTs define preparedness, their self-perceptions regarding 'preparedness to teach', and the factors that influenced these feelings and perceptions, within the context of the relevant literature.

In general, PSTs defined 'preparedness to teach' in terms of PK and CK, and they often indicated a sense of preparedness in this area. PCK was seldom discussed in definitions of 'good' teaching or 'preparedness to teach', which may be related to inadequate focus on PCK within their teacher education experiences.

The PSTs reported that feelings of efficacy regarding classroom management and behaviour management was important for feeling prepared, but stated that they felt less prepared in this regard. This was linked to unfamiliarity with the practical aspects of teaching and the disconnection between the theories learned during the ITE courses and the practical reality of the classroom. PSTs also expressed the belief that some areas in which they felt less prepared could be overcome with more classroom experience.

In describing a 'good' teacher, the PSTs often discussed personal characteristics alongside professional factors such as knowledge. In discussing how well they embodied the ideal teacher, however, the interviewees seldom mentioned personal characteristics but concentrated

more on knowledge and experience, possibly because they felt that knowledge and experience could be developed over time, whereas they felt they already naturally embodied the personal characteristics of a 'good' teacher.

Practicum was the most significant factor identified by PSTs as influencing their sense of preparedness and feelings of efficacy. According to the PSTs' accounts, practicum was important because it gave them experience in actual classrooms and a chance to apply PK such as using a range of teaching strategies. Positive feedback from the cooperating teacher also contributed to feelings of preparedness, but notably feedback was limited or missing for some PSTs. However, when challenges could be overcome during the practicum this contributed to feelings of preparedness. The PSTs in this study, like those in other studies carried out in Saudi Arabia, expressed a desire for more time spent in the practicum and for more time spent on PCK in the mathematics methods courses. The ITE courses, especially, the mathematical methods courses, were regarded as beneficial for shaping feelings of preparedness. General teaching methods courses covering PK were seen as overly theoretical and disconnected from actual classroom experience. University mathematics courses were seen as somewhat helpful for increasing feelings of preparedness.

Conclusions and implications for ITE programs in Saudi Arabia and potential areas of further research are presented in the next chapter.

7. Conclusion

7.1 Introduction

The purpose of this thesis was to examine the perceptions of Saudi female PSTs regarding their preparedness to teach mathematics, with the aim of gaining insight into how well they felt prepared to teach mathematics at middle or secondary schools. This study used a mixed methods approach (i.e., questionnaires and in-depth interviews) to provide quantitative and qualitative data to explore the phenomenon of preparedness to understand more about the nature, development, and sufficiency of preparedness to teach mathematics.

The data from the two research gathering tools (the questionnaires and interviews) were analysed and discussed in Chapter 5 and 6. Analysis of the themes revealed aspects that related to Saudi cultural values, the educational system and policies, and teacher resources which all acted as factors that influenced PSTs' perceptions. The findings from this study will contribute to the current drive to improve teacher and teaching quality, including ITE in Saudi Arabia.

This chapter presents the conclusion of the study focusing on exploring female Saudi mathematics PSTs' perceptions of preparedness to teach, their self-efficacy beliefs about teaching mathematics, their perceptions of the characteristics of good mathematics teaching, and the factors influencing the formation of mathematics PSTs' perceptions. A summary of the findings is presented in Section 7.2, followed by the implications of this study for practice and policy in Section 7.3. The limitations of the study are identified in Section 7.4 and proposals for future research are made in Section 7.5. Finally, the research contributions along with concluding thoughts are provided in Section 7.6 and section 7.7 respectively.

7.2 Research Summary

A focus of this study was the beliefs that PSTs hold about 'preparedness to teach'. The findings showed that for the PSTs in this study, being prepared to teach was related to having teaching efficacy, good knowledge for teaching, a sense of preparedness, and professionalism. Pedagogical knowledge (PK) was the most common type of teaching knowledge discussed as being important for effective mathematics teaching, followed by content knowledge (CK) and knowledge of the curriculum. PSTs' discussion of PK suggested that by this, they meant

knowledge aligned to the ‘delivery’ of the content through direct transmission type teaching, as opposed to more responsive pedagogy. However, the PSTs’ feelings of preparedness in terms of affective aspects (e.g., feelings of confidence and control, and the ability to form relationships with students) clearly reflected a desire to follow a student-centred rather than a teacher-centred approach to teaching and learning. Less awareness existed about the importance of pedagogical content knowledge (PCK), this is possibly a result of inadequate focus on PCK within their teacher education experiences.

In contrast, there was strong awareness that all types of teacher knowledge including PCK contribute to good mathematics teaching. The PSTs defined good mathematics teachers in terms of knowledge and professionalism along with the teacher as a person. The PSTs were less aware of the importance of knowing suitable assessment methods and tools, and lacked awareness of the importance of professional responsibility and the ability to communicate with the parents of students. A lack of awareness, and indeed concern about assessment methods may reflect the limited attention to assessment within ITE curricula. However, given that assessment plays a critical role in students’ mathematics education, in that grade progression is dependent on achieving satisfactory level of achievement informed by frequent in-class summative tests, the lack of attention to assessment practices was surprising.

The second research question asked how prepared PSTs perceived themselves to begin teaching. The study showed that the majority of PSTs felt that they were sufficiently prepared to teach. They felt most confident in the areas of CK and PK rather than PCK. This was not surprising, as they were less aware of the importance of PCK. However, the majority felt that classroom management was the aspect in which they felt least prepared; this was related to the disjunction between theory and practice. The PSTs also expressed feelings of being less prepared in relation to applying multiple mathematical representations for problem solving, making mathematical connections with problems outside mathematics, using technology in teaching, and working with parents and families to support students learning. In addition, although the PSTs felt adequately prepared, they expressed only a moderate level of general teaching efficacy (GTE). These aspects of lower efficacy related directly to supporting students as learners and included their ability to help all students achieve high academic standards, improving students’ retention of information, helping students to value learning, using assessment results to enhance students’ learning, and motivating students with a low level of interest.

The different perspectives regarding PSTs' levels of preparedness and efficacy appeared to be a result of the two separate influences: the ITE and the practicum experience. Gaining knowledge within ITE courses made the PSTs feel prepared to teach; however, the challenges they encountered during the practicum to put the knowledge into practice resulted in a lower sense of efficacy. According to the PSTs, the theory-practice divide occurred on two fronts: firstly, they felt that their ITE courses had emphasised theory over the practical application of teaching methods, and secondly the promoted mathematics education reforms within the ITE courses were less likely to be seen or expected to be practised when on practicum.

PSTs suggested that one way to bridge the theory-practice divide was to have more time in the mathematics methods course, as well as extra time in the practicum,—providing more opportunities to practice *how to* teach mathematics. This belief reflected their desire to strengthen their confidence regarding their knowledge and the teaching skills that they felt less prepared in, particularly those skills associated with learning the complex work of responsive pedagogies (Lampert et al., 2013). As mentioned elsewhere in this study and by other researchers, “access to a high-quality clinical practicum” (Behrstock-Sherratt, Bassett, Olson, & Jacques, 2014, p. 8) is a key element of ITE. A well-designed practicum that is operated as a partnership between the ITE provider and the cooperating teacher helps PSTs bridge the theory-practice divide (Darling Hammond 2006; Whatman & McLean Davies, 2017).

Moreover, the practicum is important not only for helping PSTs apply skills and knowledge but also to “deal with the emotional aspects of becoming and being a teacher” (Whatman & McLean Davies, 2017, p. 23), aspects that we have seen have an influence on PSTs' feelings of preparedness.

The third research question explored the factors influencing the formation of mathematics PSTs' perceptions. The university mathematics courses and university supervisors were perceived as less influential, with the practicum playing the biggest role in shaping PSTs' sense of preparedness and feelings of efficacy, followed by the ITE courses. The PSTs discussed how these experiences had positive impacts on their perceptions as well as how the classroom environment, challenges, and school culture encountered during the practicum had lowered their sense of preparedness and teaching efficacy.

In general, it seems that the quality of practicum support and school cultural norms are issues, as are the transition to student-centred responsive pedagogies, the theory–practice divide, and the inclusion of PCK in ITE.

7.3 Implications

This study emphasised the importance of the practicum for building PSTs' sense of preparedness, but it also revealed that the PSTs surveyed seemed unaware of the importance of PCK. This suggests that ITE courses look at how they can support PSTs to connect the theory of PK with the more specialised PCK (especially as it relates to mathematics education). The current study reinforces calls from Western contexts for ITE reform (e.g., CBMS, 2001; Darling Hammond, 2000; Rosas & West, 2011; Hunter, Anthony, & Hunter, 2015), given that PCK affects the way that teachers think about their subject (Toh et al., 2013) and demonstrates that this need is also applicable to the Saudi Arabian context.

Earlier studies have recommended that ITE courses should help mathematics PSTs to make better connections between secondary/middle school-level and university-level mathematics (Wilburne & Long, 2010) and to deepen their CK (Ball et al., 2008; Flake, 2014). Given that many of the PSTs found a disconnect between the mathematics content they studied at university and the mathematics content they taught in the schools the present research also makes the same recommendations for ITE in Saudi Arabia. PSTs need opportunities to develop school-related CK that emphasises the correct application of academic mathematical knowledge, as advocated by Heinze, Lindmeier, and Dreher (2015) and Cho and Kwon (2017), as part of their ongoing CK expertise.

One area that PSTs in this study felt poorly prepared in was that of integrating technology into teaching mathematics. This finding has two main implications. Firstly, ITE providers should emphasise the importance of using technology in teaching as well as providing more support to operationalise this in practice. A first step to do this is for ITE providers to encourage educators to use technology during lectures so that PSTs can observe technology being used in practice. Secondly, schools need to provide PSTs with the opportunity to observe technology being used for teaching in the classroom by the cooperating teacher, and to have the opportunity to integrate technology into mathematics teaching during the practicum (e.g., providing access to computers, the internet, projectors, etc.). In addition, ITE could look to provide specialised

computer and ICT courses and workshops to help PSTs gain knowledge and feel more prepared in this area.

One problem encountered by the PSTs in this study was that the professors teaching their mathematics teaching methods course were not themselves specialists in both mathematics and pedagogy (i.e., they were not experts in PCK for mathematics). This suggests that in order to help mathematics PSTs to feel more prepared, care must be taken by ITE providers to ensure that the professors of the mathematics teaching methods courses have experience both in mathematics and mathematics education. This finding may indicate the need for professors of the teaching mathematics ITE courses in Saudi Arabia to undertake professional development to develop their own knowledge and adapt their teaching methods.

In addition, the curriculum and the teaching methods used by the instructors of the ITE courses may need to be adapted to challenge the theory–practice divide—referred to as a ‘discontinuity problem’ in teacher education (Grudnoff & Tuck, 2003). The PSTs in this study noted differences between the theory presented during the ITE courses and the reality of the classroom encountered during the practicum. This raises the question as to how ITE programs can help PSTs prepare for the realities of the classroom, and again highlights the importance of the practicum for teacher preparation. It is essential for ITE program to be practice-focused (i.e. where the goal of the university lectures is to provide PSTs with the skills they need for the practicum) so that it can be adaptive and robust as well as effective (Campbell & Elliott, 2015).

One way to do this, as advocated by practice-based reforms (Zeichner, 2012), is for PSTs to have the opportunity to engage and enact core teaching practices in carefully planned and scaffolded experiences with appropriate guidance, rather than just learning about the practices (Collaboration for Effective Educator Development, Accountability, and Reform (CEEDAR) Grant, 2017; Hunter et al., 2015). Practice-based ITE is acknowledged to be beneficial, but it requires changes in the ITE curriculum and how it is assessed (Anthony et al., 2015). In the words of McDonald et al. (2014), ITE courses need to link the “what” to the “how”. This may require ITE providers to consider how PSTs learn how to teach and how best to support them in learning to practice (McDonald et al., 2013). Emergent studies in practice-based pedagogies also note that PSTs need explicit support for link the practice-based pedagogies to the actual classrooms. This requires ITE designs to be responsive to the school settings by using approximations of practice of mathematics teaching that are more responsive to the work of

teaching as defined in schools in ways that enable improving mathematical opportunities for students (Campbell & Elliott, 2015).

In addition, support should be provided for practicum schools in order for them to develop their role of providing guidance and support for PSTs. Stronger partnerships should be developed between cooperating teachers and the school and the university to ensure that PSTs can learn and practice skills and apply what they have learned in the classroom (Whatman & McLean Davies 2017). One possibility may be to provide PSTs with more opportunities to observe their cooperating teacher and see how theoretical PK can be put into practice. Observing effective teachers as they carry out their teaching roles gives the PSTs examples that they can follow (Darling-Hammond 2001), although this may be a problem in cases where the ITE curriculum has been reformed recently and the cooperating teacher has not yet changed their methods to adopt student-centred teaching practices, which is likely to be the case in Saudi Arabia. Ideally, a national level program of professional development of teachers may be needed to address reforms in mathematics education, involving both ITE and teachers leaders.

This current study found that the cooperating teachers and feedback from them had a significant influence on PSTs' feelings of preparedness. As highlighted in the NCTE Guidelines (2006), cooperating teachers working with PSTs should be experienced and effective teachers. Carefully matched with PSTs, cooperating teachers should work with PSTs to assist them with practical aspects of teaching, such as lesson planning, knowing the students, and understanding established classroom procedures. In addition, cooperating teachers could assist PSTs to relate to the students' families which was found to be an area in which the PSTs in this study felt less prepared. This collaborative support is in contrast to the experience of many PSTs in this study who noted that at times cooperating teachers treated PSTs as relief teachers instead of providing support and guidance.

Cooperating teachers could also provide support, guidance, and experience in assessment tools and methods. PSTs' lack of awareness and concern about assessment methods reflected the limited attention to assessment practices within ITE curricula, with attention to the provision of summative testing more so than formative testing. However, given that formative assessment plays a critical role in mathematics education reforms that value students' thinking as a resource (Stockero, Rupnow, & Pascoe, 2017), PSTs need to be provided with a strong knowledge base and opportunities to enact formative assessment practice as part of their learning (Dixson & Worrell, 2016; McGlamery & Shillingstad, 2017).

The notion of partnerships between ITE providers and the practicum schools is a hallmark of quality ITE (McLean Davies, 2017) and a good and close partnership between the practicum school and the university has been demonstrated to improve PSTs' feelings of preparedness (Harlow, Cooper, & Cowie, 2014). To ensure that PSTs receive the maximum benefit from the benefits of the practicum, ITE providers need to review PSTs teaching progress more frequently and provide adequate feedback, which will enable PSTs to increase their feelings of preparedness, teaching efficacy, and confidence. Better communication between the ITE providers and the practicum schools may help to ensure that the PSTs obtain the maximum benefit from the practicum experience. A first step could be for PSTs to visit schools and meet with and observe their cooperating teachers before the practicum, and to have selected cooperating teachers involved in some aspects of ITE programs. This close partnership may help overcome the theory–practice divide by providing a more integrated experience for PSTs. This could be done by following the clinical practicum model of ITE that involves several embedded or long-term practicum experiences, which has been referred to in the literature as the “third space” or a “hybrid space”, that treats the universities and the practicum schools as a single entity providing ITE (Kretchmar & Zeichner, 2016; Zeichner, 2010).

Post practicum workshops can also be used to provide PSTs with the opportunity to reflect on their teaching practice, feelings of confidence, and how well they embody their ideal teacher. One way that ITE programs could help PSTs benefit more from this opportunity could be to hold workshops after the practicum on the areas perceived to be weaknesses, and to encourage PSTs to practice reflection and self-evaluation (e.g., journaling), which is an inquiry practice that can be continued by beginning teachers (Boman, 2014; Hobson et al., 2009; MacDonald, Whatman, & Stevens, 2016).

In conclusion, the expectation that newly qualified Saudi mathematics teachers should *be and feel* prepared with strong knowledge of new teaching methods following student-centred teaching and learning practices it yet to be fully realised. Indeed, despite an overall sense of preparedness, the current experiences of ITE and practicum can lead to some PSTs feeling inadequately prepared. Given that ITE is only the beginning of the teaching pathway, much more support will be needed during the first few years of teaching for the PSTs in this study. PSTs need to be made aware that this support will be provided by the schools and through professional development so that even if they do not feel that they embody their ideal teacher upon completing their ITE course, they will have the chance to learn this.

7.4 Limitations of the study

As with most studies that rely on the participation of volunteers and seeks to understand and interpret participants' meanings and experiences, this study had a number of limitations.

Firstly, because of social and cultural norms, the sample group was limited to female PSTs, as Saudi society and culture do not allow a female researcher to conduct interviews with male PSTs. All attempts were made to ensure that the sample was representative of the wider populations of middle and secondary school female mathematics PSTs in Saudi Arabia. The mixed methods approach of the study was used to provide rich data into the perceptions, opinions, and feelings of female mathematics PSTs, and provide insights into their feelings of preparedness and the factors shaping their beliefs and feelings, which have not been provided by earlier studies.

In the sample pool of the survey, the younger PSTs outnumbered the older PSTs, and middle school PSTs outnumbered secondary PSTs and those who had their practicum experience in both middle and secondary schools. This imbalance may have affected some of the statistically significant differences between subgroups revealed by the research, such as how older PSTs were more likely to express feelings of being less-well prepared. Repeating the study with a more balanced mix of older and younger PSTs would help to validate these findings.

It is acknowledged that the concept of feeling 'prepared to teach' is subjective and may vary from culture to culture. Thus, these findings are specific to the unique setting of Saudi Arabian society and may not be applicable to other countries or cultures, although some overlap and agreement with international research was presented in the discussion.

This study used self-reported feelings of preparedness as a data source, and did not triangulate these data by obtaining other evidence of good teaching practice (e.g., observations of the PSTs' teaching behaviours). As noted by Bandura (1977), feelings of preparedness, efficacy, and confidence are subjective and are subject to change under the influence of factors such as stress, moods, emotional condition, and physical state (e.g., tiredness, illness, premenstrual syndrome). In addition, because the PSTs are not as experienced in the classroom, their effectiveness and self-evaluated strengths may not match those perceived by more experienced teachers. Self-reporting bias is always a limitation for any study using self-reports of behaviours, opinions, and beliefs. Further studies could possibly follow the suggestion of Berg

(2004) and provide additional viewpoints of the preparedness of PSTs, such as the perspectives of cooperating teachers.

Furthermore, the classroom experience of the PSTs in this study was limited to the practicum experience. It would be expected that feelings of preparedness and efficacy may change upon starting their careers as beginning teachers (Haigh & Anthony, 2012). The direction of this change may be positive or negative. Indeed, as noted by one of the interviewees, during practicum some of the students treated the PST as “not a real teacher”; this specific challenge would not be faced by a beginning teacher. On the other hand, a beginning teacher would have to take responsibility for cooperating with colleagues, interacting with parents, and assessing students, which are areas in which these PSTs felt poorly prepared. It is therefore possible that these PSTs’ feelings of efficacy and preparedness could increase or decrease when they become beginning teachers. To overcome this limitation, a follow-up study on feelings of efficacy, confidence, and preparedness in beginning teachers could be of interest in determining the expectations around the strength of preparedness at the time of graduation.

Furthermore, this study does not attempt to draw any conclusions about whether or not the PSTs surveyed are or will be effective teachers. Although feelings of preparedness are linked to teaching efficacy as evaluated by student achievement and teaching behaviours (Tschannen-Moran et al., 1998), it is risky to assume a cause and effect relationship from feelings of preparedness and teaching quality (Darling-Hammond et al., 2002). Instead, the focus of this study was on PSTs’ perceptions and experiences, and using the findings to suggest possible areas that ITE could improve to help develop PSTs that feel more prepared to teach mathematics at middle and secondary school level in Saudi Arabia.

7.5 Suggestions for further research

Further research could extend this present study in a number of ways. Firstly, the study could be repeated with a larger group of survey and interview participants to reduce the likelihood of bias in the sample. In particular, having a balance between older and younger PSTs and between middle school and secondary school PSTs would also be useful for validating the present findings. This could also help discover whether other trends exist, such as the influence of different ITE providers, distance between the ITE provider and the practicum school, and rural versus urban practicum schools.

A similar study could also be used to find similarities and differences between the perceptions of female Saudi mathematics PSTs and their peers from another country. This would help to reveal any culture-specific trends, concerns, or issues. The study could be extended further to other groups of PSTs beyond female mathematics PSTs teaching at secondary and/or middle school level. For example, subsequent studies could examine the perceptions of male PSTs, primary school level PSTs, or PSTs in other subject areas (e.g., science). Another possibility for extending this study could be to compare and contrast PSTs' feelings of efficacy and confidence with those of other groups such as experienced teachers and beginning teachers.

As a further extension of the present study, classroom observations and other evidence could be used to triangulate the data and provide further insights into the phenomenon of preparedness and teaching efficacy in PSTs. Using multiple techniques to gather data helps strengthen the power of the survey and validate the findings (Leedy, 2001). Other possible methods that could provide additional evidence include reports by mentor teachers and cooperating teachers, students' perceptions of PSTs, PSTs' records and planning documents, and ITE course results and evaluations.

As well as comparing and contrasting the views of female mathematics PSTs with those of other groups, changes in perceptions over time could be investigated to extend this study in another direction. For example, one could conduct longitudinal studies investigating how self-perceived efficacy and confidence change over time. In addition, given the importance of the practicum in shaping feelings of preparedness, a subsequent study could compare PSTs' feelings of preparedness, efficacy, and confidence before and after the practicum experience.

A third way that the findings of this study could be used as a basis for further research would be to look more deeply into how ITEs can improve PSTs' preparedness to teach and which methods or practices are best for doing so (e.g., improved partnerships and communication between schools and universities, curriculum reform, ITE teaching methods, etc.). Such research could take the form of reviews and meta-analyses that consider the perspectives of PSTs as well as other data sources.

7.6 Research Contribution

This study, by examining Saudi female mathematics PSTs' feelings of preparedness to teach, provided some valuable insights into ITE and teacher preparation in Saudi Arabia. This research fills a gap in the literature on teacher preparedness and ITE in Saudi Arabia by collecting qualitative and quantitative data in a mixed-methods approach via questionnaires with Likert-type scales and open-ended questions, and semi-structured interviews. To the best of the researcher's knowledge, this is the first mixed-methods study of the perceptions of female Saudi mathematics PSTs regarding their feelings of preparedness to teach and the factors contributing to this such as the role of the practicum experience.

Overall, the findings contribute to the current knowledge on the preparation of secondary and middle school mathematics PSTs, and suggest areas that could be strengthened to improve ITE in Saudi Arabia in order to develop quality teachers. This study highlighted the challenges faced by PSTs in the context of Saudi ITE, including the persistence of the theory–practice divide, and the associated need to forge stronger links between ITE and classrooms. In this regards, the importance of the practicum experience in enhancing feelings of preparedness was emphasised in line with the findings of prior studies (Darling-Hammond et al., 2002; Hoy & Spero, 2005; Zientek, 2007). The practicum experience was seen as the strongest influence on the PSTs' feelings of preparedness and helped to increase the PSTs' feelings of efficacy (Zeichner, 2010). However, many PSTs in this study struggled to capitalise on the “opportunity to integrate theory into practice” (Allen & Wright, 2014, P. 137) within their practicum and in turn, the practicum sometime served to confuse rather than to “facilitate [them] to experience what it means to be a teacher within an academic context” (Sulistiyo, Mukminin, Abdurrahman, & Haryanto, 2017, p. 312).

In listening to PSTs' voice to understand how the PSTs perceive their learning in the ITE program, this study contributes to enriching our understanding of what it means to feel prepared to teach within the context of teacher education. Their voices exposed their dilemma of understanding preparedness, expressed as a tension between what PSTs think preparedness means and what preparedness needs to be. Preparedness entails having the traditional skills, having knowledge, and having psychological feelings of being prepared. However, PSTs are not always fully aware of all the kinds of knowledge needed for being prepared. Moreover, tension comes from their perspectives of being positive and satisfied about how ITE has prepared them for being a teacher, and their desire to be change agents enacting responsive

pedagogies going forward. Thus, their overall satisfaction comes from their sense of having tradition skills, but also there is a sense of uneasiness because they want to have other skills, which they know about, but have had limited opportunity to see and experience in the practice of the classroom.

By listening to the PSTs' voice, this study exposes the dilemma for those young female graduates: they want to mirror their cooperating teachers and develop their sense of preparedness of having the knowledge of having traditional teaching skills, but they also want to be agents of change who apply new student-centred pedagogies. This study captures a moment-in-time for these young female graduates who are at the crossroads of what may seem like two worlds: tradition and reform. In the survey, their notions of preparedness tended to be more traditional, but in the interviews, it was clear that they are struggling with the question as to whether they are really prepared to go forward to be the future-focussed teacher they wish to become. The theory-practice divide between these two worlds has contributed to the tension in their sense of preparedness because they are not really sure what they are prepared for: are they prepared for the past or for the future?

This study suggests that what PSTs learn in their ITE programs and what they practice cannot take place in separate sites (the university and the practicum school). To support PSTs' sense of preparedness —the two need to be integrated.

7.7 Concluding Thoughts

The examination of how PSTs define preparedness to teach has highlighted that the phenomenon can mean different things to individual PSTs, and that it is a complex, nuanced, and uncertain phenomenon in the increasingly complex and diverse world of modern teaching (Zeichner, 2010). The idea of preparedness and the notion that a PST is either prepared or less-prepared (Britzman, 2003), may, in the Saudi context, reflect less about the complexity of teaching and more about the practical reality of PSTs who have experienced traditional teaching methods during their school years, but who strive for the ideals of the newly reformed Saudi curriculum. Within Saudi culture, the female role in society is in a process of change that will need to be reflected in a changing education system that will enable the young women to operate in modern Saudi culture. Given these changes, it is vital that PSTs feel prepared to enact a coherent vision of mathematics teaching going forward. The voices of these PST

graduates, their experiences, and the tensions and dilemmas they face, indicate the need for ongoing reforms to ensure the design of high-quality ITE programs that support PSTs sense of preparedness.

References

- ACET, Inc. (2013). *Selecting an evaluation: Qualitative, quantitative, and mixed method approaches*. Minneapolis, MN.
- Adu, E. O., & Olantundun, S.O. (2007). Teachers' Perception of teaching as correlates students' academic performance in Oyo State Nigeria. *Essays in Education*, 20, 57–63.
- Afamasaga-Fuata'i, K., Meyer, P., & Falo, N. (2008). Assessing primary preservice teachers' mathematical competence. In M. Goos, R. Brown, & K. Makar (Eds.), *Navigating Currents and Charting Directions: Proceedings of the 31st Annual Conference of the Mathematics Education Research Group of Australasia* (pp. 43–49). Sydney, Australia: MERGA.
- Agyei, D. D. (2012). *Preparation of pre-service teachers in Ghana to integrate information and communication technology in teaching mathematics* (Doctoral dissertation, University of Twente, Enschede, The Netherlands). Retrieved from <https://research.utwente.nl/en/publications/preparation-of-pre-service-teachers-in-ghana-to-integrate-informa>
- Aitken, G., Sinnema, C., & Meyer, F. (2013). *Initial teacher education outcomes: Standards for graduating teachers*. University of Auckland. Retrieved from www.educationcounts.govt.nz/publications/ECE/2511
- Akbaba-Altun, S. (2009). An investigation of teachers, parents, and students' opinions on elementary students' academic failure. *Elementary Education Online*, 8(2), 567–586.

- Akiri, A. A., & Ugborugbo, N. M. (2009). Teachers' effectiveness and students' academic performance in public secondary schools in delta state, Nigeria. *Studies of Home Communication Science*, 3 (2), 107–113.
- Aktas, M., Kurt, H., & Aksu, O., & Ekici, G. (2013). Gender and experience as predictor of biology teachers' education process self-efficacy perception and perception of responsibility from student success. *International Journal on New Trends in Education and Their Implications*, 4(3), 37–47.
- Al Nazeer, M. (2004). *A proposed program for developing teaching mathematics in the middle cycle* (Unpublished doctoral dissertation). King Saud University, Riyadh, Saudi Arabia.
- Al Shannag, Q., Tairab, H., Dodeen, H., & Abdel-Fattah, F. (2013). Linking teachers' quality and student achievement in the Kingdom of Saudi Arabia and Singapore: The impact of teachers' background variables on student achievement. *Journal of Baltic Science Education*, 12(5), 652–665.
- Alanazi, N. (2008). *The use of physical punishment on children in Saudi Arabia. Perceptions and experiences of parents and young people*. (Doctoral dissertation, Durham University, Durham, England). Retrieved from <http://etheses.dur.ac.uk/2184/>
- Alaqail, A. (2005). *Education policy and system in the kingdom of Saudi Arabia*. Riyadh, Saudi Arabia: Alroshed Library Press.
- Albalawi, A. (2010). *Research priorities in the field of teaching and learning mathematics in Saudi Arabia*. Retrieved from <https://ecsme.ksu.edu.sa/ar/node/688>

- Albalawi, A., & Ghaleb, R. (2011). Professional development needs of mathematics teachers in Saudi Arabia. In L. Gómez Chova, D. Martí Belenguer, A. López Martínez (Eds.), *Proceedings of EDULEARN11 3rd International Conference on Education and New Learning Technologies* (pp. 569–582). Barcelona, Spain: EDULEARN11.
- Albayrak, M., & Unal, Z. A. (2011). The effect of methods of teaching mathematics course on mathematics teaching efficacy beliefs of elementary pre-service mathematics teachers. *International Journal of Humanities and Social Science*, 1(19), 183–190.
- Al-Bursan, I., & Tighezza, E. (2013). Assessment practices of mathematics teachers in Kingdom of Saudi Arabia and South Korean: A comparison study. *Journal of Education and Psychology*, 39(4), 25–53.
- Al-Eisa, A. M., & Sahab, S. A. (2006). *The experience of King Abdulaziz University in accreditation and quality*. Paper presented at the First Arabic Conference for University Quality and Requirements of Licensing and Academic Accreditation, Al-Sharjah, United Arab Emirates.
- Al-Essa, A. (2009). *Education reform in Saudi Arabia between Absence of Political Vision, Apprehension of the Religious Culture and Disability of Educational Management* (1st ed.). Beirut, Lebanon: Dar Al Saqi.
- Alfarhod, S. (2009). Teaching mathematics, the reality and expectations. *The Journal of Education and Psychology: Saudi Association for Educational and Psychological*, 283–308.
- Alghamdi, A. (2015). Challenges and constraints encountered by Saudi pre-service science teachers: A critical perspective. *Learning and Teaching in Higher Education: Gulf Perspectives*, 12(1), 1–20.

- Alghamdi, A. K. (2013). Pre-service teachers' preferred methods of assessment: A perspective from Saudi Arabia. *Australian Journal of Teacher Education*, 38(4), 66–90.
- Alghamdi, A. K., & Al-Salouli, M. S. (2012). Saudi elementary school science teachers' beliefs: Teaching science in the new millennium. *International Journal of Science and Mathematics Education*, 11(2), 1–25. doi: 10.1007/s10763-012-9353-0
- Alharbi, A. (2011). *The development and implementation of a CPD program for newly qualified teachers in Saudi Arabia* (Doctoral dissertation, University of Southampton, Southampton, United Kingdom). Retrieved from https://eprints.soton.ac.uk/209275/1/PHD_theses_A.Alharbi.pdf
- Aljabber, J. M. (2002). *Grades 7-12 preservice teacher preparation science program in Riyadh Teachers College in the Kingdom of Saudi Arabia* (Unpublished doctoral dissertation). Indiana University, Bloomington, Indiana, USA.
- Allamnakhrah, A. (2013). Learning critical thinking in Saudi Arabia: Student perceptions of secondary pre-service teacher education programs. *Journal of Education and Learning*, 2(1), 197–210. doi:10.5539/jel.v2n1p197
- Allen, J. M., & Wright, S. E. (2014). Integrating theory and practice in the pre-service teacher education practicum. *Teachers and Teaching*, 20(2), 136–151. doi:10.1080/13540602.2013.848568
- Almazroa, H. (2013, September). *Professional development: A vision for Saudi science teachers*. Paper presented at the Annual Conference of European Science Education Research Association (ESERA), Nicosia, Cyprus.

- Almazroa, H., Aloraini, A., & Alshaye, F. (2015, April). *Science and math teacher's perceptions of professional development within the new science curriculum implementation*. Paper presented at the Annual Conference of the National Association for Research in Science Teaching (NARST), Chicago, IL, U.S.
- Al-Miziny, H. (2010). *Abdicating of Education in Saudi Arabia* (1st ed.). Beirut, Lebanon: Arab Diffusion Company.
- Almoathm, k. (2008). *Research trends of teaching mathematics in Saudi Arabia: Analysis study for master and doctoral studies* (Unpublished doctoral dissertation). Umm Al-Qura University, Makkah, Saudi Arabia.
- Al-Musallam, A. (2007, May). *Higher education accreditation and quality assurance in the Kingdom of Saudi Arabia*. Paper presented at the First National Conference for Quality in Higher Education, Riyadh, Saudi Arabia.
- Alnabhan, M., Al-Zegoul, E., & Harwell, M. (2001). Factors related to achievement levels of education students at Mu'tah University. *Assessment and Evaluation in Higher Education*, 26(6), 593–604.
- Alqahtani, N., Kanasa, H., Garrick, B., & Grootenboer, P. (2016). Saudi teachers' perceptions of the qualities of effective teachers. *Australian Journal of Sustainable Business and Society*, 2(1), 93–104.
- Alsaleh, F. I. (2013). *The attitudes towards mathematics of female secondary students in Saudi Arabia* (Unpublished Master dissertation). University of Waikato, Hamilton, New Zealand.

- Al-Saud, F. A., & Al-Sadaawi, A. S. (2014, May). *Raising the quality of education: Developing professional standards for Saudi teachers*. Paper presented at the 40th Annual Conference of the International Association for Educational Assessment, Singapore, Singapore.
- Alshamrani, S. (2012). Priorities of research in science education in Saudi Arabia. *Journal of Educational Sciences and Islamic Studies*, 24(1), 199–128.
- Alsharif, K. (2011). *Towards quality teacher education: Productive pedagogies as framework for Saudi pre-service teachers' training in mathematics education*. (Doctoral dissertation, Curtin University, Bentley, Western Australia). Retrieved from https://espace.curtin.edu.au/bitstream/handle/20.500.11937/425/186709_Al-Sharif2012.pdf?sequence=2
- Alshehri, K. A. (2012). *The influence of mathematics teachers' knowledge in technology, pedagogy and content (TPACK) on their teaching effectiveness in Saudi public schools*. (Doctoral dissertation, University of Kansas). Retrieved from <https://www.learntechlib.org/p/117983>
- Alshumrani, S. (2008). Saudi Arabia. In I. V. S. Mullis, M. O. Martin, J. F. Olson, D. R. Berger, D. Milne, & G. M. Stanco (Eds.), *TIMSS 2007 encyclopedia: A guide to mathematics and science education around the world* (pp. 505–512). Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- Alzaydi, D. (2010). *Activity theory as a lens to explore participant perspectives of the administrative and academic activity systems in a university–school partnership in initial teacher education in Saudi Arabia* (Unpublished doctoral dissertation). University of Exeter, Exeter, England.

- Anderson, L. M., & Stillman, J. A. (2013). Student teaching's contribution to preservice teacher development: A review of research focused on the preparation of teachers for urban and high-needs contexts. *Review of Educational Research*, 83(1), 3–69.
doi:10.3102/0034654312468619
- Anthony, G. (2018). Practice-based initial teacher education: Developing inquiring professionals. In G. Kaiser, H. Forgasz, M. Graven, A. Kuzniak, E. Simmt, & B. Xu (Eds.), *Invited Lectures from the 13th International Congress on Mathematics Education*, ICME-13 Monographs (pp. 1–18), Cham, Switzerland: Springer International Publishing.
- Anthony, G. J., Cooke, A., & Muir, T. (2016). *Challenges, reforms, and learning in initial teacher education*. In K. Makar, S. Dole, J. Visnovska, M. Goos, & A. Bennison (Eds.), *Research in mathematics education in Australasia 2012-2015* (pp. 305–327). Singapore: Springer.
- Anthony, G., & Hunter, R. (2012). (Re)thinking and (re)forming initial mathematics teacher education. *New Zealand Journal of Educational Studies*, 47(1), 145–151.
- Anthony, G., & Kane, R. with Bell, B., Butler, P., Davey, R., Fontaine, S., Haigh, M., Lovett, S., Mansell, R., Naidoo, K., Ord, K., Prestidge, B., Sandretto, S., Stephens, C. (2008). *Making a difference: The role of initial teacher education and induction in the preparation of secondary teachers*. Wellington, New Zealand: Teaching and Learning Research Initiative.
- Anthony, G., & Walshaw, M. (2009). Characteristics of effective teaching of mathematics: A view from the West. *Journal of Mathematics Education*, 2(2), 147–164.

- Anthony, G., Hunter, J., & Hunter, R. (2015a). Prospective teachers developing adaptive expertise. *Teaching and Teacher Education*, 49, 108–117.
- Anthony, G., Hunter, J., & Hunter, R. (2015b). Supporting prospective teachers to notice students' mathematical thinking through rehearsal activities. *Mathematics Teacher Education and Development*, 17(2), 7–24.
- Anthony, G., Hunter, R., Hunter, J., & Duncan, S. (2015). How ambitious is “ambitious mathematics teaching”? *SET: Research Information for Teachers*, (2), 45–523.
- Anthony, G., Hunter, R., Hunter, J., Rawlins, P. Averill, R., Drake, M., ... Harvey, R. (2015). Learning the work of ambitious mathematics teaching. Teaching and Learning Research Initiative. Retrieved from http://www.tlri.org.nz/sites/default/files/projects/TLRI_Anthony_Final%20Summary%20Report%20%28v3%29.pdf
- Armor, D., Conroy-Oseguera, P., Cox M., King, N., McDonnell, L., Pascal, A. Pauly, E., & Zellman, G. (1976). *Analysis of the school preferred reading programs in selected Los Angeles minority schools* (Report No. R-2007-LAUDS). Santa Monica, CA: Rand Corporation.
- Askew, M., Brown, M., Rhodes, V., Wiliam, D., & Johnson, D. (1997). *Effective teachers of numeracy: Report of a study carried out for the Teacher Training Agency*. London, England: King's College, University of London.
- Association of Mathematics Teacher Educators. (2017). *Standards for Preparing Teachers of Mathematics*. Retrieved from amte.net/standards.

- Atweh, B., & Brady, K. (2009). Socially response-able mathematics education: Implications of an ethical approach. *Eurasia Journal of mathematics, science & technology education*, 5(3), 267–276.
- Australian Institute of Teaching and School Leadership. (2011). *Accreditation of initial teacher education programs in Australia: Standards and procedures*. Carlton South, Australia: Education Services Australia.
- Aydin, Y. C., & Woolfolk Hoy, A. (2005). What predicts student teacher self-efficacy? *Academic Exchange Quarterly*, 9(4), 123–127. Retrieved from [http://www.thefreelibrary.com/What predicts student teacher self-efficacy?-a0142636402](http://www.thefreelibrary.com/What+predicts+student+teacher+self-efficacy?-a0142636402).
- Balatti, J. & Rigano, D. (2011, July). Pre-service teacher perceptions of good mathematics teachers: What matters? In J. Clark, B. Kissane, J. Mousley, T. Spencer, & S. Thornton (Eds.), *Mathematics: Traditions and (new) practices*. Proceedings of the AAMT-MERGA Conference held in Alice Springs, (pp.82-88). Adelaide, Australia: MERGA.
- Ball, D. L., & Bass, H. (2003). Toward a practice-based theory of mathematical knowledge for teaching. In B. Davis and E. Simmt (Eds.), *Proceedings of the 2002 annual meeting of the Canadian Mathematics Education Study Group* (pp. 3–14). Edmonton, AB: CMESG/GDEDM.
- Ball, D. L., & Forzani, F. M. (2009). The work of teaching and the challenge for teacher education. *Journal of Teacher Education*, 60(5), 14.
- Ball, D. L., & Forzani, F. M. (2010). What does it take to make a teacher? *Phi Delta Kappan*, 92(2), 5.

- Ball, D. L., & Forzani, F. M. (2011). Teaching skillful teaching. *Educational Leadership*, 68(4), 40–45.
- Ball, D. L., & Hill, H. (2009). The curious-and-crucial case of mathematical knowledge for teaching. *Phi Delta Kappan*, 91(2), 3.
- Ball, D. L., Hill, H. C., & Bass, H. (2005). Knowing mathematics for teaching: Who knows mathematics well enough to teach third grade, and how can we decide? *American Educator*, 30(3), 14–46.
- Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? Special? *Journal of Teacher Education*, 59(5), 389–407.
doi:10.1177/0022487108324554
- Ball, D. L., Thames, M. H., Bass, H., Sleep, L., Lewis, J., & Pelps, G. (2009). A practice-based theory of mathematical knowledge for teaching. In M. Tzekaki, M. Kaldrimidou, & H. Sakonidis (Eds.), *Proceedings of the 33rd Conference of the International Group for the Psychology of Mathematics Education* (pp. 95–98). Thessaloniki, Greece: PME.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191–215.
- Bandura, A. (1994). Self-efficacy. In V. S. Ramachaudran (Ed.), *Encyclopedia of human behavior* (pp. 71–81). New York, NY: Academic Press.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.
- Bandura, A. (2007). Much ado over faulty conceptions of perceived self-efficacy grounded in faulty experimentation. *Journal of Social and Clinical Psychology*, 26(6), 641–758.

- Bazeley, P. (2004). Issues in mixing qualitative and quantitative approaches to research. In R. Buber, J. Gadner, & L. Richards (Eds.), *Applying qualitative methods to marketing management research* (pp. 141–156). Basingstoke, England: Palgrave Macmillan.
- Beck, C., & Kosnik, C. (2000). Associate teachers in pre-service education: Clarifying and enhancing their role. *Journal of Education for Teaching*, 26(3), 207–224.
<http://dx.doi.org/10.1080/713676888>
- Begle, E. G. (1968). Curriculum research in mathematics. In H. J. Klausmeier & G. T. O'Hearn (Eds.), *Research and development toward the improvement of education*. Madison, WI: Dembar Educational Research Services.
- Behrstock-Sherratt, E., Bassett, K., Olson, D., & Jacques, C. (2014). *From good to great: Exemplary teachers share perspectives on increasing teacher effectiveness across the career continuum*. Retrieved from <https://eric.ed.gov/?id=ED555657>
- Ben-Motreb, K., & Al-Salouli, M. (2012, October). *Pre-service teachers' mathematics knowledge for teaching*. Paper presented at the Fourth Asian Conference on Education, Osaka, Japan.
- Ben-Nun, P. (2008). Respondent fatigue. In P. J. Lavrakas (Ed.), *Encyclopedia of survey research methods* (pp. 743–744). Los Angeles, CA: Sage.
- Berg, B. L. (2004). *Qualitative research methods for the social sciences*. Boston, MA: Pearson Education and Allyn and Bacon.
- Bilali, O. (2013). Teaching efficacy to student teachers in the faculty of education, Elbasan Albania. *Journal of Educational and Social Research*, 3(1), 179–185. doi: 10.5901/jesr.2013.v3n1p179

- Biza, I., Nardi, E., & Joel, G. (2015). Balancing classroom management with mathematical learning: Using practice-based task design in mathematics teacher education. *Mathematics Teacher Education and Development*, 17(2), 182–198.
- Bogdan, R. C., & Biklen, S. K. (2007). *Qualitative research for education: An introduction to theories and methods* (5th ed.). Boston, MA: Pearson Allyn and Bacon.
- Boman, J. (2014). Does reflective writing enhance training? An evaluation of a skills-based teaching assistant training program. *Transformative Dialogues: Teaching & Learning Journal*, 7(2), 1–18.
- Boni, S. (2014). *An exploration of pre-service teachers' perceptions of self-efficacy* (Unpublished doctoral dissertation). George Fox University, Newberg, Oregon.
- Borko, H., Eisenhart, M., Brown, C. A., Underhill, R. G., Jones, D., & Agard, P. C. (1992). Learning to teach hard mathematics: Do novice teachers and their instructors give up too easily? *Journal for Research in Mathematics Education*, 23(3), 194–222.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- Britzman, D. P. (2003). *Practice makes practice: A critical study of learning to teach* (Revised Edition). Albany, US: State University of New York Press.
- Brown, A. L., Lee, J., & Collins, D. (2015). Does student teaching matter? Investigating preservice teachers' sense of efficacy and preparedness. *Teaching Education*, 26(1). 77 – 93. DOI: 10.1080/10476210.2014.957666

- Bruce, C. D., Esmonde, I., Ross, J., Dookie, L., & Beatty, R. (2010). The effects of sustained classroom-embedded teacher professional learning on teacher efficacy and related student achievement. *Teaching and Teacher Education*, 26(8), 1598–1608.
- Bryan, C. A., Wang, T., Perry, B., Wong, N-Y., & Cai, J. (2007). Comparison and contrast: Similarities and differences of teachers' views of effective mathematics teaching and learning from four regions. *ZDM Mathematics Education*, 39, 329–340.
- Bryman, A. (2006). Integrating quantitative and qualitative research: How is it done? *Qualitative Research*, 6(1), 97–113. doi: 10.1177/1468794106058877
10.1080/13645570600595280
- Bryman, A. (2007). Barriers to integrating quantitative and qualitative research. *Journal of Mixed Methods Research*, 1(1), 8–22. doi: 10.1177/2345678906290531
- Bryman, A. (2012). *Social research methods* (4th ed.). Oxford, England: Oxford University Press.
- Buehl, M. M., & Fives, H. (2009). Exploring teachers' beliefs about teaching knowledge: Where does it come from? Does it change? *The Journal of Experimental Education*, 77(4), 367–408. doi:10.3200/jexe.77.4.367–408
- Bullough Jr, R. V. (2014). Recalling 40 years of teacher education in the USA: A personal essay. *Journal of Education for Teaching: International research and pedagogy*, 40(5), 474–491, DOI: 10.1080/02607476.2014.956537
- Burghes, D. (Ed.) (2008). *International comparative study in mathematics teacher training*. Reading: CfBT Education Trust. Retrieved from <https://cdn.ima.org.uk/wp/wp->

content/uploads/2016/02/International-comparative-study-in-Mathematics-teacher-training.pdf

Byrnes, J. P. (2008). *Cognitive development and learning* (3rd ed.). Boston: Pearson.

Cabaroğlu, N. (2012). Prospective EFL teachers' perceptions of classroom management and misbehaviour. *Çukurova University Faculty of Education Journal*, 41(1), 117–132.

Cai, J., Perry, B., Wong, N.-Y., & Wang, T. (2009). What is effective teaching? A study of experienced mathematics teachers from Australia, the Mainland China, Hong Kong-China, and the United States. In J. Cai, G. Kaiser, B. Perry, & N.-Y. Wong (Eds.), *Effective mathematics teaching from teachers' perspectives—National and cross-national studies* (pp. 1–36). Rotterdam, Netherlands: Sense Publishers.

Caires, S., Almeida, L., & Vieira, D. (2012). Becoming a teacher: Student teachers' experiences and perceptions about teaching practice. *European Journal of Teacher Education*, 35(2), 163–178. doi:10.1080/02619768.2011.643395

Çakiroğlu, J. Çakiroğlu, E., & Boone, W. J. (2005). Pre-service teacher self-efficacy beliefs regarding science teaching: A comparison of pre-service teachers in Turkey and the USA. *Science Educator*, 14(1), 31–40.

Cameron, R. (2009). A sequential mixed model research design: Design, analytical and display issues. *International Journal of Multiple Research Approaches*, 3(2), 140–152.

Campbell, M. P., & Elliott, R. (2015). Designing approximations of practice and conceptualising responsive and practice-focused secondary mathematics teacher education. *Mathematics Teacher Education and Development*, 17(2), 146–164.

- Cantrell, S. C., Almasi, J. F., Carter, J. C., & Rintamaa, M. (2013). Reading intervention in middle and high schools: Implementation fidelity, teacher efficacy, and student achievement. *Reading Psychology, 34*(1), 26–58.
- Caprara, G. V., Barbaranelli, C., Borgogni, L., & , Steca, P. (2003). Efficacy beliefs as determinants of teachers' job satisfaction. *Journal of Educational Psychology, 95*(4), 821–832. doi:10.1037/0022-0663.95.4.821
- Caprara, G. V., Barbaranelli, C., Steca, P., & Malone, P. S. (2006). Teacher self-efficacy beliefs as determinants of job satisfaction and students' academic achievement: A study at the school level. *Journal of School Psychology, 44*(6), 473–490. doi:10.1016/j.jsp.2006.09.001
- Carr, E. C., & Worth, A. (2001). The use of the telephone interview for research. *Journal of Research in Nursing, 6*(1), 511–524.
- Carter, H. (2006). *The impact of student teaching on preservice teachers' teaching self efficacy beliefs*. (Doctoral dissertation, Northern Arizona University, Arizona, U.S.). Retrieved from Dissertations & Theses: Full Text database. (Publication No. AAT 3241820)
- Center for Teaching Quality. (2013). Teaching 2030: Leveraging Teacher Preparation 2.0. Hillsborough, NZ: Author. Retrieved from http://www.teachingquality.org/sites/default/files/TEACHING_2030_Leveraging_Teacher_Preparation.pdf
- Check, J., & Schutt, R. K. (2012). *Research methods in education*. Los Angeles, CA: Sage.

- Chen, J., & Brown, G. T. L. (2013). High-stakes examination preparation that controls teaching: Chinese prospective teachers' conceptions of excellent teaching and assessment. *Journal of Education for Teaching*, 39(5), 541–556. doi: 10.1080/02607476.2013.836338
- Cheon, S. H., Reeve, J., Lee, Y., & Lee, J.-w. (2018). Why autonomy-supportive interventions work: Explaining the professional development of teachers' motivating style. *Teaching and Teacher Education*, 69, 43–51. doi: <https://doi.org/10.1016/j.tate.2017.09.022>
- Cheung, H. Y. (2008). Teacher efficacy: A comparative study of Hong Kong and Shanghai primary in-service teachers. *The Australian Educational Researcher*, 35(1), 103–123.
- Cho, H., & Kwon, O. N. (2017). Understanding future teachers' mathematical knowing to overcome double discontinuities. In B. Kaur, & L.N. Hoe (Eds.), *Empowering Mathematics Learners* (pp. 75–97). Singapore, Singapore: World Scientific.
- Clark, S. K. (2009). *A comparative analysis of elementary education preservice and novice teachers' perceptions of preparedness and teacher efficacy* (Doctoral dissertation, Utah State University, Logan, Utah). All Graduate Theses and Dissertations, 427. Retrieved from <https://digitalcommons.usu.edu/etd/427/>
- Clark, S. K., Byrnes, D., & Sudweeks, R. R. (2015). A comparative examination of student teacher and intern perceptions of teaching ability at the preservice and inservice stages. *Journal of Teacher Education*, 66(2), 170–183. doi: 10.1177/0022487114561659

- Clarke, D., Emanuelsson, J., Jablonka, E., & Mok, I. (Eds.). (2006). *Making connections: Comparing mathematics classrooms around the world*. Rotterdam, Netherlands: Sense Publishers.
- Clarke, P. A., Thomas, C. D., & Vidakovic, D. (2009). Preservice mathematics teachers' attitudes and developing practices in the urban classroom: Are they 'winging' it? *Research and Practice in Social Sciences*, 5(1), 220–243.
- Clements, D. H., & Sarama, J. (2014). *Learning and teaching early math: The learning trajectories approach* (2nd ed.). New York, NY: Routledge.
- Cochran–Smith, M. (2003). Assessing assessment in teacher education. *Journal of Teacher Education*, 54(3), 187–191. doi:10.1177/0022487103054003001
- Cochran-Smith, M. (2006). Ten promising trends (and three big worries). *Educational Leadership*, 63(6), 20–25.
- Cochran-Smith, M., & Power, C. (2010). New directions for teacher preparation. *Educational Leadership*, 67(8), 6–13.
- Cochran-Smith, M., & Villegas, A. M. (2015). Framing teacher preparation research: An overview of the field, part I. *Journal of Teacher Education*, 66(1), 7–20.
- Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education* (7th ed.). London, England: Routledge, Falmer.
- Collaboration for Effective Educator Development, Accountability, and Reform (CEEDAR) Grant. (2017). *Developing quality fieldwork experiences for teacher candidates: A planning guide for educator preparation programs and district partners*. Retrieved

from <http://cedar.education.ufl.edu/wp-content/uploads/2017/03/CEEDAR-FieldExperGuide-508.pdf>

Confait, S. P. (2014). *A Seychelles case of beginning teachers' perspectives of support and challenges in their pursuit of effective teaching practices* (Unpublished doctoral dissertation). Victoria University, Wellington, New Zealand.

Conference Board of the Mathematical Sciences. (2012). *The mathematical education of teachers II (MET-II)*. American Mathematical Society: Providence, Rhode Island.

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). Thousand Oaks, CA, US: Sage Publications, Inc.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, California: Sage Publications.

Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research* (2nd eds.). Thousand Oaks, California: Sage Publications.

Creswell, J. W., & Plano Clark, V. L. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, California: Sage Publications.

Cripps Clark, J., & Walsh, J. (2002, November). *Elements of a model of effective teachers*. Paper presented at the annual conference of the Australian Association for Research in Education, Brisbane, Australia. Retrieved from <https://www.aare.edu.au/data/publications/2002/wal02220.pdf>

Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process*. Crows Nest, NSW, Australia: Allen & Unwin.

- Cumming, J., & Jasman, A. M. (2003). *Professional teaching standards and quality education*. UNESCO: Teacher Status and Qualifications for Education Quality Project.
- Dack, H. (2018). Structuring teacher candidate learning about differentiated instruction through coursework. *Teaching and Teacher Education*, 69, 62–74. doi: <https://doi.org/10.1016/j.tate.2017.09.017>
- Darandari, E., & Ward, S. (2011, April). *Effective partnerships –building capacity for quality in Saudi Arabian Higher Education institutions: An evaluation*. Paper presented at the Biennial Conference of the International Network for Quality Assurance Agencies in Higher Education (INQAAHE), Madrid, Spain.
- Darandari, E., Al-Qahtani, S, Allen, I., Al-Yafi, W., Al-Sudairi, A., & Catapang, J. (2009). The quality assurance system for post-secondary education in Saudi Arabia: A comprehensive, developmental and unified approach. *Quality in Higher Education*, 15 (1), 39–49.
- Darling-Hammond, L. (2000). How teacher education matters. *Journal of Teacher Education*, 51(3), 166–173.
- Darling-Hammond, L. (2001). *Thoughts on teacher preparation*. Retrieved from <https://www.edutopia.org/linda-darling-hammond-teacher-preparation>
- Darling-Hammond, L. (2005). *Professional development schools: Schools for developing a profession*. New York, NY: Teachers College Press.
- Darling-Hammond, L. (2006). *Powerful teacher education: Lessons from exemplary programs*. San Francisco, CA: Jossey-Bass.

- Darling-Hammond, L. (2010). Teacher education and the American future. *Journal of Teacher Education*, 61(1–2), 35–47.
- Darling-Hammond, L. (2012). *Creating a comprehensive system for evaluating and supporting effective teaching*. Stanford, CA: Stanford Center for Opportunity Policy in Education.
- Darling-Hammond, L., & Baratz-Snowden, J. (Eds.). (2007). A good teacher in every classroom: Preparing the highly qualified teachers our children deserve. [A report for The National Academy of Education Committee on Teacher Education]. *Educational Horizons*, 85(2), 111–132.
- Darling-Hammond, L., & Bransford, J. (Eds.). (2005). *Preparing teachers for a changing world: What teachers should learn and be able to do*. San Francisco, CA: Jossey-Bass.
- Darling-Hammond, L., Chung, R., & Frelow, F. (2002). Variation in teacher preparation: How well do different pathways prepare teachers to teach? *Journal of Teacher Education*, 54(4), 286–302.
- Dawson, V. (2008). Use of information communication technology by early career science teachers in Western Australia. *International Journal of Science Education*, 30(2), 203–219.
- Day, C., & Sachs, J. (2004). Professionalism, performativity and empowerment: Discourses in the politics, policies and purposes of continuing professional development. In C. Day & J. Sachs (Eds.), *International handbook on the continuing professional development of teachers* (pp. 3–32). Maidenhead, England: Open University Press.

- Dayal, H. C. (2013). *Pre-service secondary mathematics teachers' reflection on good and bad mathematics teaching*. In V. Steinle, L. Ball & C. Bardini (Eds.), *Proceedings of the 36th annual conference of the Mathematics Education Research Group of Australasia* (pp. 226–232). Melbourne, VIC, Australia: MERGA.
- De Nobile, J. (2007). Primary teacher knowledge of science concepts and professional development: Implications for a case study. *Teaching Science*, 53(2), 20–23.
- Depaepe, F., & König, J. (2018). General pedagogical knowledge, self-efficacy and instructional practice: Disentangling their relationship in pre-service teacher education. *Teaching and Teacher Education*, 69, 177–190. doi: <https://doi.org/10.1016/j.tate.2017.10.003>
- Dibapile, W. T. S. (2012) A review of literature on teacher efficacy and classroom management. *Journal of College Teaching & Learning*, 9(2), 79–91.
- Dingwall, R. (2012). How did we ever get into this mess? The rise of ethical regulation in the social sciences. In K. Love (Ed.), *Ethics in social research* (pp. 3–26). Bingley, England: Emerald.
- DiStefano, C., & Motl, R. W. (2006). Further investigating method effects associated with negatively worded items on self-report surveys. *Structural Equation Modeling-a Multidisciplinary Journal*, 13(3), 440–464. doi: 10.1207/s15328007sem1303_6
- Dixson, D. D. & Worrell, F. C. (2016). Formative and summative assessment in the classroom. *Theory Into Practice*, 55(2), 153–159.
- Dodeen, H., Abdelfattah, F., Shumrani, S. & Abu Hilal, M. (2012). The effects of teachers' qualifications, practices, and perceptions on student achievement in TIMSS

- mathematics: A comparison of two countries. *International Journal of Testing*, 12(1), 61–77.
- Drake, C., & Sherin, M. G. (2006). Practicing change: Curriculum adaptation and teacher narrative in the context of mathematics education reform. *Curriculum Inquiry*, 36(2), 153–187.
- Duffy, B., Smith, K., Terhanian, G., & Bremer, J. (2005). Comparing data from online and face-to-face surveys. *International Journal of Market Research*, 47(6), 615–639.
doi:10.1177/147078530504700602
- Eckert, S. A. (2013). What do teaching qualifications mean in urban schools? A mixed-methods study of teacher preparation and qualification. *Journal of Teacher Education*, 64(1), 75–89. doi: doi: 10.1177/0022487112460279
- Ekici, G. (2012a). Responsibility perception scale of teachers' for student achievement: the adaptation into Turkish, validity and reliability study. *Contemporary Education Journal*, 1(2), 23–35.
- Ekici, G. (2012b, June). *Effects of gender and experiences on biology teachers' responsibility beliefs of students' academic success*. Paper presented at 10th National Science and Mathematics Congress, Nigde University, Nigde, Turkey.
- Ell, F., & Grudnoff, L. (2012). The politics of responsibility: Teacher education and persistent underachievement in New Zealand. *The Educational Forum*, 77(1), 73–86.
doi: 10.1080/00131725.2013.739023

- El-Maghraby, H. (2011). *Quality Assurance in Newly Established Universities in Saudi Arabia*. AlJouf University, 1–9. Retrieved from http://www.anqahe.org/files/abu_dhabi_2011/FullPapers/Hussein_Maghraby.pdf
- Elyas, T. (2008). The attitude and the impact of the American English as a global language within the Saudi education system. *Novitas-ROYAL*, 2(1), 28–48.
- Evers, W. M., & Walberg, H. J. (2002). *School accountability*. Stanford: Hoover Institution Press.
- Feiman-Nemser, S. (2001). From preparation to practice: Designing a continuum to strengthen and sustain teaching. *Teachers College Record*, 103(6), 42.
- Fennema, E., & Franke, M. L. (1992). Teachers' knowledge and its impact. In D. A. Groews (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 147–164). New York: Macmillan.
- Fenstermacher, G. D., & Richardson, V. (2005). On making determinations of quality in teaching. *Teachers College Record*, 107(1), 186–213.
- Firestone, W. A. (1987). Meaning in method: The rhetoric of quantitative and qualitative research. *Educational Researcher*, 16(7), 16–21.
- Fives, H., & Buehl, M. M. (2014). Exploring differences in practicing teachers' valuing of pedagogical knowledge based on teaching ability beliefs. *Journal of Teacher Education*, 65(5) 435–448. doi:10.1177/0022487114541813
- Fives, H., & Buehl, M. M. (2008). What do teachers believe? Developing a framework for examining beliefs about teachers' knowledge and ability. *Contemporary Educational Psychology*, 33(2), 134–176. doi:10.1016/j.cedpsych.2008.01.001

- Flake, M. W. (2014). *An investigation of how preservice teachers ability to professionally notice children's mathematical thinking relates to their own mathematical knowledge for teaching*. (Doctoral dissertation, University of Kansas). Retrieved from <http://hdl.handle.net/1808/15149>
- Flegg, N., Mohamed, K., & Trimmer, K. (2013). *Synthesising the literature concerning math anxiety to inform a project on pre-service teacher retention rates*. Proceedings of the 3rd Advancing the STEM Agenda Conference (pp. 1–13). Grand Rapids, Michigan: ASQ Advancing the STEM Agenda. Retrieved from <http://rube.asq.org/edu/2013/04/best-practices/synthesizing-the-literatureconcerning-the-math-anxiety-to-inform-a-project-on-pre-service-teacher-retentionrates.pdf>
- Flyvbjerg, B. (2004). Five misunderstanding about case-study. In C. Seale, G. Gobo, J. Gubrium & D. Silverman (Eds.), *Qualitative Research Practice* (pp. 420–434). Thousands Oaks. CA: Sage.
- Franke, L. M., Kazemi, E., & Battey, D. (2007). Understanding teaching and classroom practice in mathematics. In F. K. Lester (Ed.), *Second handbook of research on mathematics teaching and learning: A project of the National Council of Teachers of Mathematics* (pp. 225–257). Charlotte, NC: Information Age Publishing.
- Furlong, J. (2015). *Tomorrow's teachers. Options for the future of initial teacher eudcation in Wales*. Oxford, England: University of Oxford.
- Gay, L. R., Mills, G. E., & Airasian, P. (2009). *Education research competencies for analysis and application*. New Jersey: Pearson Education.

- Gerber, L. N., (2012). *The effects of a model developmental mathematics program on elementary and middle school pre-service teachers*. Retrieved from <https://digital.library.txstate.edu/handle/10877/4418>
- Ghousseini, H., & Herbst, P. (2014). Pedagogies of practice and opportunities to learn about classroom mathematics discussions. *Journal of Mathematics Teacher Education* 19(1), 79–103. <http://doi.org/10.1007/s10857-014-9296-1>
- Giallo, R., & Little, E. (2003). Classroom behaviour problems: The relationship between preparedness, classroom experiences, and self-efficacy in graduate and student teachers. *Australian Journal of Educational & Developmental Psychology*, 3(1), 21–34.
- Gibson, S., & Dembo, M. (1984). Teacher efficacy: A construct validation. *Journal of Educational Psychology*, 76(4), 569–582. doi:10.1037/0022-0663.76.4.569
- Gill, L. & Dalgarno, B. (2008). Influences on pre-service teachers' preparedness to use ICTs in the classroom. In R. Atkinson & C. McBeath (Eds.), *Proceedings of the 25th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education* (pp. 330–339). Melbourne, Australia: Deakin University.
- Giovacco-Johnson, T. (2005). I just don't feel like a teacher: Struggling to figure out the first year as an early childhood special educator. *Journal of Early Childhood Teacher Education*, 26(2), 99-113.
- Goddard, R. D., Hoy, W. K., & Woolfolk Hoy, A. (2004). Collective efficacy beliefs: Theoretical developments, empirical evidence, and future directions. *Educational Researcher*, 33(3), 3-13.

- Goe, L., & Stickler, L. (2008). *Teacher quality and student achievement: Making the most recent research* (TQ Research and Policy Brief). Washington, DC: National Comprehensive Center for Teacher Quality. Retrieved from <http://www.tqsource.org/publications/March2008Brief.pdf>
- Goldhaber, D. (2006, April). *Everybody's doing it, but what does teacher testing tell us about teacher effectiveness?* Paper presented at the American Educational Research Association (AERA) annual meeting. San Francisco, California.
- Goldhaber, D. D., & Brewer, D. J. (2000). Does teacher certification matter? High school teacher certification status and student achievement. *Educational Evaluation and Policy Analysis*, 22(2), 129–45.
- Goodwin, A. L. (2002). The social/political construction of low teacher expectations for children of color: Re-examining the achievement gap. *Journal of Thought*, 37(4), 83–103.
- Goodwin, A. L. (2010). Globalization and the preparation of quality teachers: Rethinking knowledge domains for teaching. *Teaching Education*, 21(1), 19–32, doi: 10.1080/10476210903466901
- Gowrie, G., & Ramdass, M. (2012). Pre-service beginning teachers' beliefs, expectations and other teacher preparation issues of the practicum at the University of Trinidad and Tobago. *International Journal of Higher Education*, 1(2), 184–197.
- Gravett, S., & Ramsaroop, S. (2015). Bridging theory and practice in teacher education: Teaching schools—a bridge too far? *Perspectives in Education*, 33(1), 131–146.

- Greenberg, J., & Walsh, K. (2008). *No common denominator: The preparation of elementary teachers in mathematics by America's education schools*. Washington, DC: National Council on Teacher Quality. Retrieved from https://www.nctq.org/dmsView/No_Common_Denominator_NCTQ_Report
- Grix, J. (2004). *The Foundations of Research*. London, England: Palgrave Macmillan.
- Grootenboer, P. (2008). Mathematical belief change in prospective primary teachers. *Journal of Mathematics Teacher Education*, 11(6), 479–497.
- Grossman, P. L. (1990). *The making of a teacher: Teacher knowledge and teacher education*. New York: Teachers College Press, Teachers College, Columbia University.
- Grossman, P. L. (1991). Overcoming the apprenticeship of observation in teacher education coursework. *Teaching and Teacher Education*, 7(4), 345–357. doi: 10.1016/0742-051x(91)90004-9
- Grossman, P., & McDonald, M. (2008). Back to the future: Directions for research in teaching and teacher education. *American Educational Research Journal*, 45(1), 184–205.
- Grossman, P., Hammerness, K., & McDonald, M. (2009). Redefining teaching, re-imagining teacher education. *Teachers and Teaching: Theory and Practice*, 15(2), 273–289.
- Grudnoff, L. & B. Tuck (2002, September). *Becoming a teacher: Reflections on the professional development of new teachers and the implications for initial teacher education*. Paper Presented to the British Educational Research Association. Exeter, England.

- Guskey, T. R. (1987). Context variables that affect measures of teacher efficacy. *Journal of Educational Research*, 81(1), 41–47.
- Gutiérrez, R. (2013). Why (Urban) mathematics teachers need political knowledge. *Journal of Urban Mathematics Education December*, 6(2), 7–19.
- Gutkin, T. B., & Reynolds, C. R. (1990). *The handbook of school psychology*. New York: John Wiley & Sons.
- Guyton, E., & McIntyre, D. J. (1990). Student teaching and school experiences. In W. R. Houston (Ed.), *Handbook of research on teacher education* (pp. 514-534). New York: Macmillan.
- Haigh, M. A., & Anthony, G. J. (2010). Induction and efficacy: A case study of New Zealand newly qualified secondary science teachers. *Journal of Science Teacher Education*, 23(6), 651–671. doi 10.1007/s10972-012-9285-0
- Harlow, A., Cooper, B., & Cowie, B. (2014). *Collaborative university school partnerships research brief: Hamilton– The first-year practicum experience, 2013*. Retrieved from <http://www.waikato.ac.nz/wmier/research/projects/collaborative-university-school-partnerships/>
- Harris, D., & McCaffrey, D. (2010). Value-added: Assessing teachers contributions to student achievement. In M. M. Kennedy (Ed.), *Teacher assessment and the quest for teacher quality: A handbook* (pp. 251–282). San Francisco, CA: Jossey-Bass.
- Hattie, J. A. C. (2012). *Visible learning for teachers. Maximizing impact on achievement*. Oxford, England: Routledge.

- Heinze, A., Lindmeier, A., & Dreher, A. (2015, December). *Teachers' mathematical content knowledge in the field of tension between academic and school mathematics*. Paper presented at the meeting of Kompetenzzentrum HochschulDidaktik mathematic, Hannover, Germany.
- Hemmi, K., & Ryve, A. (2014). Effective mathematics teaching in Finnish and Swedish teacher education discourses. *Journal of Mathematics Teacher Education*. doi: 10.1007/s10857-014-9293-4
- Hemmings, B., Grootenboer, P., & Kay, R. (2010). Predicting mathematics achievement: the influence of prior achievement and attitudes. *International Journal of Science and Mathematics Education*, 9(3), 691–705.
- Henry, G. T., Patterson, K., Campbell, S., & Yi, P. (2013). *UNC teacher quality research: 2013 teacher preparation program effectiveness report*. Chapel Hill, NC: Education Policy Initiative at Carolina. Retrieved from https://publicpolicy.unc.edu/files/2013/11/UNC_TQR_OverallProgramReport_Final.pdf
- Henry, G. T., Bastian, K. C., & Smith, A. A. (2012). Scholarships to recruit the “best and brightest” into teaching who is recruited, where do they teach, how effective are they, and how long do they stay? *Educational Researcher*, 41(3), 83–92.
- Henson, R., Kogan, L., & Vacha-Haase, T. (2001). A reliability generalization study of the teacher efficacy scale and related instruments. *Educational and Psychological Measurement*, 61(3), 404–420. doi:10.1177/00131640121971284
- Hickey, R., Whitehouse, H., & Evans, S. (2010, November). *Preservice teachers' perceptions of sustainability as professional practice*. Paper presented at the annual

conference of the Australian Association for Research in Education, Melbourne, Vic, Australia.

Hiebert, J., & Stigler, J. (2009). Closing the teaching gap. *Phi Delta Kappan*, 91(3), 5.

Hill, H. C., Blunk, M. L., Charalambous, C. Y., Lewis, J. M., Phelps, G. C., Sleep, L., Ball, D. L. (2008). Mathematical knowledge for teaching and the mathematical quality of instruction: An exploratory study. *Cognition and Instruction*, 26(4), 430 –511.

Hill, H. C., Rowan, B., & Ball, D. H. (2005) Effects of teachers' mathematical knowledge for teaching on student achievement. *American Educational Research Journal*, 42(2), 371–406.

Hine, G. S. C. (2015). Strengthening pre-service teachers' mathematical content knowledge. In *Teaching and learning uncapped. Proceedings of the 24th Annual Teaching Learning Forum*. Perth, Australia: The University of Western Australia. Retrieved from <https://clt.curtin.edu.au/events/conferences/tlf/tlf2015/refereed/hine.pdf>

Hirschheim, R. (1985). *Information systems epistemology: An historical perspective*. In R. Galliers (Ed.), *Proceedings of the IFIP WG 8.2. Working Conference on Information Systems Research: Issues, Methods and Practical Guidelines* (pp. 28-60). London: Blackweel Scientific Publications.

Hittleman, D. R., & Simon, A. J. (2006). *Interpreting educational research: An introduction for consumers of research*, (4th ed.). Upper Saddle River, NJ: Prentice-Hall.

Hlas, A. C., & Hlas, C. S. (2012). A Review of high-leverage teaching practices: Making connections between mathematics and Foreign languages. *Foreign Language Annals*, 45(s1), s76–s97. doi: 10.1111/j.1944-9720.2012.01180.x

- Hobson, A.J., Malderez, A., Tracey, L., Homer, M.S., Ashby, P., Mitchell, N., ... Tomlinson, P.D. (2009). *Becoming a teacher: Teacher experiences of initial teacher training, induction and early professional development* (Report No. DCSF-RR115). Retrieved from <http://dera.ioe.ac.uk/11168/1/DCSF-RR115.pdf>
- Hogan, A. S. B. (2011). *Preservice teacher preparedness: Deficiencies and strengths*. (Doctoral dissertation Capella University, Minneapolis, Minnesota). Retrieved from <http://pqdtopen.proquest.com/#viewpdf?dispub=3465883>
- House of Representatives Standing Committee on Educational and Vocational Training (HRSCEVT). (2007). *Top of the class: Report on the inquiry into teacher education*. Canberra, Australia: The Parliament of the Commonwealth of Australia.
- Housego, B. E. J. (1990). Student teachers' feelings of preparedness to teach. *Canadian Journal of Education*, 15(1), 37–56.
- Housego, B. E. J. (1994). How prepared were you to teach? Beginning teachers assess their preparedness. *Alberta Journal of Educational Research*, XL(3), 355–373.
- Housego, B., & Badali, S. (1996). One year later: Beginning teachers revisit their preparation program experiences. *Alberta Journal of Educational Research*, XLII(4), 378–394.
- Hoy, A. W. (2000, April). *Changes in teacher efficacy during the early years of teaching*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.
- Hoy, A. W., & Spero, R. B. (2005). Changes in teacher efficacy during the early years of teaching: A comparison of four measures. *Teaching and Teacher Education*, 21(4), 343–356. doi:10.1016/j.tate.2005.01.007.

- Hudson, P. (2007). Benchmarking preservice teachers' perceptions of their mentoring for developing mathematics teaching practices. In J. Watson., & K. Beswick (Eds.), *Proceedings of the 30th annual conference of the Mathematics Education Research Group of Australasia* (pp. 412-420). Hobart, TAS: MERGA.
- Hudson, S. (2009). Preservice teachers' perceptions of their middle schooling teacher preparation. *International Journal of Learning*, 16(1), 1–12.
- Hudson, S. (2011). Preservice teachers' perceptions of their middle schooling preparation: A sample of the Australian context. (Doctoral dissertation, Southern Cross University, Lismore, NSW). Retrieved from <https://epubs.scu.edu.au/cgi/viewcontent.cgi?article=1282&context=theses>
- Hufferd-Ackles, K., Fuson, K. C., & Sherin, M. G. (2004). Describing levels and components of a math-talk learning community. *Journal for Research in Mathematics Education*, 35(2), 81–116.
- Hunter, J., Anthony, G., & Hunter, R. (2015). Exploring and critiquing practice-based approaches in teacher education *Mathematics Teacher Education & Development*, 17(2), 1–6.
- Hutchinson, L. (1997). *Learning for teaching: A case of constructing the bridge between subject matter knowledge and pedagogical content knowledge* (Research Report). Laramie, Wyoming: University of Wyoming.
- Ingvarson, L. (2012). Standards for graduation and initial teacher certification: The international experience. *Australian Council for Educational Research*. Retrieved from http://works.bepress.com/lawrence_ingvarson1/206

- Ingvarson, L. (2013). Standards for beginning teachers. *Research Developments, Australian Council for Educational Research*. Retrieved from <http://rd.acer.edu.au/article/standards-for-beginning-teachers>
- Ingvarson, L., Meiers, M. & Beavis, A. (2005). Factors affecting the impact of professional development programs on teachers' knowledge, practice, student outcomes & efficacy. *Education Policy Analysis Archives*, 13(10), 1–28. Retrieved from <http://epaa.asu.edu/epaa/v13n10/>.
- Jackson, C., & Povey, H. (2014). Intimations of class in responses to innovative mathematics pedagogy in initial teacher education. In A. Rogerson (Ed.), *Proceedings of the 12th International Conference of the Mathematics Education into the 21st Century Project*. Herceg Novi, Montenegro: Mathematics Education for the Future.
- Jamieson-Proctor, R., & Finger, G. (2006). Relationship between preservice and practising teachers confidence and beliefs about using ICT. *Australian Educational Computing*, 21(2), 25–33.
- Johnson, B., & Christensen, L. B. (2012). *Educational research: Quantitative, qualitative, and mixed approaches*: Thousand Oaks, California: Sage Publications.
- Johnson, L. E., & Reiman, A. J. (2007). Beginning teacher disposition: Examining the moral/ethical domain. *Teaching and Teacher Education*, 23(5), 676–687.
doi:10.1016/j.tate.2006.12.006
- Johnson, R. B., Onwuegbuzie, A. J. & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, 1(2), 112–133.

- Johnson, R., & Onwuegbuzie, A. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14–26.
- Jones, A. F. (1998). *A comparison of perceptions of preparedness in teacher education* (Unpublished doctoral dissertation). Tennessee State University, Nashville, Tennessee.
- Jordan, M. E. (2016). Teaching as designing: Preparing pre-service teachers for adaptive teaching. *Theory into Practice*, 55(3), 197–206.
- Kafa, A. (2009, May). *The role of the educational curricula for establishing security of intellectual "curriculum of uniformity in high school in Saudi Arabia case study*. Paper presented at the First national security conference "concepts and challenges", Riyadh, Saudi Arabia.
- Kajander, A. (2007). Unpacking mathematics for teaching: A study of preservice elementary teachers' evolving mathematical understandings and beliefs. *Journal of Teaching and Learning*, 5(1), 33–54.
- Kajander, A. (2010). Elementary mathematics teacher preparation in an era of reform: The development and assessment of mathematics for teaching. *Canadian Journal of Education*, 33(1), 228–255.
- Kane, R. G., & Fontaine, S. (2008). How prepared are New Zealand secondary teachers? Results from a national graduate survey. *New Zealand Journal of Educational Studies (NZJES)*, 43(2), 29–46.
- Katz, L., & Rath, J. D. (1985). Dispositions as goals for teacher education. *Teaching and Teacher Education*, 1(4), 301–307.

- Kazemi, E., Franke, M., & Lampert, M. (2009). *Developing pedagogies in teacher education to support novice teachers' ability to enact ambitious instruction*. In R. Hunter, B. Bicknell, & T. Burgess (Eds.), *Proceedings of the 32nd annual conference of the Mathematics Education Research Group of Australasia* (pp. 11-29). Palmerston North, New Zealand: MERGA.
- Kee, A. N. (2012). Feelings of preparedness among alternatively certified teachers: What is the role of program features? *Journal of Teacher Education*, 63(1), 23–38.
- Kellner, P. (2004). Can online polls produce accurate findings? *International Journal of Market Research*, 46(1), 3–22. doi:10.1177/147078530404600102
- Kennedy, K. & Archambault, L. (2012). Offering pre-service teachers field experiences in K-12 online learning: A national survey of teacher education programs. *Journal of Teacher Education*, 63(3), 185–200.
- Kennedy, M. M. (2008). Sorting out teacher quality. *Phi Delta Kappan*, 90(1), 59–63.
- Kessell, J., Wingenbach, G., & Lawver, D. (2006, March). *Student teachers' confidence in teaching special needs students in agricultural education*. Paper presented at the meeting of the American Association for Agriculture Education, Charlotte, NC.
- Khashan, D. K. (2014). Conceptual and procedural knowledge of rational numbers for Riyadh elementary school teachers. *Journal of Education and Human Development*, 3(4), 181–197. doi:10.15640/jehd.v3n4a17
- Khoury-Kassabri, M. (2012). The relationship between teacher self-efficacy and violence toward students as mediated by teacher's attitude. *Social Work Research*, 36(2), 127–139. doi:10.1093/swr/svs004

- Kieffer, K. M., & Henson, R. K. (2000, April). *Development and validation of the sources of self-efficacy inventory (SOSI): Exploring a new measure of teacher efficacy*. Paper presented at the annual meeting of the National Council on Measurement in Education, New Orleans, LA.
- Kilic, H. (2011). Preservice secondary mathematics teachers' knowledge of students. *Turkish Online Journal of Qualitative Inquiry*, 2(2) 17–35.
- Knight, S. L., Lloyd, G. M., Arbaugh, F., Gamson, D., McDonald, S. P., Nolan, J., & Whitney, A. E. (2015). Reconceptualizing teacher quality to inform preservice and inservice professional development. *Journal of Teacher Education*, 66(2), 105–108. doi: 10.1177/0022487115570564
- Knoblauch, D., & Woolfolk Hoy, A. (2008). Maybe I can teach *those* kids: The influence of contextual factors on student teachers' sense of efficacy. *Teaching and Teacher Education*, 24(1), 166–179.
- Koehler, A., Feldhaus, C. R., Fernandez, E., & Hundley, S. P. (2013). Alternative certification programs and pre-service teacher preparedness. *Journal of STEM Education: Innovations and Research*, 14(4), 45–55.
- Kraut, N. J. (2013). *What it means to feel prepared to teach: A mixed methods* (Unpublished doctoral dissertation). North Carolina State, Raleigh, North Carolina.
- Kretchmar, K., & Zeichner, K. (2016). Teacher prep 3.0: A vision for teacher education to impact social transformation. *Journal of Education for Teaching*, 42(4), 417–433.
- Krosnick, J. A. (1999). Survey research. *Annual Review of Psychology*, 50(1), 537–567. doi: 10.1146/annurev.psych.50.1.537

- Kurt, H. (2013). The analyze of teachers' responsibility beliefs for student academic successes and failures (The sample of Turkish biology teachers). *International Online Journal of Educational Sciences*, 5(2), 314–329.
- LaBoskey, V. K., & Richert, A. E. (2002). Identifying good student teaching placements: A programmatic perspective. *Teacher Education Quarterly*, 29(2), 7–34.
- Lampert, M. (2010). Learning teaching in, from, and for practice: What do we mean? *Journal of Teacher Education*, 61(1–2), 21–34.
- Lane, J., Lane, A. M., & Kyprianou, A. (2004). Self-efficacy, self-esteem and their impact on academic performance. *Social Behavior and Personality*, 32(1), 247–256.
- Lang, C. (1996). *Preparedness for teaching: Beginning teachers' experiences during their first year of teaching* (Unpublished master dissertation). University of Waikato, Hamilton, New Zealand.
- Langham, B., Sundberg, S., & Goodman, T. (2006). Developing algebraic thinking: An academy model for professional development. *Mathematics Teaching in the Middle School*, 11(7), 318–323.
- Lauermann, F., & Karabenick, S. A. (2013). The meaning and measure of teachers' sense of responsibility for educational outcomes. *Teaching and Teacher Education*, 30(0), 13–26. doi: <http://dx.doi.org/10.1016/j.tate.2012.10.001>
- Lavy, I., & Shriki, A. (2008). Investigating changes in prospective teachers' views of a 'good teacher' while engaging in computerized project-based learning. *Journal of Mathematics Teacher Education*, 11(4), 259–284. doi:10.1007/s10857-008-9073-0

- Lazarides, R., Buchholz, J., & Rubach, C. (2018). Teacher enthusiasm and self-efficacy, student-perceived mastery goal orientation, and student motivation in mathematics classrooms. *Teaching and Teacher Education*, 69, 1–10. doi: <https://doi.org/10.1016/j.tate.2017.08.017>
- Le Cornu, R., & Ewing, R. (2008). Reconceptualising professional experiences in pre-service teacher education reconstructing the past to embrace the future teacher and teacher education. *Teaching and Teacher Education*, 24(7), 1799–1812.
- LeCompte, M.D., & Schensul, J.J. (1999). Analyzing and interpreting ethnographic data. Walnut Creek, CA: Altamira Press, a division of Sage Publications.
- Leong, K. E. (2012). Good mathematics teaching: Perspectives of beginning secondary teachers (Unpublished doctoral dissertation). Columbia University, New York City, NY.
- Lerman, S. (2006). Review of new teacher identity and regulative government: The discursive formation of primary mathematics teacher education. *Journal of Mathematics Teacher Education*, 9(3), 299–305.
- Leung, C., Wong, B. K., & Wong, J. (2013). Conceptions of leaning in pre-service and in-service early childhood education students and the impact of teaching experience. *Australasian Journal of Early Childhood*, 38(3), 57–67.
- Levine, A. (2006). *Educating School Teachers*. Washington, D.C.: The Education Schools Project.

- Levine, M. (2009). *Preparing high quality teachers for high needs schools: Investing in clinical education and partnerships*. Washington, DC: National Council for Accreditation of Teacher Education
- Li, Y. (2011). Elementary teachers' thinking about good mathematics lesson. *International Journal of Science and Mathematics Education*, 9(4), 949–973.
- Lim, W. (2011). *An evaluation of a 4 – 8 mathematics teacher preparation program at a large state institution in Texas* (Unpublished doctoral dissertation). University of Houston, Houston, Texas.
- Lin, H.-L., & Gorrell, J. (2001). Exploratory analysis of pre-service teacher efficacy in Taiwan. *Teaching and Teacher Education*, 17(5), 623–635. doi: [http://dx.doi.org/10.1016/S0742-051X\(01\)00018-X](http://dx.doi.org/10.1016/S0742-051X(01)00018-X)
- Lin, H., Gorrell, J. & Taylor, J. (2002). Influence of culture and education on U.S. and Taiwan pre-service teachers' efficacy beliefs. *The Journal of Educational Research*, 96(1), 37–46.
- Lortie, D. (1975). *Schoolteacher: A sociological study*. Chicago: The University of Chicago Press.
- Lotan, R. A., & Marcus, A. (2002). Standards-based assessment of teacher candidates' performance in clinical practice. *Issues in Teacher Education*, 11(1), 31–47
- Luciano Beltramo, J. (2017). Developing adaptive teaching practices through participation in cogenerative dialogues. *Teaching and Teacher Education*, 63, 326–337. doi: <https://doi.org/10.1016/j.tate.2017.01.007>

- Ma, L. (1999). *Knowing and teaching elementary mathematics* (shelf Ed.). Mahwah, NJ: Lawrence Erlbaum Associates.
- Ma, X., Millman, R., & Wells, M. (2008). Infusing assessment into mathematics content courses for pre-service elementary school teachers. *Educational Research of Policy and Practice*, 7(3), 165–181.
- MacDonald, J., Whatman, J., & Stevens, L. (2016). *2015 Annual evaluation report for the Teach First NZ programme pilot delivered in partnership with the University of Auckland*. Wellington, New Zealand: Wellington Ministry of Education.
- Mack, L. (2010). The philosophical underpinnings of educational research. *Polyglossia*, 19, 5–11.
- Mapolelo, D. C., & Akinsola, M. K. (2015). Preparation of mathematics teachers: Lessons from review of literature on teachers' knowledge, beliefs, and teacher education. *American Journal of Educational Research*, 3(4), 505–513. doi: 10.12691/education-3-4-18
- Marsh, H. W., Abdeljabbar, A. S., Parker, P. D., Morin, A. J. S., Abdelfattah, F., & Nagengast, B. (2014). The big-fish-little-pond effect in mathematics: A cross-cultural comparison of U.S. and Saudi Arabian TIMSS responses. *Journal of Cross-Cultural Psychology*, 45(5), 777–804. doi:10.1177/0022022113519858
- Marshall, J., & Smith, J. (1997). Teaching as we're taught: The university role in the education of English teachers. *English Education*, 29(4), 246–268.
- Martin, D. B. (2015). The collective Black and principles to actions. *Journal of Urban Mathematics Education*, 8(1), 17–23.

- Martin, R., & Van Gunten, D. (2002). Reflected identities: Applying positionally and multicultural social reconstructionism in teacher education. *Journal of Teacher Education*, 53(1), 44–54.
- Marzano, R. & Toth, M. (2013). *Teacher evaluation that makes a difference: A new model for teacher growth and student achievement*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Masters, G. N. (2009). *A shared challenge: Improving literacy, numeracy and science learning in Queensland schools*. Retrieved from: Australian Council for Educational Research website: <http://education.qld.gov.au/mastersreview/pdfs/final-report-masters.pdf>
- Maurer, T. J. (2001) Career-relevant learning and development, worker age, and beliefs about self-efficacy for development. *Journal of Management* 27(2), 123–140.
- Maxwell, J. A., & Mittapalli, K. (2010). Realism as a stance for mixed methods research. In A. Tashakkori & C. Teddlie (Eds.), *SAGE handbook of mixed methods social and behavioral research* (2nd ed., pp. 145–167). Thousand Oaks, CA: Sage.
- Mayer, D. (2014). Forty years of teacher education in Australia: 1974–2014. *Journal of Education for Teaching*, 40(5), 461–473. doi: 10.1080/02607476.2014.956536
- McCoy, A. C. (2011). *Specialized mathematical content knowledge of preservice elementary teachers: The effect of mathematics teacher efficacy* (Unpublished doctoral dissertation). University of Missouri, Kansas City, MO.

- McCray, J., & Chen, J-Q. (2012). Pedagogical content knowledge for preschool mathematics: Construct validity of a new teacher interview. *Journal of Research in Childhood Education*, 26(3), 291–307.
- McDonald, M., Kazemi, E., & Kavanagh, S. S. (2013). Core practices and pedagogies of teacher education: A call for a common language and collective activity. *Journal of Teacher Education*, 64(5), 378–386.
- McDonald, M., Kazemi, E., Kelley-Petersen, M., Mikolasy, K., Thompson, J., Valencia, S. W., & Windschitl, M. (2014). Practice makes practice: Learning to teach in teacher education. *Peabody Journal of Education*, 89(4), 500–515.
- McGlamery, S., & Shillingstad, S. (2017) Learning to assess student understanding through formative and summative assessment. *Journal of Curriculum, Teaching, Learning and Leadership in Education*, 2(1), 11–20.
- McIntyre, D. (1995). Initial teacher education as practical theorising: A response to Paul Hirst. *British Journal of Educational Studies*, XXXIII(4), 365–383.
- McLean Davies, L. (2017). *Clinical teaching in education. MESH Guide, 2017*. Retrieved from <http://www.meshguides.org/guides/node/593>
- McMurray, A., Pace, W., & Scott, D. (2006). *Research: A commonsense approach*. Southbank, VIC: Thomson Learning.
- Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). San Francisco, CA: Jossey-Bass.
- Ministry of Education. (2000). *A report of the developing teaching strategies project*. Riyadh, Saudi Arabia: Public administration of educational supervisors.

- Mitchell, N., Marsh, B., Hobson, A. J., & Sorensen, P. (2010). Bringing theory to life: findings from an evaluation of the use of interactive video within an initial teacher preparation programme. *Teacher Development: An international journal of teachers' professional development*, 14(1), 15–27. doi:10.1080/13664531003696543
- Mohd, N., Mahmood, T. F. P. T., & Ismail, M. N. (2011). Factors that influence students in mathematics achievement. *International Journal of Academic Research*, 3(3), 49–54.
- Moore-Hayes, C. (2008). *Teacher-efficacy exploring preservice and beginning teachers' perceptions of preparedness to teach* (Unpublished doctoral dissertation). Capella University, Minneapolis, Minnesota.
- Morris, D. B. (2010). *Sources of teaching self-efficacy: A scale validation* (Unpublished doctoral dissertation). Emory University, Atlanta, Georgia.
- Murphy, C., Neil, P., & Beggs, J. (2007). Primary science teacher confidence. *Educational Research*, 49(4), 415–430.
- Murray, E., & Star, J. R. (2013). What do secondary preservice mathematics teachers need to know? Content courses connecting secondary and tertiary mathematics. *Notices of the American Mathematical Society*, 60(10), 1297–1299.
- Myers, M. D. (1997). Qualitative research in information systems. *Management Information Systems Quarterly*, 21(2), 241–243.
- Nasir, S. M., & Safran, N. A. (2014). An assessment to analyze pre-service teachers' perceptions of teacher efficacy. *International Journal of Education and Research*, 2(4), 209–222.

National Center for Assessment in Higher Education. (2017). *Mathematics Teacher Handbook – Intermediate and Secondary School*. Retrieved from <http://qiyas.sa/ar/Exams/profession/Documents/%D8%AF%D9%84%D9%8A%D9%84%20%D8%B1%D9%8A%D8%A7%D8%B6%D9%8A%D8%A7%D8%AA%20%D9%85%D8%AA%D9%88%D8%B3%D8%B7%20%D8%AB%D8%A7%D9%86%D9%88%D9%8A1439.pdf>

National Center for Assessment in Higher Education. (2018). *Teacher Test*. Retrieved from <http://qiyas.sa/ar/exams/profession/teachers/Pages/default.aspx>

National Commission for Academic Accreditation and Assessment (NCAAA). (2013). *Standards for Quality Assurance and Accreditation of Higher Education Institutions*. Retrieved from http://abraima.com/wp-content/uploads/2016/10/12-StandardsforHEdPrograms_-Final-2013.pdf

National Council for Accreditation of Teacher Education (NCATE). (2006). *What makes a teacher effective? A summary of key research findings on teacher preparation*. Washington, DC: Author. Retrieved from <http://www.ncate.org/documents/resources/teacherEffective.pdf>

National Council for the Accreditation of Teacher Education. (2010). *Transforming teacher education through clinical practice: A national strategy to prepare effective teachers. A report of the Blue Ribbon Panel on Clinical Preparation and Partnership for Improved Student Learning*. Washington, DC: NCATE.

National Council of Teachers of English (NCTE). (2006) *Guidelines for the preparation of teachers of English language arts*. Urbana, IL: NCTE. Retrieved from

http://www.ncte.org/library/NCTEFiles/Groups/CEE/NCATE/Guidelines_for_Teacher_Prep_2006.pdf

National Council of Teachers of Mathematics. (2014). *Principles to actions: Ensuring mathematical success for all*. Reston, VA: NCTM.

National Mathematics Advisory Panel (2008). *Foundations for success: The final report of the national mathematics advisory panel*. Washington, D.C.: U.S. Department of Education.

Neuman, W. L. (2006). *Social research methods: Qualitative and quantitative approaches*. Boston: Pearson Education.

New Zealand Teachers Council. (2007). *Graduating teacher standards: Aotearoa New Zealand*. Wellington, New Zealand: New Zealand Teacher Council - Te Pouherenga Kaiako o Aotearoa.

Ng'eno, J., Githua, B., & Changeiywo, J. (2013). Teachers' perceptions of their preparedness to integrate information communication and technology in secondary school mathematics instruction in Rift Valley Region, Kenya. *Journal of Education and Practice*, 4(12), 51-57.

Nolan, K. (2012). Dispositions in the field: Viewing mathematics teacher education through the lens of Bourdieu's social field theory. *Educational Studies in Mathematics*, 80(1-2), 201-215.

Novick, G. (2008). Is there a bias against telephone interviews in qualitative research? *Research in Nursing & Health*, 2008, 31(4), 391-398.

- O'Connor, H. (2006) Online Interviews. Section 2: Exploring online research methods. Project Website, ESRC and University of Leicester.
- O'Neill, J., Hansen, S., & Lewis, E. (2014). *Dispositions to teach: Review and synthesis of current components and applications, and evidence of impact* (Report to the Schooling Policy Group). Wellington, New Zealand: Ministry of Education. Retrieved from <https://www.education.govt.nz/assets/Uploads/DispositionsReportFinal100914.pdf>
- O'Neill, S., & Stephenson, J. (2012a). Exploring Australian pre-service teachers' sense of efficacy, its sources, and some possible influences. *Teaching and Teacher Education*, 28(4), 535–545. doi:10.1016/j.tate.2012.01.008
- O'Neill, S., & Stephenson, J. (2012b). Does classroom management coursework influence pre-service teachers' perceived preparedness or confidence? *Teaching and Teacher Education*, 28(8), 1131–1143. doi: <https://doi.org/10.1016/j.tate.2012.06.008>
- Oakes, W. P., Lane, K. L., Jenkins, A., & Booker, B. B. (2013). Three-tiered models of prevention: Teacher efficacy and burnout. *Education & Treatment of Children*, 36(4), 96–126.
- Obeikan for Research and Development. (2010). *Project of mathematics and natural sciences*. Retrieved from <http://msd-ord.com/project.htm>
- Ogden, M. A. (2012). *Effects of course experiences on self-efficacy in teaching math: a case study of preservice elementary teachers*. (Doctoral Dissertation, University of Southern California, Los Angeles, California). Retrieved from <http://digitallibrary.usc.edu/cdm/compoundobject/collection/p15799coll3/id/203899/rec/1872>

- Onwuegbuzie, A. J., & Combs, J. P. (2010). Emergent data analysis techniques in mixed methods research: A synthesis. In A. Tashakkori & C. Teddlie (Eds.), *SAGE handbook of mixed methods in social and behavioral research* (2nd ed., pp. 397-430). Thousand Oaks, CA: Sage.
- Onwuegbuzie, A. J., & Johnson, R. B. (2006). The validity issue in mixed research. *Research in the Schools*, 13(1), 48–63.
- Onwuegbuzie, A. J., & Teddlie, C. (2003). A framework for analyzing data in mixed methods research. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 351-383). Thousand Oaks, CA: Sage.
- Ord, K. A. (2010). *Bodies of knowledge: Early childhood teachers' experiences of their initial teacher education programme and sense of preparedness for teaching*. (Doctoral Dissertation, Massey University, Palmerston North, New Zealand). Retrieved from <http://hdl.handle.net/10179/2483>
- Ord, K., & Nuttall, J. (2016). Bodies of knowledge: The concept of embodiment as an alternative to theory/practice debates in the preparation of teachers. *Teaching and Teacher Education*, 60, 355-362.
- Owen, S. (2013). *Corporal punishment of children in Saudi Arabia: Briefing for the Universal Periodic Review, 17th session, 2013*. Retrieved from <https://webcache.googleusercontent.com/search?q=cache:bCvCEONvG6MJ:https://uprdoc.ohchr.org/uprweb/downloadfile.aspx%3Ffilename%3D109%26file%3DEnglishTranslation+%&cd=1&hl=ar&ct=clnk&gl=nz>
- Özgün-Koca, S. A., & Şen, A. İ. (2011). Evaluation of beliefs and attitudes of high school students. *Journal of Turkish Science Education*, 8(1), 42–60.

- Patton, M. Q. (1990). *Qualitative evaluation and research method*, (2nd ed.). Newbury, Park, CA: Sage Publications.
- Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.
- Pendergast, D., Garvis, S., & Keogh, J. (2011). Pre-service student-teacher self-efficacy beliefs: An insight into the making of teachers. *Australian Journal of Teacher Education*, 36(12), 45–58.
- Petrou, M., & Goulding, M. (2011). Conceptualising teachers' mathematical knowledge in teaching. In T. Rowland & K. Ruthven (Eds.), *Mathematical Knowledge in Teaching* (pp. 9-25). New York: Springer.
- Pietila, A. (2003). *Fulfilling the criteria for good mathematics teacher-the case of one student*. Paper presented at the Thematic Group 2, 3rd Conference of the European Research in Mathematics Education III, Bellaria, Italy. Retrieved from http://fibonacci.dm.unipi.it/~didattica/CERME3/proceedings/Groups/TG2/TG2_pietila_cerme3.pdf
- Ponte, J. & Brunheira, L. (2001). Analysing practice in preservice mathematics teacher education. *Mathematics Education Research Journal*, 3, 16–27.
- Poulou, M. (2007). Personal teaching efficacy and its sources: student teachers' perceptions. *Educational Psychology*, 27(2), 191–218. doi:10.1080/01443410601066693
- Pratt, D. (2008). Lina's letters a 9-year-old's perspective on what matters most in the classroom. *Phi Delta Kappan*, 89(7), 515–518. Retrieved from Academic Search Premier database.

- Prescott, A., & Cavanagh, M. (2006). An investigation of pre-service secondary mathematics teachers' beliefs as they begin their teacher training. In P. Grootenboer, R. Zevenbergen & M. Chinnappan (Eds.), *Proceedings of the 29th annual conference of the Mathematics Education Research Group of Australasia* (pp. 424–431). Adelaide, Australia: MERGA.
- Preston, C. (2014). *Relationships between teacher preparation and beginning teacher quality in North Carolina public universities* (Unpublished doctoral dissertation). Vanderbilt University, Nashville, TN.
- Punch, K. F. (2005). *Introduction to social research: Quantitative and qualitative approaches* (2nd ed.). London, England: Sage.
- Rice, J. K. (2003). *Teacher quality: Understanding the effectiveness of teacher attributes*. Washington, D.C.: Economic Policy Institute.
- Richards, L., & Morse, J. M. (2007). *Readme first for a user's guide to qualitative methods*. Thousand Oaks, CA: Sage.
- Rios, F., Montecinos, C., & van Olphen, M. (2007). Lessons learned from a collaborative self-study in international teacher education: Visiones, preguntas, y desafios. *Teacher Education Quarterly*, 43(1), 57–74.
- Robertson, M., & Al-Zahrani, A. (2012). Self-efficacy and ICT integration into initial teacher education in Saudi Arabia: Matching policy with practice. *Australasian Journal of Educational Technology*, 28(7), 1136–1151. doi:10.14742/ajet.793
- Roble, D. B., & Bacabac, M. A. A. (2016). Teaching proficiency and preparedness of pre-service secondary mathematics teachers: Its implications to actual practice. *American*

Journal of Educational Research, 4(16), 1184–1190. doi: 10.12691/education-4-16-10.

Rodie, P. (2011). The perceptions of beginning secondary teachers about their professional learning experiences in the Solomon Islands Context. *Waikato Journal of Education*, 17(1), 1–273.

Rosas, C., & West, M. (2011). Pre-service teachers' perception and beliefs of readiness to teach mathematics. *Current Issues in Education*, 14(1), 1–23.

Ross, J., & Bruce, C. (2007). Professional development effects on teacher efficacy: Results of a randomized field trial. *The Journal of Educational Research*, 101(1), 50–60.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs*, 80(1), 1–28.

Rowland, T., Huckstep, P., & Thwaites, A. (2005). Elementary teachers' mathematics subject knowledge: The knowledge quartet and the case of Naomi. *Journal of Mathematics Teacher Education*, 8(3), 255–281.

Ruthven, K. (2011). Using international study series and meta-analytic research syntheses to scope pedagogical development aimed at improving student attitude and achievement in school mathematics and science. *International Journal of Science and Mathematics Education*, 9, 419–458.

Sabah, S. A., Fayez, M., Alshamrani, S. M., & Mansour, N. (2014). Continuing professional development (CPD) provision for science and mathematics teachers in Saudi Arabia: Perceptions and experiences of CPD providers. *Journal of Baltic Science Education*, 13(1), 91–104.

- Santagata, R., & Yeh, C. (2014). Learning to teach mathematics and to analyze teaching effectiveness: evidence from a video-and practice-based approach. *Journal of Mathematics Teacher Education*, 17(6), 491–514.
- Sarantakos, S. (2005). *Social research* (3rd ed.). New York, NY: Palgrave MacMillan.
- Saunders, M., Lewis, P. and Thornhill, A. (2007) Research methods for business students (4th ed.). Harlow, Essex, England: Financial Times Prentice Hall.
- Schlette, R. (2006). *Differences in perception: A study of pre-service and beginning teachers* (Unpublished doctoral dissertation). University of Missouri, Columbia, Missouri.
- Schoenfeld, A. H. (2007). The complexities of assessing teacher knowledge. *Measurement: Interdisciplinary research and perspectives*, 5(2), 198 – 204.
- Schoenfeld, A. H., & Kilpatrick, K. (2008). Toward a theory of proficiency in teaching mathematics. In D. Tirosh & T. Wood (Eds.), *The international handbook of mathematics teacher education: Tools and processes in mathematics teacher education* (pp. 321 – 354). Rotterdam: Sense Publishers.
- Shannag, Q. A., Tairab, H., Dodeen, H., & Abdel-Fattah, F. (2013). Linking teachers' quality and student achievement in the Kingdom of Saudi Arabia and Singapore: The impact of teachers' background variables on student achievement. *Journal of Baltic Science Education*, 12(5), 652–655.
- Shidler, L. (2009). The impact of time spent coaching for teacher efficacy on student achievement. *Early Childhood Education Journal*, 36(4), 453–460.
- Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4–14.

- Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1–22.
- Sinclair, C., Downson, M. & Thistleson-Martin, J. (2006). Motivations and profiles of cooperating teachers: Who volunteers and why? *Teaching and Teacher Education*, 22, 263–296.
- Sinnema, C., Meyer, F., & Aitken, G. (2017). Capturing the complex, situated, and active nature of teaching through inquiry-oriented standards for teaching. *Journal of Teacher Education*, 68(1) 9–27.
- Sivri, H., & Balcı, E. (2015). Pre-service teachers' classroom management self-efficacy beliefs. *International Online Journal of Educational Sciences*, 7(4), 37–50.
- Skaalvik, E. M., & Skaalvik, S. (2010). Self-efficacy efficacy and teacher burnout: A study of relations. *Teaching and Teacher Education*, 26(4), 1059–1069.
- Skamp, K. & Mueller, A. (2001). A longitudinal study of the influences of primary and secondary school, university and practicum on student teachers' image of effective primary science practice. *International Journal of Science Education*, 23(3), 227–245.
- Smith, K., & Lev- Ari, L. (2005). The place of the practicum in pre- service teacher education: The voice of the students. *Asia- Pacific Journal of Teacher Education*, 33(3), 289–302.
- Smith, M. S., Stein, M. K. (2011). *5 practices for orchestrating productive mathematics discussions*. Reston, VA: National Council of Teachers of Mathematics.
- Solmus, T. (2004). Business life, locus of control and five factor personality model. *Turkish Psychological Bulletin*, 10 (34- 35), 196–205.

- Stockero, S. L., Rupnow, R. L., & Pascoe, A. E. (2017). Learning to notice important student mathematical thinking in complex classroom interactions. *Teaching and Teacher Education*, 63, 384–395. doi: <https://doi.org/10.1016/j.tate.2017.01.006>
- Stripling, C. T., & Roberts, T. G. (2013). Investigating the effects of a math-enhanced agricultural teaching methods course. *Journal of Agricultural Education*, 54(1), 124–138. doi: 10.5032/jae.2013.01124
- Stripling, C., Ricketts, J. C., Roberts, T. G., & Harlin, J. F. (2008). Preservice agricultural education teachers' sense of teaching self-efficacy. *Journal of Agricultural Education*, 49(4), 120–130. doi: 10.5032/jae.2008.04120
- Stronge, J. (2007). *Qualities of effective teachers*. (2nd ed.). Alexandria, VA: ASCD.
- Stuart, C., & Thurlow, D. (2000). Making it their own: Preservice teachers' experiences, beliefs, and classroom practices. *Journal of Teacher Education*, 51(2), 113–121.
- Stuckey, M., Hofstein, A., Mamlok-Naaman, R., & Eilks, I. (2013). The meaning of 'relevance' in science education and its implications for the science curriculum. *Studies in Science Education*, 49(1), 1–34. doi: 10.1080/03057267.2013.802463
- Suárez Flórez, S. A., & Basto Basto, E. A. (2017). Identifying pre-service teachers' beliefs about teaching EFL and their potential changes. *Profile Issues in Teachers' Professional Development*, 19(2), 167–184.
- Sulistiyo, U., Mukminin, A., Abdurrahman, K., & Haryanto, E. (2017). Learning to teach: A case study of student teachers' practicum and policy recommendations. *The Qualitative Report*, 22(3), 712–731. Retrieved from <http://nsuworks.nova.edu/tqr/vol22/iss3/3>

- Sünger, M. (2007). *An analysis of efficacy beliefs, epistemological beliefs and attitudes towards science in preservice elementary science teachers and secondary science teachers* (Unpublished Master thesis). Middle East Technical University, Ankara, Turkey.
- Swabey, K., Castleton, G., & Penney, D. (2010). Meeting the standards? Exploring preparedness for teaching. *Australian Journal of Teacher Education*, 35(8), 3.
- Sywelem, M. M. G., & Witte, J. E. (2013). Continuing professional development: Perceptions of elementary school teachers in Saudi Arabia. *Journal of Modern Education Review*, 3(12), 881–898.
- Tarman, B. (2012). Prospective teachers' beliefs and perceptions about teaching as a profession. *Educational Consultancy and Research Center*, 12(3), 1964–1973.
- Tashakkori, A. & Teddlie, C. (Eds.) (2003). *Handbook of Mixed Methods in Social and Behavioral Research*. Thousand Oaks, CA.: Sage.
- Tatar, N., & Buldur, S. (2013). Improving preservice science teachers' self-efficacy about the use of alternative assessment: Implication for theory and practice. *Journal of Baltic Science Education*, 12(4), 452–464.
- Tatto, M. T., Peck, R., Schwille, J., Bankov, K., Senk, S. L., Rodriguez, M., & Rowley, G. (2012). *Policy, practice, and readiness to teach primary and secondary mathematics in 17 countries: Findings from the IEA teacher education and development study in mathematics (TEDS-MM)*. Amsterdam, The Netherlands: International Association for the Evaluation of Educational Achievement.

- Teacher Education Ministerial Advisory Group (TEMAG). (2015). Action Now: Classroom Ready Teachers –Australian Government Response. *The journal Professional Voice*, 10(3), 10–18.
- Thompson, C. J. M. (2011). *Beginning teachers' perceptions of preparedness: A teacher education program's transferability and impact on the secondary English/language arts classroom* (Unpublished doctoral dissertation). Georgia State University, Atlanta, Georgia
- Thrupp, M., & White, M. (2013). *Research, analysis and insight into national standards (RAINS) project final report: National standards and the damage done*. Hamilton, New Zealand: Wilf Malcom Institute of Educational Research, The University of Waikato.
- Timperley, H. (2013). *Learning to practise: A paper for discussion*. University of Auckland. Retrieved from www.educationcounts.govt.nz/publications/schooling/2511/learning-to-practise
- Tirosh, D., & Even, R. (2007). Teachers' knowledge of students' mathematical learning: An examination of commonly held assumptions. *Mathematics knowledge in teaching seminar series: Conceptualising and theorizing mathematical knowledge for teaching (Seminar1)*. Cambridge, MA: University of Cambridge.
- Toh, T. L., Kaur, B., & Koay, P. L. (2013). Singapore pre-service secondary mathematics teachers' content knowledge: Findings from an international comparative survey. *International Journal for Mathematics Teaching and Learning*, 1(2), 1–22. Retrieved from <http://www.cimt.plymouth.ac.uk/journal/>

Tschannen-Moran, M., & Hoy, A. (2001). Teacher efficacy: Capturing an elusive construct.

Teaching and Teacher Education, 17(7), 783–805. doi:10.1016/S0742-051X

(01)00036-1

Tschannen-Moran, M., Woolfolk Hoy, A., & Hoy, W. K., (1998). Teacher efficacy: Its meaning and measure. *Review of Educational Research*, 68(2), 202-248.

Tsouloupas, C. N., Carson, R. L., & Matthews, R. A. (2014). Personal and school cultural factors associated with the perceptions of teachers' efficacy in handling student misbehavior. *Psychology in the Schools*, 51(2), 164–180. doi:10.1002/pits.21739

Victoria. Parliament. Education and Training Committee. (2005). *Step up, step in, step out:*

Report on the inquiry into the suitability of pre-service teacher training in Victoria: final report. Melbourne, Australia: The Committee. Retrieved from

<https://www.parliament.vic.gov.au/vufind/Record/66388>

Vieluf, S., Kunter, M., & F. J. R., van de Vijver. (2013). Teacher self-efficacy in crossnational perspective. *Teaching & Teacher Education*, 35, 92–103.

doi:10.1016/j.tate.2013.05.006

Wager, A. A. (2012). Incorporating out-of-school mathematics: From cultural context to embedded practice. *Journal of Mathematics Teacher Education*, 15(1), 9–23.

Walshaw, M., & Anthony, G. (2007). Creating opportunities through care in the mathematics classroom. *Set: Research Information for Teachers*, 1, 48–52.

Wang, J., Lin, E., Spalding, E., Klecka, C. L., & Odell, S. J. (2011). Quality teaching and teacher education. *Journal of Teacher Education*, 62(4), 331–338.

doi:10.1177/0022487111409551

- Wenglinsky, H. (2002). How Schools Matter: The link between teacher classroom practices and academic performance. *Education Policy Analysis Archives*, 10(12), 1–30.
Retrieved from <http://epaa.asu.edu/ojs/article/view/291>.
- Wetzel, A. P., De Arment, S. T., & Reed, E. (2015). Building teacher candidates' adaptive expertise: Engaging experienced teachers in prompting reflection. *Reflective Practice*, 16(4), 546–558. doi: 10.1080/14623943.2015.1064380
- Whatman, J., & McLean Davies, J. (2017). *High quality practica and the integration of theory and practice in initial teacher education: A literature review prepared for the Education Council*. Wellington, New Zealand: New Zealand Council for Educational Research.
- Wilburne, L. M., & Long, M. (2010). Secondary pre-service teachers' content knowledge for State assessments: Implications for mathematics education programs. *Issues in the Undergraduate Mathematics Preparation of School Teachers: The Journal*, 1, 1-13.
- Wilson, P., Cooney, T., & Stinson, D. (2005). What constitutes good mathematics teaching and how it develops: Nine high school teachers' perspectives. *Journal of Mathematics Teacher Education*, 8(2), 83–111.
- Wilson, S. M., Floden, R. E., & Ferrini-Mundy, J. (2001). *Teacher preparation research: current knowledge, gaps, and recommendations*. Seattle, WA: Center for the Study of Teaching and Policy.
- Wilson, S. M., Floden, R. E., & Ferrini-Mundy, J. (2002). Teacher preparation research. An insider's view from the outside. *Journal of Teacher Education*, 53(3), 190–204.

- Wiseman, A. W., & Al-Bakr, F. (2013). The elusiveness of teacher quality: A comparative analysis of teacher certification and student achievement in Gulf Cooperation Council (GCC) countries. *Prospects: Quarterly Review of Comparative Education*, 43(3), 289–309. doi: 10.1007/s11125-013-9272-z
- Wolfolk, A. E. (1987). *Educational psychology* (3rd ed.). Englewood Cliffs, NJ: Prentice Hall, Inc.
- Wolters, C. A., & Daughtery, S. T. (2007). Goal structures and teachers' sense of efficacy: Their relation and association of teaching experience and academic level. *Journal of Educational Psychology*, 99(1), 181–193.
- Yackel, E. (2000). Introduction: Perspectives on semiotics and instructional design. In P. Cobb, E. Yackel, & K. McClain (Eds.), *Symbolising and communicating in mathematics classrooms perspectives on discourse, tools and instructional design* (pp. 1–15). Mahwah, NY: Lawrence Erlbaum Associates, Publishers.
- Yatvin, J. (2007, November). *2007 NCTE Presidential Address: Where ignorant armies clash by night*. Presented at the National Council of Teachers of English Annual Convention, New York.
- Yeung, K., & Watkins, D. (2000). Hong Kong student teachers' personal construction of teaching efficacy. *Educational Psychology*, 20, 213–236.
- Yilmaz, C. (2011). Teachers' perceptions of self-efficacy, English proficiency, and instructional strategies. *Social Behavior and Personality: An International Journal*, 39 (1), 91–100. doi:10.2224/sbp.2011.39.1.91
- Yin, R. K. (2012). *Applications of case study research*. Thousand Oaks, CA: Sage.

- Yinger, R. J., & Hendricks-Lee, M. S. (2000). The language of standards and teacher education reform. *Educational Policy*, 14(1), 94-106. doi: 10.1177/0895904800014001008
- Zeichner, K. & Conklin, H.G. (2008). Teacher education programs as sites for teacher preparation. In M. Cochran-Smith, S. Feiman-Nemser, & J. McIntyre (Eds.), *Handbook of research on teacher education: Enduring issues in changing contexts* (3rd edition, pp. 269–289). New York, NY: Routledge.
- Zeichner, K. (2010). Rethinking the connections between campus courses and field experiences in college- and university-based teacher education. *Journal of Teacher Education*, 61(1–2), 89–99.
- Zeichner, K. (2012). The turn once again toward practice-based teacher education. *Journal of Teacher Education*, 63(5), 376–382. doi:10.1177/0022487112445789
- Zeichner, K. M., & Conklin, H. (2005). Research on teacher education programs. In M. Cochran-Smith & K. Zeichner (Eds.), *Studying teacher education: The report of the AERA panel on research and teacher education* (pp. 645–736). Mahwah, NJ: Erlbaum.
- Zientek, L. (2007). Preparing high-quality teachers: Views from the classroom. *American Educational Research Journal*, 44(4), 959–1001.
- Zimmerlin, D., & Nelson, M. (2000). The detailed analysis of a beginning teacher carrying out a traditional lesson. *Journal of Mathematical Behavior*, 18(3), 263–279.

Appendices

Appendix A

Participants Information Sheet (To be translated into Arabic language)

Researcher: Fatimah Alsaleh (Doctoral Student), Massey University, NZ, Palmerston North

Research Title: Preparedness to teach: The perceptions of Saudi female pre-service mathematics teachers

Introduction:

I am a doctoral student at Massey University in New Zealand. As part of my doctoral study on pre-service teachers' perceptions on preparedness I am looking to explore how pre-service teachers define their preparedness to teach and how they come to form perceptions of their levels of preparedness. The results from this study will add to the current knowledge base in teacher preparation in Saudi Arabia and have implications for policy directions for beginning teacher in-service education, teacher induction and teacher professional development.

This research study is pursued as a requirement for my doctoral thesis. The data collected may also be used in articles and conference papers that will highlight the professional development needs of pre-service teacher education in Saudi Arabia.

Participant involvement

To assist in my data collection, I am asking you to participate by completing a questionnaire that explores your perceptions about levels of preparedness to teach mathematics. It will take about 15 minutes to complete this questionnaire. At the end of the questionnaire I also seek contact details for those of you who may be willing to participate in a follow up interview to individual perceptions of preparedness in more depth. The interviews - about 15 mins – would be conducted at a time to suit your study commitments.

Sharing information

All information received from you will be treated as completely confidential and in particular, no details about individual information will be shared with your program teaching staff. In the writing (thesis and journal articles) and presentation of my research/doctoral study at conferences all efforts will be made to protect the confidentiality of individual responses. This will be achieved by avoiding any personal descriptors that could be linked to an individual and the use of pseudonyms.

Confidentiality

Your identity will remain confidential and pseudonyms will be used. Your agreement to participate in this study will be gained when you complete the questionnaire. Participation in this study is voluntary and you have the right not to answer any question or item.

If you have any questions about this research project you can e-mail me at [REDACTED]. My project is being supervised by Professor Glenda Anthony and she can be emailed at "G.J.Anthony@massey.ac.nz"

"This project has been judged by peer review and evaluated to be low risk. Consequently, it has not been reviewed by one of the university's human ethics committees. The researcher named above is responsible for the ethical conduct of this research.

If you have any concerns about conduct this research that you wish to raise with someone other than the researcher, please contact with Dr Brain Finch, Director (research ethics), telephone 06 356 9099, extn 86015, e-mail humanethics@massey.ac.nz".

Thank you for considering this request

Appendix B

Questionnaire

In the following tables a number of statements to gather information about your sense of preparedness to teach at the end of your initial teacher education. Therefore, please read the instructions for each of the following questions. Review the response options carefully before you mark your answers. There are no right or wrong answers. I am only interested in your frank opinions on these statements. Your responses will be kept confidential.

Section A: Personal details

1) I am a pre-service teacher in.....

1) Middle School

2) Secondary School

2) Age

1) 20 years or less

2) 21-25

3) 26 or over

Section B: Beliefs about mathematics and teaching mathematics

1. How much do you like mathematics?

(1) Really Like (2) Like (3) Dislike (4) Really Dislike

2. How do you regard mathematics?

(1) Very Important (2) Somewhat Important (3) Not Important

3. How much do you like teaching mathematics?

(1) Really Like (2) Like (3) Dislike (4) Really Dislike

Section C: Being Prepared to Teach

1. What does the phrase “prepared to teach” mean to you?

2. Name the five most important attributes of a good mathematics teacher

3. Name four kinds of knowledge or skills that you think are important to be a well prepared teacher

4. Please tick the appropriate response at the right column of each statement.

Key: (1 = Very well prepared; 2 = Well prepared; 3 = Somewhat prepared; 4 = Not at all prepared).

Statements	1	2	3	4
	Very	Well	Somewhat	Not at all
1. Overall, how well prepared do you feel to begin teaching mathematics?				
2. How well prepared do you feel in your mathematics content knowledge?				
3. How well prepared do you feel in your pedagogical content knowledge?				
4. How well prepared do you feel to teach basic knowledge and skills as specified by the curriculum?				
5. How well prepared do you feel to use mathematical problem solving processes in teaching?				

-
6. How well prepared do you feel to support students to engage in mathematical discourse?
 7. How well prepared do you feel to take into account students' prior conceptions about mathematics when planning curriculum and instruction?
 8. How well prepared do you feel to use technology in your teaching to increase students interest and learning?
-

5. Please tick the appropriate response at the right column of each statement.

Key: (1 = Strongly agree; 2 = Agree; 3 = Disagree; 4 = Strongly Disagree).

Statements	1	2	3	4
	Strongly agree	Agree	disagree	Strongly disagree
1. I believe my initial teacher education program has given me the necessary skills to become an effective teacher.				
2. I am satisfied that I have been well prepared to teach.				
3. I think I need to spend more time in the mathematics methods course.				
4. I think I need to spend more time in the school practicing teaching mathematics.				

6. *Teacher knowledge*

Please tick the appropriate response at the right column of each statement.

Key: (1=Strongly agree; 2= Agree; 3= Disagree; 4=Strongly Disagree).

Statement	1 Strongly agree	2 Agree	3 Disagree	4 Strongly Disagree
1. I have a good understanding of the purpose of teaching mathematics.				
2. I have a good understanding of mathematics content for the school curriculum.				
3. I have a good understanding of mathematical concepts.				
4. I have a good understanding of how and why mathematical procedures work.				
5. I have good problem solving skills.				
6. I have the ability to apply multiple mathematical representations for problem solving.				
7. I have the ability to connect between mathematics ideas.				
8. I have the ability to make mathematical connections with the problems outside of mathematics.				
9. I have the ability to handle most discipline problems that may arise in my classroom.				
10. I have the ability to resolve interpersonal conflicts in the classroom.				
11. I have the ability to maintain an orderly, purposeful learning environment.				
12. I have the ability to maintain a good relationship with my students.				
13. I have the ability to work with parents and families to better understand students and to support their learning.				
14. I have the ability to apply a variety of teaching strategies in my teaching.				

-
15. I have the ability to apply questioning and explanation skills well in my teaching.
 16. I have the ability to conduct whole class mathematics discussion.
 17. I have the ability to engage students in collaborative group-based activities.
 18. I have the ability to incorporate effective assessment strategies into my planning and teaching.
 19. I have the ability to plan and prepare a variety of teaching resources to help me in my teaching.
 20. I have the ability to make links between theory and practice of teaching in the classroom.
 21. I have a good understanding of instructional strategies that best represent mathematical topics.
 22. I have the ability to relate classroom learning to the real world.
 23. I have the ability to select effective teaching approaches to illustrate difficult mathematical concepts.
 24. I have a good understanding of students' conceptual and practical understanding of mathematical concepts.
-

Section D: Efficacy

Please tick the appropriate response at the right column of each statement.

Key: (1=Strongly agree; 2= Agree; 3= Disagree; 4=Strongly Disagree).

Statement	1	2	3	4
	Strongly agree	Agree	Disagree	Strongly Disagree
1. I have the ability and skills to teach all of the mathematics lessons for the middle/secondary curriculum.				
2. I have the ability to actively listen to my students' mathematical thinking				
3. I can get any of my students to believe that I truly care about her.				
4. I wonder if I have the necessary skills to teach mathematics.				
5. Even if I try very hard, I will not be able to teach mathematics effectively.				
6. I tend not to believe others when they tell me I will be a good teacher.				
7. When a student gets a better grade than she usually gets, it is most likely because I found better ways of teaching that student.				
8. If students underachieve in mathematics, it is most likely due to ineffective mathematics teaching.				
9. The teacher is generally responsible for the achievement of students in mathematics.				
10. A teacher is very limited in what she can achieve because a student's home environment is a large influence on her achievement.				
11. Students are responsible for their own learning.				
12. I can help all students achieve high academic standards.				
13. I can help students learn to think critically and solve problems.				
14. I can use assessment results to enhance students' learning.				
15. When a student is having difficulty with a task, I am usually able to adjust it to her developmental level.				

-
16. If a student did not remember information I gave in a previous lesson, I would know how to increase his/her retention in the next lesson.
 17. I can improve the understanding of a student who is failing.
 18. I can get students to believe they can do well in mathematics.
 19. I can help my students value learning.
 20. I can motivate students who show low interest in mathematics.
 21. Even a teacher with good teaching abilities may not reach many students.
-

Section E: What factors do you believe have influenced your sense of preparedness for mathematics teaching?

Please tick the appropriate response at the right column of each statement.

Key: (1=Strongly influential; 2=Moderately influential; 3=Less influential; 4=Not at all influential).

Statements	1 Strongly	2 Moderately	3 Less	4 Not at all
1. My prior experiences as a student				
2. My teacher education program				
3. My professors in my methods course				
4. My graduate study				
5. Actually teaching during student teaching experience				
6. Feedback I received from my cooperating teacher during practicum				
7. Watching other skillful teachers				
8. My beliefs about the nature of mathematics, learning mathematics, teaching mathematics				
9. My mathematics ability				
10. My ability to interact with students				

Name other factors that you believe have influenced your sense of preparedness that is not on the list provided above. (Otherwise, type 'None')

Appendix C

Invitation to participate in the interview

I appreciate that your time is valuable and thank you so much for taking the time to complete this questionnaire. As a pre-service teacher who is near the end of your training, I am interested to discuss with you in more depth some of the questions in the survey about your preparedness to teach in a 'real' classroom. This would involve you meeting with me to complete a short (approx. 10 min) interview at a time convenient to you.

If you are interested and able to assist in the interview phase of my study, please provide your contacts details below. I will contact you shortly to finalise the details of your participation.

Name _____

Phone number _____

Email _____

Appendix D

INTERVIEW

Please think back to your practicum and teaching methods courses and answer the following questions:

You are just about to graduate, tell me what sort of mathematics teachers would you like to be when you graduate?

- In what way is this vision of teaching the same or different to the teaching you experienced when you were at school?

How well prepared do you feel to ‘be’ that teacher?

- Talk about those areas that you feel most confident or prepared in, and those that you feel less prepared.

There are many factors that influence a beginning teacher’s sense of preparedness ranging from personal experiences and history as a learner, your program of study and field-based experience: Talk me through some of the main factors that have influenced your sense of preparedness.

- What role do you see your own education and teachers playing in your sense of preparedness?
- What role do you see your maths methods courses playing in your sense of preparedness?
- How did the practicum experience influence your feelings of preparedness?
- What other factors impact your sense of preparedness?

How well do you think others think about your levels of preparedness? What feedback have you got from say you family, your peers, your professors, your teachers and students in schools?

- Practicum: Have cooperating/mentors/supervising teachers observed your teaching and have provided feedback? Are you satisfied about their feedback? Or did you expect you will get better feedback?
- How have you done on your final exam?

To finish off, it would be really helpful if you could think for a moment and recap on the question: How would you define what “preparedness to teach” means or looks like?

Appendix E

Coding, categories, and sub- categories

Category	Subcategory	Code
Like/Dislike of Maths		I
	Helping students love maths	IA
	Students hate maths	IB
	Personal liking of maths	IC
Teacher Attributes		II
	Balance between strictness and lenience	IIA
	Familiarity with the curriculum	IIB
	Adapting to students & students' abilities	IIC
	Experience	IID
	Mathematical knowledge	IIE
	Patience/able to manage anger	IIF
	Establishing rapport or closeness with students	IIG
	Considerate of students' feelings, understanding psychology	IIH
	Clear voice/speaking	IIJ
	Answering students' questions	IIK
	Responsibility	IIL
	Being a strong leader or confident	IIM
Skills Needed		III
	Use of technology in class	IIIA
	Clear, simple explanations (step by step explanations)	IIIB
	Problem solving using different strategies	IIIC
	Going beyond the textbook	IIID
	Lesson planning and preparation (familiar with lesson)	IIIE
	Applying maths to real life or other subjects	IIIF
	Classroom management/discipline	IIIG
	Using different strategies	IIIH
	Organising the blackboard neatly	IIIJ
	Managing time	IIIK
	Giving quizzes	IIIL
	Using worksheets	IIIM
Feelings of Preparedness		IV
	Feeling confident and/or prepared	IVA
	Improving during the practicum	IVB

	Learning from mistakes	IVC
	Need to try harder or develop more	IVD
	Feeling somewhat prepared (half prepared, mostly prepared)	IVE
	Need for more training	IVF
	Research or trying things out at home (teacher)	IVG
	Use of the internet to prepare	IVH
	Speaking in front of people	IVJ
	Being liked by students	IVK
	Feeling nervous in class	IVL
	Feeling unprepared	IVM
Influences & Other Factors		V
	Previous teachers - positive	VA
	Previous teachers - negative	VB
	Cooperating teacher in the practicum	VC
	Class size	VD
	Time constraints	VE
	Resource constraints/availability, classroom space	VF
	Feelings of fear, nervousness and shyness	VG
	Family	VH
	Students' attitudes (positive or negative)	VJ
	Self-confidence	VK
	Feedback	VL
	Feelings about mathematics	VM
	School system	VN
	Own previous classroom behaviour	VO
	University study (specialist maths papers)	VP
	Lecturers	VQ
	Difference between university and school maths	VR
	Not wanting to be a teacher in the past	VS
Beneficial parts of the maths teaching methods course		VI
	Lesson design	VIA
	Classroom management	VIB
	Teaching strategies	VIC
	Student psychology	VID
	Mini lesson	VIE
	Curriculum development	VIF
Negative parts of the maths teaching methods course		VII
	Too much theory	VIIA

	Not maths specific	VIIB
	No benefit	VIIC
Supervisors, Cooperating Teachers and Feedback		VIII
	No lesson observations	VIIIA
	Positive feedback	VIIIB
	Criticism - fair or justified	VIIIC
	Criticism - unfair or unjustified	VIIID
	Supervisor/Mentor was not a maths specialist	VIIIE
	Students not respecting pre-service teachers	VIIIF
	School/teachers not respecting pre-service teachers	VIIIG
	Feedback from peers	VIIIH
	Feedback from students	VIIIJ
Grades		IX
	Good grades	IXA
	Poor grades	IXB

Appendix F

Saudi professional standards for mathematics teachers

Domain	Standards	Sub-standards (Indicators)
1. Number and operations	1. Knowing numbers and their operations	- Identifying the number groups (natural, whole, integers, rational, real, composite) and their different classifications - Familiarity with the basic properties of number theory (the greatest common divisor, the least common multiple, divisibility, prime numbers and compositions, and congruence) - Recognizing the concept of ratios and proportions and their applications, and solving problems related to these - Using estimation strategies and mental arithmetic, and the ability to judge the reasonableness of such results - Carrying out processes on the different sets of numbers (the four operations, comparison, roots, and exponents) - Distinguishing the different representations of composite numbers and finding their factors - Solving verbal problems with different numbers
	2. Knowing the principles of algebra and real functions	- Identifying the algebraic properties of sets and their processes (intersection, union, etc.) - Analysing and simplifying algebraic expressions - Solving equations, and linear, quadratic, and absolute value inequalities - Solving matrix operations - Solving systems of linear equations, using matrices and determinants, and representing the solution algebraically and geometrically - Using the properties of exponential and logarithmic functions to solve equations - Comparing between relations and functions, the properties and types of real-valued functions, and their domain and range - Performing operations involving functions (four operations, composition, inverse functions) - Drawing linear functions and polynomials of the second degree
	3. Knowing calculus and its applications	- Calculating the arithmetic and geometric sum of sequences and series - Judging the convergence of infinite sequences and series - Knowing limits and using them in defining the derivative function and judging its values at nearby inputs

		- Calculating the derivative function and drawing its curve - Calculating the integration of a function and using it to calculate areas and volumes - Solving applied mathematical problems involving calculus
3. Geometry and measurement	Understanding the concepts and theories of geometry	- Using the properties of parallel and perpendicular lines and angles to figure out shapes - Using geometric relations (Pythagoras' theorem, similar triangles, intersections between a straight line and two parallel lines, etc.) to solve mathematical problems - Recognising the types of triangles and cases of congruence between two triangles - Describing the properties of quadrilateral shapes - Explaining the characteristics of three-dimensional shapes and their properties - Finding a slope and the equation of a straight line in a plane and its relationship to another straight line - Finding a distance between two points or a point and a straight line in a plane - Representing geometric transformations (perspective, translation, rotation and changes in dimension). - Determining the relationship between the angles resulting from an intersection between two straight lines - Using the geometric relations of triangles - Recognising conic sections and identifying their equations and characteristics, and representing them graphically - Recognising trigonometric functions and the relationships between them - Recognising vectors and performing operations with them - Solving applied mathematical problems on Euclidean and Solid geometry
	Knowing measurement and its units and applications	- Recognising units of measurement (angle, length, perimeter, area, volume, temperature, and time) - Convert between different measurement units within the same system - Finding the perimeter and the area of triangles, circles, and quadrilateral shapes - Calculating the volume of 3D solids and finding the number of sides and surface area. - Solving problems involving drawing to scale using ratios and proportionality - Using rounding in measurement

		7. Solving applied mathematical problems relating to measurement
4. Statistics and probability	6. Understanding the concepts of statistics, probability, and their application	1. Collecting and representing data appropriately (tables, pie graphs, histograms), and analysing and interpreting them 2. Identifying survey studies and sample types, and using them for making predictions. 3. Calculating the measures of central tendency and variance in a set of data 4. Understanding probability and its basic concepts (independence, variance, discrete and continuous distribution etc.) and solving problems 5. Calculating and interpreting correlation coefficients 6. Solving applied mathematical problems involving statistics and probability
5. Discrete mathematics, logic, and mathematical inference	7. Understanding discrete mathematics and its applications	1. Recognising, representing, analysing, and generalizing patterns 2. Recognising the principles of counting, permutation, computation and binomial theory 3. Recognising the basics of the shape theory 4. Solving applied mathematical problems involving colour, shapes and methods of counting
	8. Understanding logic and mathematical reasoning	1. Identifying mathematical reports and correct values, using appropriate tools to create tables 2. Recognising logical consequences, equivalence, and logical measurement 3. Identifying the different methods used for proofs and their uses
6. Mathematics education	9. Knowledge of learning and teaching methods for mathematics and their techniques	1. Identifying the elements of mathematical knowledge (concepts, relationships and skills) and how to analyse, teach and evaluate them 2. Efficiently employing the methods and strategies used for teaching mathematics suitable for intermediate and secondary stages 3. Recognizing the skills of mathematical thinking and methods of developing and teaching them 4. Recognizing the learning theories related to the learning and teaching of mathematics and their applications 5. Employing modern techniques in the learning and teaching of mathematics (calculators of all kinds, computer programs, manipulatives, etc.)
7. Mathematics procedures	10. Knowing ways to solve the mathematical problem and strategies for doing so	1. Identifying the steps to solve mathematical problems 2. Identifying multiple strategies to solve a specific mathematical problem and choosing the most appropriate strategy

		3. Using diverse strategies to solve applied mathematical problems
	11. Knowing mathematical communications	1. Using mathematical language to express mathematical concepts accurately 2. Recognizing all kinds of mathematical discourse skills and using in when communicating with students and others 3. Recognizing methods of developing students' mathematical discourse
	12. Knowing mathematical interconnectedness	1. Showing the mathematical interconnectedness among different mathematical concepts and topics 2. Showing the relationships between mathematics and other subjects 3. Demonstrating mathematical applications in different fields of life
	13. Knowing mathematical representations	1. Demonstrating mathematical knowledge with various representations 2. Using mathematical representations to model mathematical content 3. Using mathematical representations to model and interpret natural phenomena