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

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This study investigates how well Saudi pre-service teachers feel prepared to teach mathematics at secondary or middle schools through an interview-based exploration. The participants, a sample of 16 female mathematics pre-service teachers, were near the end of the final year of their 4-year education degree. Key findings show that these graduate teachers felt prepared in teaching methods and strategies, but less prepared about some aspects, namely classroom management, lesson preparation, and integration of technology. Findings from this study will contribute to the current drive to improve teacher and teaching quality, including initial teacher education in Saudi Arabia.

Being well prepared for teaching is a key outcome of initial teacher education (ITE). There is a positive connection between preparation and teacher quality and subsequent student achievement in schools (Hattie, 2012). Recent calls for improvements in learning outcomes for diverse learners have focused on teacher quality (Lim, 2011) with ITE being seen as "an ideal site for increasing teacher quality, providing it is subject to reform" (Ell & Grudnoff, 2013, p. 79). Within Saudi Arabia, concerns about student mathematics achievement, fuelled by low TIMSS data in 2007, has likewise put the spotlight on teacher quality. Analysing educational reforms that focus on only specific parts of the education system, Alghamdi (2013) argues that more efforts are needed to address styles and theories of classroom instruction and their impact. This call is backed by studies of teacher quality and its relationship to mathematical achievement in Saudi schools (Al-bursan & Tighezza, 2013) that suggest that researchers need to look at teacher-related factors including how well pre-service teachers (PSTs) are prepared to teach.

In this paper, we report on part of a doctoral study investigating Saudi PSTs' sense of preparedness to teach mathematics at secondary or middle schools. Specifically, we report findings from interviews that explored PSTs' sense of preparedness to teach by addressing two research questions: (i) How do PSTs define or describe being prepared to teach? and (ii) How do PSTs perceive their level of preparedness to teach mathematics?

Literature Review

The influence of quality teaching is undisputable, with the likes of Darling-Hammond (2006) and Hattie (2012) claiming that the biggest influence on student outcomes is attributed to teaching quality. With regard to ITE, studies note that well-prepared graduates are likely to outperform those who are not and are more likely to have better student outcomes and remain in teaching for longer (NCATE, 2006). In contrast, poorly prepared teachers disrupt the learning environment (Mitchell, Marsh, Hobson, & Sorensen, 2010) and leave teaching at high rates (Darling-Hammond, Chung, & Frelow, 2002). However, ensuring the preparation of quality teachers is challenging, with ITE program design involving "a range of complex and even controversial issues" (Cochran-Smith & Power, 2010, p. 6), each of which may impact on effectiveness. For example, PSTs need to be well

prepared in content knowledge (CK), specialised pedagogical content knowledge (PCK), and pedagogical knowledge (PK) (Ponte & Brunheira, 2001). In addition, to knowing and being skilled in a range of pedagogical approaches to help all students learn (Kraut, 2013), a well-prepared graduate should also be self-confident in their knowledge of students, know how to choose appropriate materials and strategies, understand how different contexts affect education (NCATE, 2006).

Many studies claim that PSTs' beliefs about teaching and learning influence their practices, but few consider how these beliefs might impact on perceptions of preparedness (Buehl & Fives, 2009; Leong, 2012). In looking to assess levels of preparedness, Kraut (2013) found that preparedness meant different things to different PSTs. Some studies have found that PSTs' sense of preparedness is strongly related to their perceived levels of teacher knowledge. For example, beginning teachers in Leong's (2012) study considered that CK was the best indicator of good mathematics teaching and helped them feel more confident with lesson planning and explaining concepts in different ways. Connected to PTS' sense of preparedness, Buehl and Fives (2009) found that CK and PK were identified by PSTs as the most important components for effective teaching. However, other studies (e.g., Balatti & Rigano, 2011) found that PSTs did not consider CK to be so important, possibly because they took CK for granted. Rather, the PSTs in Balatti and Rigono's study mentioned characteristics such as the ability to relate to students, organisational skills, communication skills, and using creative learning tasks, real-life examples, and student-centred teaching strategies as important indicators of preparedness.

Confidence in PK, especially behaviour management, is another area that contributes to feelings of preparedness. O'Neill and Stephenson (2012) found that Australian PSTs felt only somewhat prepared regarding their ability to manage misbehaviour. Although somewhat confident in their ability to use a variety of behaviour management strategies they tended to use only a few strategies (e.g., praise and encouragement). In contrast, Cabaroğlu's (2012) study in Turkey, found that PSTs mostly used reactive strategies (e.g., shouting and threatening). We need to be careful not to assume that this contrast reflects differences between Western and non-Western nations as Roble and Bacabac (2016) found that mathematics PSTs in the Philippines were confident about using a wide range of behaviour management strategies.

Studies that seek to quantify PSTs' sense of preparedness typically use measures of teacher efficacy. Darling-Hammond et al.'s (2002) exploration of teachers' sense of preparedness noted that the strongest predictor of beginning teachers' preparedness was their sense of efficacy. They 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). Likewise, Clark (2009) found that PSTs' feelings of preparedness and associated teaching efficacy were important indicators of how well they felt they would be able to cope with the daily challenges of the classroom and how successful they will be in their teaching careers.

Previous studies that have explored PSTs' sense of preparedness across a range of curriculum areas (e.g., Clark, 2009; Darling-Hammond, 2006) found that most ITE graduates felt adequately prepared to teach and rated their ITE as effective for preparing them for their careers. Anthony et al. (2008) reported that ~87% of graduating secondary teachers felt well prepared or very well prepared to begin teaching. However, when

digging deeper, studies have found that PSTs, despite their overall sense of preparedness, reported feeling less confident in some areas. For example, in Anthony et al.'s study PSTs felt less prepared in assessment and monitoring of student progress, responding to students' diverse needs, inclusive educational practices related to Māori, and communication and working with parents. Rodie (2011) found that PSTs were less confident about planning assessments, writing reports, communicating with students and other teachers, standing in front of the class, preparing teaching resources, and dealing with misbehaviour. Similarly, Koehler, Feldhaus, Fernandez, and Hundley (2013) found that PSTs felt less prepared about classroom management and meeting students' psychological needs.

There is a notable absence of studies related to PSTs' sense of preparedness in Saudi Arabia, but studies in other developing nations, such as Ghana (Agyei, 2012) and Kenya (Ng'eno, Githua, & Changeiywo, 2013), point to PSTs' concerns about the use of technology. Unfamiliarity with ICT, low accessibility, and a lack of infrastructure mirror the situation in Saudi Arabia (Alshehri, 2012).

In studies involving prospective mathematics teachers, concerns about levels of CK are more likely to be expressed by primary or intermediate teachers than specialist secondary teachers. For example, in Lim's (2011) study many U.S middle school PSTs felt poorly prepared due to inadequate CK. Likewise, in an Australian study, Hine (2015) noted that 60% of upper primary and middle school PSTs felt unconfident about their levels of CK. A study Ben-Motreb and Al-Salouli (2012), investigating the PCK of 40 Saudi PSTs, expressed concern that many PSTs were unable to explain the concepts they were teaching, show connections between/among different knowledge strands, or demonstrate how mathematics relates to daily life. Other Saudi studies involving middle school teachers (Al Nazeer, 2004) and elementary school teachers (Khashan, 2014), also found that most PSTs had a more procedurally based CK rather than a profound understanding of mathematics.

Methodology

Conducted in Saudi Arabia, the findings reported in this paper draw on interviews with 16 female mathematics PSTs in the final year of their 4-year undergraduate program at a university-college of teacher education. At the time of data collection, the participants had recently completed their practicum, which took place in intermediate and/or secondary school over a period of ~4 months.

In the larger study, data were collected via interviews and a questionnaire. Interviews, the focus of this paper, were carried out face-to-face or by telephone. Taking approximately 30 minutes, interviews were selected as an appropriate means for exploring the participants' perceptions of situations and their constructions of reality related to their experiences in learning to become a teacher. Following a pre-planned protocol, the semi-structured nature of the interviews allowed the interviewer to probe participants' responses. The recorded interviews were transcribed into Arabic then translated to English for analysis. Manually sorting and categorising the data allowed the researcher to understand the topic's complexity and become familiar with the data. The data were analysed through summarisation, coding, and derivation of themes through applying description and conceptualisation analysis. The segments were named through a process of inductive coding to represent the data as distinct themes, sub-themes or categories.

Findings

Definitions of Preparedness to Teach

Four themes emerged from PSTs' explanation of preparedness to teach: levels of pedagogical knowledge and skills; levels of specialised and curriculum knowledge; feeling confident and gaining experience; and teacher attributes related to the 'good' teacher.

A sense of efficacy in different aspects of pedagogical knowledge and skills was the most frequent (n=13) framing of preparedness. Of note was that seven of the descriptions focused on capabilities related to classroom management—including time management, 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 it is essential to have respect between the teacher and her students". Lesson planning and good preparation was mentioned by three PSTs (e.g., PST13 specified "being fully prepared to prepare the lesson content and objectives"). These three PSTs also mentioned the importance of being able to "enthuse the students about the lesson". Effective delivery of content, linked to clear step-by-step explanations and illustrations and familiarity with and the ability to apply different teaching methods (e.g., using teaching aids and motivating students), was also used to define preparedness by ten interviewees.

Content and curriculum knowledge was the second theme (n=12). Here PSTs described preparedness as "having a good understanding of the subject content", "the ability to apply multiple mathematical representations", or "being fully versed in understanding the content of the mathematics curriculum". Of note was the lack of reference to pedagogical content knowledge (PCK) in relation to preparedness. Only two aspects of PCK were mentioned: "familiarity with the teaching strategies that are specific for mathematics" and "making students like the subject and not forcing memorization".

Feeling confident and gaining experience were used to define preparedness to teach by seven PSTs. Becoming 'good' at teaching was 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.

For some PSTs, their definition of preparedness included teacher attributes such as "having a strong personality", being "strict" or "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 to the students previously".

The picture that emerges is that being prepared for these PSTs comprised having sufficient PK to help them know how to manage the classroom and feel confident. Preparedness also involved having sufficient CK and familiarity with the curriculum, with PCK being less important in shaping their descriptions of preparedness. However, as many of the interviewees pointed out, familiarity with the curriculum and tools and developing teaching expertise comes with experience. Not surprisingly then, these PSTs affirmed the importance of the practicum.

Sense of Preparedness

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

Feeling prepared about applying different teaching methods was noted by half the interviewees. These PSTs reported feeling confident about using different teaching methods to deliver mathematical content to ensure students' understanding. They also felt prepared about using different teaching methods to adapt to the abilities of diverse learners, to involve all students to participate, to support students' positive relationship with mathematics, and to develop students' mathematical thinking skills. In addition, some PSTs indicated a sense of confidence in their ability to use teaching aids such as concept maps and manipulatives and worksheets to check students' understanding. Only two PSTs expressed that they felt well prepared to link mathematical concepts to reality by using examples from daily life. They elaborated how using a variety of strategies (e.g., playing, teacher role-playing, and cooperative learning) helped them support students' understanding and motivate and engage them in lessons. Feeling prepared about using technology (e.g., PowerPoint and display sketches and images related to the lesson) was reported by only three PSTs.

Nine PSTs reported a sense of being prepared in classroom management. Discussions around classroom management typically included behaviour management techniques simultaneously focused on rewards and punishment. For example, PST10 reported using:

> rewarding methods 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.

Seven PSTs discussed how they felt well prepared in aspects of lesson preparation and explanation, especially preparing lessons in advance, organizing the blackboard, delivering mathematical information, and using step-by-step explanations.

Familiarity with the mathematics curriculum and CK was noted by five PSTs as an indicator of their sense of preparedness. Regarding the curriculum, PST1 noted: "I have the ability to answer a student's question from another curriculum for the following grade that I have not taught, because I have a background in mathematics as a university student". Feeling prepared in CK was reported as "I have enough knowledge in mathematics".

Feeling confident was or a strong leader was another area described by four PSTs (e.g., "I am confident of my knowledge and the information that I have", "I have a strong leadership personality").

Although the PSTs indicated that they felt prepared in some areas, their explanations indicated that that they were aware of their need to become even more prepared ("I hope to be able to strengthen my strengths"), particularly in classroom management, using a range of teaching strategies and technology, and linking mathematics to reality.

Feeling Less Prepared

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

The majority of the interviewees (n=14) reported feeling less prepared in classroom management. Concerns included difficulty managing a large number of students and difficulty adjusting the narrow and crowded classrooms for implementing student-centred teaching strategies. For example:

> 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)

> Most of the teaching strategies that we have studied cannot be applied because the class time finishes, but the strategy has not yet been completed. (PST13)

Managing behaviour was a central concern for most PSTs. Several PSTs reported instances of lack of patience and difficulty in controlling their anger. For example, PST12 noted:

> 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.

Content and curriculum knowledge was less often mentioned by PSTs as an issue. However, five PSTs expressed a desired to be more versed in CK in general and problem-solving strategies in particular, and more familiar with the curriculum across grade levels. PST15 noted ways that she was addressing this shortcoming as follows:

> I am acquainted with the maths curriculum for middle school, but I was not familiar with maths curriculum for secondary school, so I was searching on the Internet to be more familiar with it.

Four PSTs noted specific aspects of lesson preparation and explanation as areas of feeling less prepared. Elaborations included concerns about lesson planning, engaging the students, delivering lessons for student understanding, and using mathematical expressions and symbols.

> 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 PSTs noted that they felt less prepared to connect mathematics with real life, reporting that going forward they were relying on learning about these aspects online.

> 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, but there were too many mathematics lessons that I could not link to reality. (PST12)

Surprisingly, integrating technology into teaching was mentioned in relation to 'being less prepared' by only one PST. However, it was evident from interview responses that PSTs felt they needed to be more prepared in going beyond using PowerPoint and that integrating technology in mathematics was not sufficiently covered in their ITE.

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

In discussing areas where they felt less prepared it was apparent that although the PSTs reported knowing different teaching strategies they found that in practicum they could not implement them properly because of time, space, and behavioural management constraints. The picture that emerges is that PSTs had gained PK in an academic sense from their ITE course, but found that applying these in reality was harder than expected. This highlights the importance of the practicum for helping PSTs feel prepared.

Discussion and Implications

As in other studies (e.g., Anthony et al., 2008; Clark, 2009; Rodie, 2011), the PSTs generally expressed an overall sense of preparedness to begin teaching, espoused through

their knowing about different teaching methods and strategies. However, they defined being prepared to teach mostly in terms of 'having' teacher knowledge, especially CK and PK, suggesting that ITE enabled them to feel prepared in this respect. Interestingly, aspects of PCK, an aspect more closely related to 'practice' was seldom mentioned in the interviews. Their definitions were consistent with the findings of many studies (e.g., Buehl & Fives, 2009; Kraut, 2013; Leong, 2012), though they conflicted with the perceptions of PSTs in Balatti and Rigano's (2011) study who did not consider CK to be important.

Affirming a theory/practice divide, it appears that PSTs found the application of different pedagogical strategies when on practicum was harder than expected. In this respect, classroom management proved especially challenging and somewhat disrupting to their trialling of more non-traditional student centred teaching approaches. This finding agrees with Koehler et al. (2013), and O'Neill and Stephenson (2012) who found that the PSTs felt prepared regarding CK but less confident about classroom management, especially behaviour management.

In accord with Balatti and Rigano (2011), the interviews revealed that teacher characteristics concerning confidence and the ability to relate to students were important aspects of PSTs' sense of preparedness. 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). However, a sense of preparedness related to these attributes, reflecting a desire to enact a student-centred rather than a teacher-centred approach, were mixed, with PSTs identifying a continuum of strengths. On the positive side, several PSTs expected that this was an area that they would continue to develop expertise in once teaching in the classroom.

While the findings affirm the importance of the practicum for helping PSTs feel more prepared, the lack of explicit reference to PCK by the PSTs suggests scope for ITE methods courses to make the link between PK and PCK more explicit, as suggested in practice-based reforms (Hunter, Anthony, & Hunter, 2015). Indeed learning the work of teaching could include a focus on management of learning, more so then the management of behaviours. In examining PSTs' feelings of preparedness to teach mathematics, this study has provided further insight into the preparation of secondary and middle mathematics teachers in Saudi Arabia. Informing our understanding about improvements needed to ensure quality mathematics teaching these findings suggest that greater links are needed between the teacher education programmes and the sometimes contradictory realities of the classroom.

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