



Research paper

Teacher self-efficacy sources during secondary mathematics initial teacher education

Gosia Marschall ^{a, b, *}^a Department of Mathematics and Science Education, Department of Teaching and Learning, Stockholm University, 106 91, Stockholm, Sweden^b Department of Education, University of Oxford, 15 Norham Gardens, Oxford, OX2 6PY, United Kingdom

H I G H L I G H T S

- Although mastery experiences are generally considered to be the most significant sources of teacher self-efficacy, the importance of other sources must not be underestimated, particularly for individuals who can be considered vulnerable.
- A conceptualisation of physiological and affective states as a teacher self-efficacy source, which goes beyond classroom episodes and includes more general affective states related to pre-service teachers' narratives, is necessary to further understanding of the process of teacher self-efficacy appraisal.
- Modelling of serviceable pedagogical strategies in realistic classroom context (i.e., knowledge in action) is an important aspect of vicarious experiences as a teacher self-efficacy source.

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A B S T R A C T

This one-year phenomenological study focuses on exploring sources of teacher self-efficacy (TSE) among pre-service secondary mathematics teachers during their initial teacher education. The findings of the study shed light on the significance of enactive, social and affective sources of TSE, and suggest the need to broaden the understanding of these sources. They also emphasize the need to explore previously unexamined aspects of TSE, in order to gain a more comprehensive understanding of this important construct in the field of education. Furthermore, the study highlights the importance of considering factors beyond just mathematics teacher knowledge when considering mathematics teacher professional learning.

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1. Introduction

Teacher self-efficacy (TSE), defined as teachers' judgements about their capability to effectively organise and execute specific courses of action in a particular professional context, has been widely explored in educational research (Bandura, 2006). It is an attractive construct since it has been shown to correlate positively with desirable educational outcomes such as increased student engagement, motivation and achievement (e.g. Chang, 2015; Katz & Stupel, 2016; Muhonen, Pakarinen, Rasku-Puttonen, & Lerkkanen, 2021; Zee, Koomen, & de Jong, 2018), and negatively with teacher

exhaustion and burn-out (Aloe, Amo, & Shanahan, 2014; Granziera & Perera, 2019; Skaalvik & Skaalvik, 2017; Zee & Koomen, 2016). Research shows that, although TSE development is especially prominent during initial teacher education (Usher & Pajares, 2006) or in the first few years of teaching (Woolfolk Hoy & Burke-Spero, 2005), it can fluctuate throughout teachers' careers (Kim, Sihn, & Mitchell, 2014; Klassen & Chiu, 2010; Samuelsson, Samuelsson, & Autio, 2015), especially when teachers face new challenges (Marschall & Watson, 2022); but also that it can be nurtured through continuous professional development (Kim et al., 2014; Lotter et al., 2018) and reflective practice (Bosman, Zee, de Jong, & Koomen, 2021; Harrington & Walsh, 2020; Siwatu, Chesnut, Alejandro, & Young, 2016; Thomson, Gray, Walkowiak, & Alnizami, 2021).

From the perspective of theory, TSE is characterised as a "product of cognitive processing of diverse sources of information

* Department of Education, University of Oxford, 15 Norham Gardens, Oxford, OX2 6PY, United Kingdom.

E-mail address: gosia.marschall@education.ox.ac.uk.

conveyed enactively, vicariously, socially and physiologically” (Bandura, 1997, p. 115). This gives rise to four TSE sources—*enactive mastery experiences, vicarious experiences, social and verbal persuasion, and physiological and affective states* (Bandura, 1997). While research exploring TSE sources is expanding (Gale, Alemдар, Cappelli, & Morris, 2021; Glackin, 2019; Klassen & Durksen, 2014; Ma & Cavanagh, 2018; Morris, Usher, & Chen, 2017; Palmer, 2011; Phan & Locke, 2015; Skaalvik & Skaalvik, 2010; Usher & Pajares, 2008; Yada et al., 2019), it remains relatively limited (Morris et al., 2017), methodologically (prioritising quantitative enquiries (Morris et al., 2017)) and conceptually (paying limited attention to the sources which are not enactive (Glackin, 2019; Van Maele & Van Houtte, 2012)). This reinforces the need for further longitudinal and qualitative research (e.g. Gale et al., 2021; Glackin & Hohenstein, 2018; Ma, McMaugh, & Cavanagh, 2021; Marschall & Watson, 2022; Philippou & Pantziara, 2015; Siwatu et al., 2016), which would contribute to our understanding around the TSE concept and bring more relevance to practice (Klassen, Tze, Betts, & Gordon, 2011). The research presented here addresses this gap by reporting findings from a year-long phenomenological study of four pre-service secondary mathematics teachers’ TSE development. This article focuses on Bandura’s (1997) four self-efficacy sources and their role in the process of TSE development, as conceptualised by the participants.

2. Sources of TSE

2.1. Enactive mastery experiences (ME)

Enactive mastery experiences, which provide teachers with authentic and tangible evidence of their capability to carry out an action (Bandura, 1997), are considered the most significant source of self-efficacy (Gale et al., 2021; Ma & Cavanagh, 2018; Neumayer DePiper et al., 2021; Yada et al., 2019). Enacting a particular activity and reflecting on the success of this enactment can lead to direct TSE appraisal (Althausen, 2018; Katz & Stupel, 2016; Morris et al., 2017; Neumayer DePiper et al., 2021; Thomson et al., 2021). If we are successful in an activity and if we are able to attribute this success to our own effort, TSE is likely to increase (e.g. Althausen, 2018) and we are more likely to expect that, when repeated, the action will bring further success in the future (Mohamadi & Asadzadeh, 2012). In contrast, lack of success may lead to lowering TSE and an anticipation of future failure, regardless of actual ability or available resources (Mohamadi & Asadzadeh, 2012). Despite this significance, ME often prove insufficient in aiding TSE development (Gale et al., 2021; Rupp & Becker, 2021), particularly for those new to the profession (Marschall, 2021; Tschannen-Moran & Woolfolk Hoy, 2007; Van Maele & Van Houtte, 2012), those whose TSE is still relatively underdeveloped and those who are likely to distrust their success experience (Bandura, 1997).

2.2. Vicarious experiences (VE)

Vicarious experiences allow individuals to judge their capabilities based on the attainments and successes of others. Through VE teachers can identify success criteria, make decisions about the manageability of a task and compare themselves to others (Bandura, 1997). VE can include: actual modelling (direct observations of colleagues), symbolic modelling (observations of lessons provided through media (Bautista, 2011)); self-modelling (observations of recordings of one’s own teaching (e.g. Bautista & Boone, 2015; Gale et al., 2021); cognitive self-modelling (visualising oneself executing certain actions); and simulated modelling (observations in simulated classroom scenarios) (Palmer, 2006). They can

also be represented by a description of a situation by an experienced other (Bandura, 1997) or observing one’s own former teachers (Ma & Cavanagh, 2018).

VE are particularly significant in contexts such as education, where there is no absolute measure of adequacy or success (Bandura, 1997), and important for individuals with little prior experience or low self-efficacy in a particular task (Skaalvik & Skaalvik, 2007). Interestingly, however, the assessment of the significance of VE in TSE appraisal in the educational context differs between quantitative and qualitative studies. While qualitative studies report positive role of VE (Bruce, Esmonde, Ross, Dookie, & Beatty, 2010; Cakir & Alici, 2009; Gunning & Mensah, 2011), quantitative studies often fail to show this effect (Morris, 2010; Rots, Aelterman, Vlerick, & Vermeulen, 2007; Yada et al., 2019). It has been suggested that this might be due to the limitations of quantitative research which fails to draw consistent conclusions across different instruments (Morris et al., 2017) that struggle to capture contextual variables (such as specific characteristics of individuals (Usher & Pajares, 2008) or learning which often occurs implicitly (Ahn, Bong, & Kim, 2017; Usher & Pajares, 2008)). Further explanations suggest that some teachers might simply have limited opportunities for observing practice and hence do not often reflect on it, or that they might already have firmly established professional identity and hence do not feel the need to focus on the actions of others (Yada et al., 2019).

2.3. Social and verbal persuasion (VP)

Social and verbal persuasion (VP) represents social validation of one’s capabilities, since “[i]t is easier for an individual to sustain a sense of efficacy, especially when struggling with difficulties, if significant others express faith in one’s capabilities” (Bandura, 1997, p. 101). VP can be particularly significant for those whose ME are relatively sparse (Labone, 2004; Tschannen-Moran & Woolfolk Hoy, 2007).

VP can take a form of a chat with or a feedback on performance from an experienced, trustworthy, knowledgeable, respected and credible other (Bandura, 1986; Morris et al., 2017; Pajares, 2006; Palmer, 2011); such is particularly pertinent in a non-hierarchical societies where feedback is less likely to be seen as an assessment (Yada et al., 2019). VP can also be provided by students who show enthusiasm, smile, hug or reward their teachers following successful learning moments or at the end of an academic year (Houtz, 2014; Poulou, 2007). It has been suggested that VP can also take the form of general social support (e.g., Guan & So, 2016), although reservations have been raised that such a conceptualisation of VP does not yet carry enough evidence to be considered as reliable proxy for VP (Morris et al., 2017).

2.4. Physiological and affective states (PAS)

Physiological and affective states are a significant source of TSE since they affect how individuals access, process and understand their actions and incoming information about their performance (Poulou, 2007). Bandura (1997) explained that:

“People often read their physiological activation in stressful or taxing situations as signs of vulnerability to disfunction. Because high arousal can debilitate performance, people are more inclined to expect success when they are not beset by aversive arousal than if they are tense and viscerally agitated” (p. 106).

In short, stressful situations can make teachers feel vulnerable and dysfunctional, consequently reducing their TSE. In contrast,

feeling satisfied with own efforts might enhance anticipation of future success and increase TSE (Aloe et al., 2014; Klassen & Chiu, 2010).

Although PAS play a particularly significant role in stressful professions, such as teaching (Gabriele & Joram, 2007; Mansfield, Beltman, Weatherby-Fell, & Broadley, 2016), they have been argued to be the weakest TSE source (Mohamadi & Asadzadeh, 2012; Morris & Usher, 2011; Poulou, 2007), or even not a significant source at all (e.g. van Rooij, Fokksen-Bruinsma, & Goedhart, 2019). It has been suggested that this might be since teachers simply do not tend to discuss PAS in the context of TSE (Gale et al., 2021), either because of the misconstruction of the idea of positive and negative effects of different affective states or because of the mediating role of cognition between affect and TSE (Poulou, 2007).

2.5. The hiatus of TSE sources

When judging their capabilities for future performance, individuals consider all of their experiences (enactive-ME, vicarious-VE, social-VP, physiological and affective-PAS) (Glackin, 2019) and subjectively weigh their significance (Bandura, 1997). This cognitive processing relates to an assessment of expended effort, skills and success attribution (Bandura, 1997), and is shaped by individuals' own understanding of the world and of themselves (Marschall, 2021; Marschall & Watson, 2022; Narayanan & Ordynans, 2021). This means that different efficacy sources are of different significance in TSE development for different individuals and at different points in their careers. For example, although ME is mainly seen as the most influential source of teacher self-efficacy (Gale et al., 2021; Ma & Cavanagh, 2018; Neumayer DePiper et al., 2021; Usher & Pajares, 2008; Yada et al., 2019), it is considered less relevant for novice teachers who have relatively little classroom experience, and who tend to rely more heavily on social aspects of learning, conveyed vicariously (VE) or through conversations with and encouragement from others (VP) (Marschall, 2021; Tschannen-Moran & Woolfolk Hoy, 2007; Van Maele & Van Houtte, 2012). In contrast, with growing experience, an accumulation of ME tends to shift the focus away from other sources towards the significance of ME (Woolfolk Hoy, Wayne, & Heather, 2009).

Previous research reported on complementary aspects of the four TSE sources (e.g. Glackin, 2019; Matney & Jackson, 2017; Van Maele & Van Houtte, 2012) where, since the sources "... affect one another, the power of given mode of efficacy influence can change markedly depending on the strength of the other modes of influence" (Bandura, 1997, p. 88). For example, the significance of successful ME can be enhanced by social validation of the success (Gale et al., 2021). In return, combining ME and positive feedback (VP) about teacher actions can raise the significance of VP by making it more concrete (Labone, 2004).

2.6. Other suggested sources of TSE

In addition to the four sources of Bandura, Palmer (2006, 2011) suggested two additional sources of TSE—cognitive content mastery and cognitive pedagogical mastery, relating to the development of teacher subject content and pedagogical knowledge respectively. This might not seem surprising, since numerous research suggests that teachers with greater subject knowledge in and understanding of mathematics tend to have stronger TSE for teaching the subject (Bates, Latham, & Kim, 2011; Hossain, Mendick, & Adler, 2013; Newton, Evans, Leonard, & Eastburn, 2012; Stevens, Aguirre-Munoz, Harris, Higgins, & Liu, 2013; Thomson, DiFrancesca, Carrier, & Lee, 2017, 2021), although it has been speculated that such an effect might be more pronounced in

cultures which put an emphasis on teachers being seen as experts in their subject field (Fackler, Sammons, & Malmberg, 2021). However, Palmer (2006) defined cognitive mastery experiences as the "success in understanding something rather than success in doing something" (p. 339), which is at odds with Bandura's emphasis that "[t]here is a marked difference between possessing subskills and being able to use them well under diverse circumstances" (Bandura, 1986, p. 391). This means that although knowledge can be seen as a prerequisite for success, it is not sufficient for that success (Zee & Koomen, 2016). In other words, knowledge alone does not guarantee strong TSE (Ma & Cavanagh, 2018), since it does not directly provide information about one's ability to utilise it in action. As a teacher in Ma and Cavanagh's (2018) study explained: having knowledge means that "in theory, I believe I can do the above [but] in practice I'm not sure that's true yet" (p. 142).

Indeed, although those who do not have extensive subject knowledge frequently struggle with their TSE (e.g. Gresham, 2007), those with strong subject knowledge are also not immune to experiencing doubts in their ability to teach (Bruun & Evans, 2020; Ma & Cavanagh, 2018; Marschall, 2021; Watson & Marschall, 2019; Yurekli, Bostan, & Cakiroglu, 2020). For example, Evans (2011) discussed how attendees of mathematics methods course on an alternative teacher education recruitment programme showed improvements in their mathematics pedagogical and content knowledge, but no improvements in their TSE for teaching mathematics. Ekstam, Korhonen, Linnanmaki, and Aunio (2018) showed that teachers with strong mathematical content knowledge judged their TSE in the domains of motivating students or adapting instructions to individual needs as low, while their colleagues, who were "special education teachers had higher efficacy beliefs regarding the teaching of mathematics to low-performing students" (Ekstam et al., 2018, p. 64), despite reporting lower subject content knowledge. A similar phenomenon is evident in this study, where all pre-service secondary mathematics teachers have strong subject knowledge, yet all experience doubts in their TSE (Marschall, 2021; Marschall & Watson, 2022; Watson & Marschall, 2019). In short, although the interaction between knowledge and TSE can be seen as complex, knowledge represents a necessary but not sufficient pre-requisite for teaching and TSE appraisal. Consequently, I argue that knowledge is to be seen as a factor playing a role in TSE appraisal, and not, as in Palmer's (2006) suggestion, as a direct source of TSE (Morris et al., 2017). I shall return to this issue throughout the article.

3. Methodology

Although research in TSE has been prominent for several decades, the field remains saturated with quantitative studies which (Morris et al., 2017), I argue, although informative, limit the treatment of TSE to a personal *belief*—a belief which can apparently be easily identified and measured (Marschall & Watson, 2022). Yet, the term *belief* itself, suffering from a definitional confusion (Leder, 2019), has long been seen as "a strong magnet for ontological collapses which obscure complexity and the situatedness" of human functioning (Heyd-Metzuyanim, 2019, p. 5). Consequently, this conceptualisation of TSE limits the scope for meaningfully investigating TSE, which can be seen as a highly complex narrative self-schema constructed by individuals in the process of meaning-making of their experiences (Marschall & Watson, 2022; Narayanan & Ordynans, 2021). As such, TSE is future-oriented but its appraisal engages in meaning-making of individuals' past and present experiences as well as future goals and aspirations (Marschall & Watson, 2022).

Such a conceptualisation of TSE aligns with philosophical

premises of phenomenology. Usher (2009) advocated for phenomenological approaches in investigating self-efficacy—approaches which enable researchers to examine different conditions of one's experience appraisal and related meaning-making. Indeed, phenomenology focuses on sensemaking or “how particular experiential phenomena have been understood from the perspective of particular people, in a particular context” (Smith, Flower, & Larkin, 2009, p. 29). In accordance with these, this study is phenomenological, paying attention to teachers' reflections and thinking (Siwatu et al., 2016). Utilising Interpretive Phenomenological Analysis (IPA, Smith et al., 2009), it focuses on a close examination of participants' sense-making of their experiences (Smith et al., 2009), in the process of narrating their professional journeys (Bruner, 1990; Marschall & Watson, 2022).

3.1. ITE programme

The secondary mathematics Initial Teacher Education (ITE) is a one-year university-led programme in England, a successful completion of which leads to the award of a Postgraduate Certificate in Education and a Qualified Teacher Status. The programme is founded on a university-school partnership, where both partners are equally involved in and responsible for the pre-service teachers' education and progress. A substantial part of the course (over 80% of the 36 weeks) pre-service teachers spend in practicum (across two different school placements). From September to December the time is divided between the university and the first school placement (PP1) in the ratio of 3:2 days per week, respectively. In January, the university-based sessions pause and from then on the pre-service teachers spend all their time in their second school placement (PP2).

During their time in schools the pre-service teachers engage in activities which relate to all aspects of the profession: being both a form tutor and a classroom teacher, participating in whole-school and departmental meetings, communicating with parents, observing practice, planning and teaching lessons, and assessing students' work. The pre-service teachers' teaching load increases gradually over the year. In the first 2 weeks of PP1, the pre-service teachers observe practice and learn about the school environment, culture and the students they are soon expected to teach. In the third week, while still observing practice, the pre-service teachers begin teaching, first parts of lessons and then slowly progressing through to teaching lessons in full (the pace of the progression depends on each individual). By the end of the year, the pre-service teachers' teaching load reaches at least 60% of that of a qualified teacher's full timetable.

3.2. Participants

Among pre-service teachers who enrolled on the programme in September 2018, 12 teachers volunteered to participate in the study. All volunteers took part in an initial interview, which focused on the pre-service teachers' experiences in the field of mathematics teaching and their thoughts, worries and anticipations in relation to the upcoming year and their future roles as mathematics teachers. The interview data and background information about each volunteer, available through the process of university application, were used to select four unique cases from the volunteer pool.

The selection process was twofold. First, individuals had to be open and elaborative. Secondly, the selection process focused on, so called, replication design, which revolved around considerations of “what can be learnt from the particular case” (Cohen, Manion, & Morrison, 2011, p. 129)—similarities between cases were expected to aid literal replications; differences were expected to “predict contrary results but for anticipatable reasons (a theoretical

replication)” (Yin, 2018, p. 55). All participants had strong mathematics subject knowledge, sufficient to teach mathematics at secondary and post-16 levels (entrants to the ITE programme hold at least an undergraduate degree with 50 per cent or more mathematical content and all undertake subject knowledge audit during the year). Participants' characteristics are presented in Table 1.

3.3. Data collection

The study utilised multiple sources of data: written weekly reflections, weekly planning documents, five lesson observations (recorded in field notes) and five semi-structured interviews (transcribed verbatim). Data collection process was divided into five blocks. In every block the participants' written weekly reflections and planning documents were collected. At the end of every block a lesson observation was conducted. Data from the three sources were pre-analysed and used in the construction of the end-of-the-block interview, which consisted of two parts. The first part focused on a cross-examination of the already collected data. This gave an opportunity to delve deeper into the participants' reflections and elaborations. The second part focused on exploring aspects of the participants' TSE development, in which they were asked to discuss their judgements of their ability to execute different aspects of teaching and to identify and elaborate on possible sources of the construction of these judgements. To avoid introducing bias towards the theoretical framework, this was done without an explicit regard for Bandura's (1997) framework, focusing instead on what participants deemed important.

3.4. Data analysis

Guided by IPA (Smith et al., 2009), the analytical process was iterative. First, during a data familiarisation stage, comprehensive descriptions of the participants' interpretations of their experiences and interpretive notes which considered questions and/or possible explanations related to those interpretations were constructed. The second stage involved coding (presented in Table 2) of specific elements of the data related to TSE, its sources and interacting factors (e.g. teacher knowledge, teacher identity). This was followed by exploring the function of different elements and their significance (the frequency of specific accounts was seen as an indication of relative importance of specific items, based on the assumption that, in the process of sensemaking individuals select events which they consider to be of particular importance (Trzebinski, 1995)). This article reports on one aspect of this study—Bandura's (1997) four self-efficacy sources and their role in the process of TSE development, as conceptualised by the participants.

4. Findings

4.1. Mastery experiences (ME)

As in previous research, ME were considered the most significant source of TSE (Gale et al., 2021; Ma & Cavanagh, 2018; Neumayer DePiper et al., 2021; Yada et al., 2019), since they were seen to represent the most tangible and realistic evidence of one's capabilities (Bandura, 1997). For example, Laura explained that “it wasn't until I actually started delivering the lessons myself that my confidence for being able to do things started to grow in myself”. Nathan emphasised that “more time in the classroom is a much more productive” way of appraising TSE, since “there is only so much you can gain by watching somebody”.

At first, the participants' reflections seemed to suggest that it was the sheer act of doing that was particularly appreciated as a positive source of TSE appraisal. For example, Katie highlighted

Table 1
Participants' profiles.

Pseudonym	First language	Fully educated in the UK?	Highest academic qualification	Previous working experience	Personal characteristics (*as described by the participants themselves ^a as assessed on the course)
Jacob (born in France to English parents)	Bilingual (French and English)	No (educated in France up to including secondary education)	Master's degree General Engineering	None	Confident* and proactive Has very high expectations of himself* Has strong subject content knowledge ^a Doubts his pedagogical knowledge, which he sees as required to teach in the UK*
Nathan	English	Yes	Master's degree Physics	None	Confident*, outgoing, positive and enthusiastic* Has strong subject content knowledge* ^a and confidence in his ability to teach*
Katie	English	Yes	Master's degree Astrophysics	None	Quiet*, shy*, softly spoken and disliking confrontations* Has a tendency to worry* and to expect pessimistic outcomes* Has strong subject content knowledge* ^a
Laura	English	Yes	Bachelor's degree Mathematics	Financial industry (8 years)	Feels unsure about her teacher persona due to looking young* Confident, ambitious*, independent* and pro-active Driven to persevere despite difficulties Has strong subject content knowledge ^a Doubts her subject content knowledge due to the break between her own education and the current moment*

Table 2
Examples of data codes related to TSE and its sources.

Code example	Expression
Teacher self-efficacy	
Teacher self-efficacy	<i>I do not know how I will be able to manage the students. I'm not sure how confident I would be with [motivating] someone who already really thought they didn't like maths and didn't want anyone to be breaking that barrier down.</i>
Sources	
Mastery experiences (ME)	<i>... it wasn't until I actually started delivering the lessons myself that my confidence for being able to do things started to grow in myself.</i>
Vicarious experiences (VE)	<i>Seeing her limits enables me to put things on a measurable scale and my doing a similar, or even better, job becomes a possibility.</i>
Social verbal persuasion (VP)	<i>I think my confidence is going alright but if my lessons are ok, it would be nice if she said. And if it's not, then it'd be nice if she gave me some advice on how to improve it. Otherwise, I just feel like I don't really know where I stand.</i>
Physiological and affective states (PAS)	<i>I also realise that I could have just stopped them halfway through and just reiterated those instructions. But I was, kind of, too scared to do that at that point.</i>

“just the number of lessons that I taught ... [was] probably the biggest factor” in developing her TSE. This seemed contrary to Morris et al. (2017) who advocated conceptualising ME “in terms of the outcomes of teachers' direct actions rather than their mere exposure to teaching experiences” (p. 822). The follow-up interviews revealed, however, that the accumulation of ME was indeed considered in terms of success, attributed directly to one's own actions. Nathan explained:

Doing things myself definitely has the biggest impact for me feeling more confident in my capabilities. I think because if you do something and see that it goes well and it's a result of something that YOU've¹ done, then that makes you feel more confident.

The significance of ME depended on two aspects. First, successful ME were not to be sporadic, but required success to be sustained in numerous lessons over a long period of time. For example, when discussing assessment for learning (AFL), Jacob said that, in order to be able to say that he “can now do AFL, I needed to have a number of lessons, in which I successfully worked out what pupils were thinking”. Secondly, reflecting theory (i.e. Bandura, 1997), the most powerful ME were those which provided challenge that was overcome with minimal or no assistance from others (particularly later in the year when the pre-service teachers were assuming sole responsibility for their students' learning). In contrast, ME with high mentor involvement were seen as

undermining one's TSE.

Beyond those, ME played a significant role in affecting other TSE sources—an aspect not previously discussed in research. First, a growing accumulation of ME affected the nature of VE over time. Initially, before any meaningful ME took place, VE played a significant role in providing the pre-service teachers with information about the teaching profession and informed them about what kind of pedagogies were possible to execute in the classroom and to what effect. These were often accepted at face-value. With increasing ME, the pre-service teachers were developing their understanding about the context and about their own struggles and limitations. This allowed them to pinpoint specific aspects of their teaching that they felt required improvement, and to shape specific focal points for further observations. This shifted the role of VE from exploratory to diagnostic, which was then seen to aid the rate of one's progress. Nathan explained:

Before you've been in a class, focusing [observations] on behaviour is all well and good but if you know that you struggle with one or two slightly more disruptive pupils who aren't doing anything, then when you're observing other lessons, you can focus on how the teacher would deal with that. But unless you have that focus, it's more difficult. And so, I feel I've been gaining confidence in my abilities quite quickly in that I can now, in observations, be much more effective.

Secondly, ME were seen to help alleviate negative emotions (an aspect previously discussed elsewhere—Ruble, Usher & McGrew, 2011). All four participants explained that any interruptions in

¹ Nathan's emphasis.

ME, like the winter break, undermined their TSE, leaving them feeling "... [not] up to the same level of confidence as before" (Laura) and "more vulnerable to ups and downs" (Jacob). They explained that "unless [they] stepped into the classroom (...) nerves [were] building up" (Katie) and they were becoming overwhelmed by anticipation and worry. Re-engagement with ME was seen to help alleviate this negative PAS. These aspects suggest that early engagement with ME should prove beneficial in developing TSE (e.g. Klassen & Durksen, 2014; Yada et al., 2019), even despite previous worries that early teaching experiences can be particularly "exhausting or overwhelming" for novice teachers (Gale et al., 2021, p. 11).

4.2. Vicarious experiences (VE)

As in previous qualitative research, VE were considered an important source of TSE (Bruce et al., 2010; Cakir & Alici, 2009). They were seen as significant in providing opportunities for making referential comparisons (e.g. Gale et al., 2021), the effects of which depended on the gap between the observer and the observed (Bruce et al., 2010). For example, observing flawless actions of others which were far beyond one's own capabilities was often disheartening. Jacob reflected on this, saying:

My mentor (...) has been really interesting for me to observe. Her explanations are clear and to-the-point, and I can tell that they have been developed and optimised by years of experience and adjusting. She is very fast at solving problems at the board and finding the best response to questions. Handouts, homework, sanctions all run like clockwork. (...) All this is a bit daunting! How can I possibly meet the standards?

However, when the capability gap appeared smaller, especially in moments when experienced teachers struggled in some aspects of their teaching, the referential comparison had a more positive effect on TSE. Explaining this, Jacob continued:

I do find relief in observing her mistakes and struggles (she is human too!). For example, she finds the lower sets tiring and has to deal with a lot of misbehaviour. I had the pleasure of teaching some great lessons with the same class: a great confidence boost. Seeing her limits enables me to put things on a measurable scale and my doing a similar, or even better, job becomes a possibility.

In short, while observing models of flawless execution of difficult tasks or a perfect overall management of the demands of the job was often daunting or overwhelming for the pre-service teachers, seeing struggles of others provided some comforting reassurance.

The role of VE in this study, however, went beyond the referential comparisons—being recognised also as providing access to pedagogical knowledge "in action" (Katie), which offered blueprints for how effective lessons could be structured and executed, and which helped the pre-service teachers to learn about manageability of different tasks in particular contexts. These VE were in the form of pre-planned lessons or observations, and were considered particularly significant when the pre-service teachers had limited classroom experience. For example, for Jacob this type of VE allowed him to become accustomed to "what people are used to or what's a typical way of teaching" mathematics in the English classroom. This role of VE went beyond developing knowledge as it allowed the pre-service teachers to appreciate practicalities related to task execution. In other words, it related to the acts of utilising pedagogical knowledge as opposed to developing the knowledge

itself. This differs from the cognitive mastery experiences suggested by Palmer (2011), which were defined in terms of understanding of pedagogical concept.

This supports previous calls for recognising modelling as an important type of VE as a TSE source (Bautista, 2011; Martinussen, Ferrari, Aitken, & Willows, 2015; Palmer, 2011) and aligns with broader theoretical principles:

By their behaviour and expressed ways of thinking, competent models transmit knowledge and teach observers effective skills and strategies for managing environmental demands (...) Modelled transactions may reveal the tasks to be more or less manageable, than the observers originally believed. Adoption of serviceable strategies and altered perceptions of task difficulty will change beliefs in one's capabilities (Bandura, 1997, p. 88).

Important to note here, however, is the aspect of limited prior experience of pre-service teachers who, consequently, might be more likely to rely on such modelled behaviour than their more experienced colleagues (Bandura, 1997).

Palmer (2011) pointed out that multiple VE, which provide a repetitious familiarity with teaching, can play an important role in alleviating fear and stress. The findings of this study, however, caution against a prolonged over-reliance on VE, which itself has a potential to induce stress. For example, Laura explained how accumulating observations at the start of the year made her feel "a bit more nervous about the teaching", since by the time she stepped into the classroom, the accumulation of ideas made teaching seem overly complicated and "like a bit of a big deal, because I'd had so much to think about by that point - I'd done all those observations and I was thinking about 101 different things". This discrepancy with Palmer (2011) might relate to the way in which VE interact with ME early on in teacher professional journey. As Nathan pointed out, observations without practice can verge on meaningless when one has still relatively limited understanding of teaching:

I didn't find observing teaching to be that useful at the start of the course. I think that until you have some experience in teaching it's very hard to pick out what the teacher is doing and why.

This suggests that, in order to be helpful, VE should be accompanied by ME relatively early on. Otherwise they can either become overwhelming or meaningless. Regarding the former, the co-inclusion of ME can create opportunities for teachers to put new knowledge into practice before there are too many new ideas to think about at any one time. Regarding the latter, ME can help teachers develop understanding of their own teaching with all its nuances, which can then help shape more meaningful observations.

4.3. Social and verbal persuasion (VP)

VP were seen by the pre-service teachers predominantly as mechanisms validating their capabilities (e.g. Gale et al., 2021). They took several forms which included: discussions with others who had similar experiences, feedback on teaching, discussions about forthcoming lessons combined with feedback on lesson plans, encouragement and support from colleagues, experienced teachers taking an interest in the pre-service teachers' work or using their resources, being offered a job. As in previous research (e.g. Gale et al., 2021), among all these, feedback from credible others was considered to be the most significant VP source of TSE. Laura pointed out that, although she herself felt growing more

confident in her teaching, receiving reassurance and guidance from her mentor was essential:

I think my confidence is going alright but if my lessons are ok, it would be nice if she said. (...) Otherwise, I just feel like I don't really know where I stand.

As in previous research, among the different characteristics of feedback, the most significant were specificity (e.g. Tschannen-Moran & McMaster, 2009) and balance (e.g. Hattie & Timperley, 2007). Feedback had to focus on specific aspects related to actions—"the more specific the feedback the better" (Katie), attending not only to what had been done and how but also providing "some advice on how to improve" (Laura). Feedback had to be honest but balanced (e.g. Hattie & Timperley, 2007), focusing on both weaknesses and strengths of the pre-service teachers, while weighing those against the pre-service teachers' vulnerability. For example, at the start of the year, the pre-service teachers felt much more vulnerable and less able to cope emotionally with too much constructive criticism. This was particularly pertinent in the case of Katie and Jacob who had tendency to take constructive feedback personally and to misconstrue it as simply negative. Katie felt often overwhelmed because "[there was] so much I need to improve and all those different ways of trying to get there"; Jacob saw constructive feedback as a reflection of him as a "bad teacher", making him continue "questioning one's qualities". Consequently, it was important for feedback to be executed with care (e.g. Klassen & Durksen, 2014), focusing on individual particular capabilities as opposed to mere deficits which were in need of rectification (Morris et al., 2017). Emotional vulnerability could also, of course, be momentary, affected by difficulties experienced in both professional and personal lives. For example, feedback grew in significance for a generally proactive and independent Laura when she started experiencing emotional difficulties in her personal life and did not feel able to analyse her own teaching effectively.

Although the findings might support Klassen and Durksen's (2014) worries that honest feedback can act as a "double-edged role" (p. 167), they also suggest that such a double effect is not necessarily fixed throughout their year. Burn, Hagger, and Mutton (2015) previously pointed out that the pre-service teachers' particular orientations towards responding to feedback can reside anywhere along the spectrum between a "tendency to be disabled by critical feedback" and "effective use of feedback to further learning" (p. 39). Self-efficacy theory suggests that this orientation is not necessarily fixed but that it is bound to change with one's growing sense of TSE—i.e. the more efficacious one is, the less likely they are to be affected by negative experiences (Bandura, 1997). Such an effect was indeed observed in this study where, as the pre-service teachers progressed through the year and continued developing their TSE, they were growing more resilient and less affected by constructive criticism related to their teaching. The growing resilience and better understanding of the different aspects of teaching and of themselves as teachers meant that the significance of feedback was generally decreasing throughout the year for all participants. Since, with time, the pre-service teachers were able to more accurately attribute success to their own actions, they were growing more inclined to appraise their TSE on the basis of enactment and self-reflection. Nathan pointed out that towards the end of the year he already had a "pretty good idea of how it was going and subsequent feedback from mentor, especially in a form of praise, was becoming fairly meaningful".

Previous research suggested that VP can help individuals develop strategies for overcoming difficulties (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). As we know, although some teachers are able to confidently capitalise on negative enactive experiences,

others experience them as a threat for their TSE (Gale et al., 2021). In such cases, "guiding early career teachers to reflect on and perhaps even reframe negative teaching experiences may be a promising approach to protecting teachers' sense of efficacy at the early stages of their careers" (ibid., p. 13). In this sense, feedback can help pre-service teachers understand the specific issues that require their attention as opposed to developing a general feeling that one is simply not able to teach; it allows one to base their own assessment of their actions on "more objective facts than own feelings" (Jacob). Nathan illustrated this effect, explaining how feedback from his mentor helped him steer away from focusing only on negative aspects of his lessons towards more general progress:

My lessons this week, I don't think have been my best in the classroom. I've felt a bit more uncertain and been aware of myself, getting my words muddled or not giving instructions as clearly as I could have. It was reassuring when my mentor pointed out the main thing: that the students learnt and gained understanding during the lesson; if anything, better than before because, even if my delivery could have been more fluid, my selection of tasks and examples was far better than before.

In order to aid the development of reflective skills, however, the possibility to actively engage with the feedback seemed essential. Nathan explained how verbal feedback allowed him to interrogate it as it was unfolding:

... being able to discuss feedback with someone is far more productive. It allows you to dig deeper and question what is being said and why.

Such a constructivist form of VP, which contributes to the development of one's observational and reflective skills, has previously been advocated as the most significant approach to TSE development (Richter et al., 2013).

The significance of feedback on TSE depended also on who it came from; with feedback from students being particularly powerful (e.g. feedback from happy or "applauding" (Jacob) students boosted TSE, whereas the effects of students communicating lack of understanding or feeling lost in the lesson were negative). For Katie, who saw herself as "young", the most significant feedback was one provided by young colleagues who were relatively new to the profession, and who Katie could associate with easily. She explained that, in contrast to an experienced mentor, feedback from such individuals "could affect my confidence much more, as there was common understanding between us". In contrast, generally confident Nathan had the greatest appreciation for feedback from the figures of authority (i.e. university mentors, professional tutor), seeing it as more credible, validating and important. He explained that "approval from people who know what they're talking about is quite nice". Although this important positive effect was also previously discussed in other studies (e.g. Glackin, 2019), the context of this seems particularly important. That is since in more hierarchical cultures VP from the individuals in the position of power can have potentially derogatory effects when being perceived as an assessment as opposed to a constructive appraisal (Yada et al., 2019).

The above-discussed forms of VP align with Morris et al. (2017) who advocated that "social persuasions [as a TSE source] should be operationalized in terms of social messages that convey capability-related information" (p. 814). However, although Morris et al. (2017) concluded that there is no sufficient evidence to suggest that general social support can be considered as a "useful proxy for

social persuasions” as a TSE source (p. 814), it was evident in this study that general reassurance and social acceptance can also be significant in aiding TSE appraisal (Marschall, 2021). For example, describing herself as “look [ing] too young” and “not like normal teachers”, throughout the year Katie continued to struggle with her sense of teacher identity, which factored heavily in her TSE appraisal (Marschall, 2021). In dealing with this issue Katie relied heavily on social acceptance, developing relationships with students (Pillen, Beijaard, & den Brok, 2013), non-verbal interactions (Carter, 2013) and social support in developing her teacher identity—all contributing to her appraising her TSE more positively. Katie described this in the following example:

Once I've been on the block [second] placement, I've had much more chance to, kind of, develop and talk to other teachers more and get to know them. And that was nice. Just that community really, just made me feel more, kind of, in place in the school and made me not to feel so on the outside and that, in a way, somehow affected my confidence 'cause I didn't feel like an annoyance but more like a teacher. This really helped me feel more confident about being able to teach and manage students.

In other words, social validation, albeit indirectly, played a significant role in her TSE appraisal (for more details, see Marschall, 2021). A similar effect was previously discussed by Guan and So (2016) in the study of self-efficacy in health-related behaviour, which concluded that “social support [is] a crucial mechanism through which social identity can exert its influence on self-efficacy” (p. 598). Naturally, there remains a question of whether this means that such general social acceptance and social support can be considered as a ‘source’ of TSE. Bandura (1997) emphasised that social sources of TSE are represented by “verbal persuasion and allied types of social influences that one possesses certain capabilities” (p. 79); influences which can often be conveyed subtly and indirectly. Consequently, one cannot help but wonder whether, since we associate one’s affirmation of professional identity with successful role enactment (Brenner, Serpe, & Stryker, 2014), it seems too far-fetched to accept that a social validation of one’s teacher identity might in fact be seen as a TSE source through indirectly affirming one’s sense of competence. The case of Katie certainly seems to support such a suggestion.

4.4. Physiological and affective states (PAS)

Among PAS as a TSE source those most frequently discussed were: high negative arousal before lessons (which tended to be exacerbated by prolonged periods of not teaching) or heightened affect experienced in the moment of teaching. Excitement and happiness related to classroom atmosphere or students’ expressed satisfaction, experienced as “enjoyable and tremendously satisfying” (Jacob) or “fulfilling” (Laura), were understood as indications of successful role enactment and provided direct boosts to TSE (Aloe et al., 2014; Gale et al., 2021; Katz & Stupel, 2016; Klassen & Chiu, 2010; Morris & Usher, 2011; Wang, Tan, Li, Tan, & Lim, 2017). As Nathan pointed out, “if you enjoy it more then you feel like you’re doing a better job”. Contrary, feelings of being “completely out of control” (Jacob), “exhausted” (Laura), “less relaxed” (Nathan) or “uncomfortable” (Katie) were seen as having derogatory effects on TSE.

Similarly to previous research, however, although seeing affect as a significant source of TSE, the pre-service teachers did not elaborate on it at length unless prompted. This, once again, raised a question about affect-related data scarcity, on which a narrative perspective on TSE can help shed some light (Marschall & Watson, 2022). Morris et al. (2017) speculated that it is “possible that

individuals underestimate the importance of [affective] experiences because their influence tends to be ongoing rather than episodic” (p. 815). It is also often emphasised that it is not the affective experiences themselves but rather the individuals’ meaning-making of those which informs TSE appraisal (Bandura, 1989; Marschall & Watson, 2022; Morris et al., 2017). The narrative perspective on TSE illustrates how its appraisal revolves around affective episodes in moments in which individuals experience incongruencies or discrepancies arising in their ongoing self-narratives (Archer, 2000; Bandura, 1989; Bruner, 1990; Garner & Kaplan, 2019); experiences which individuals make sense of in light of their ongoing life stories (Marschall & Watson, 2022). These affective experiences relate to all spheres of individuals’ lives—natural, performative and social (Archer, 2000). The findings of this study help illustrate this perspective. For example, when making sense of affective moments in his lessons, Jacob frequently discussed stress and feelings of worry related mostly to his lack of familiarity with the English mathematics education system and, consequently, the lack of enculturated pedagogical subject knowledge related to mathematics, which he saw as significantly different to the one he had been exposed to in the French system. These worries continued to raise Jacob’s doubts about his TSE, particularly in the context of being able to respond to contingent classroom situations. Reflecting on this, Jacob recalled:

My worries come from whether I will be able to adapt to the English system quick enough, not be put on the spot by something I don't know about the English system that pupils might ask me about. Or a specific piece of vocabulary I might not have used before or a specific method that it's evident for students but I'm not so familiar with. That could happen.

This momentary anxiety related to a lack of culture-specific pedagogical subject knowledge aligns with numerous previous findings (e.g. Bautista & Boone, 2015; Phan & Locke, 2015; Wang, Tsai, & Wei, 2015). However, while previous studies suggested conceptualising teacher knowledge itself as a self-efficacy source, here I draw attention to affect associated with that knowledge as a TSE source. This, once again, leads me to rejecting Palmer’s (2006, 2011) cognitive content and pedagogical mastery as TSE sources, and focusing instead on the way the information of one’s limited knowledge and capability in the moment is experienced—and that is through PAS.

In the case of Katie, the affect frequently discussed related to her personal view of herself. As an individual, Katie described herself as shy, “disliking confrontations”, “pessimistic” and “looking too young to be a teacher”. This, as she explained, made her feel anxious and intimidated by the students (especially those who she did not yet know or those who were older) (Marschall, 2021). This feeling of intimidation, discussed previously in other research (Wang et al., 2017), led Katie to experience a “mental block”, preventing her from acting in the moment and continuing to undermine her TSE, specifically in the context of classroom management and contingent situations. Explaining these, Katie said:

I do not know how I will be able to manage the students (...) students not respecting me as a teacher because I look very young (...) scares me.

For Nathan, falling ill and “prematurely increasing workload” left him feeling “exhausted both mentally and physically”. This had an immediate effect on his TSE—making him doubt his ability to teach his lessons well. Nathan explained:

I am exhausted both mentally and physically, feeling like I've taken a beating over increasing my teaching load prematurely (...) I think that [being ill] was the main reason I was feeling less confident in my ability to teach. Because I was ill and trying to teach when you're ill wasn't overly fun (...) Yeah, because you're less relaxed and you're feeling less comfortable.

For Laura the general feeling of being in control of her learning and of content with her ability to teach changed during the remaining six weeks of the course when sudden difficulties in her personal life started to affect her emotional well-being. Negative emotions and fatigue had an instant effect on Laura's TSE, as she did not feel in the right "headspace" to be able to teach. Laura explained this by saying:

I have some personal issues happening at the moment and this is definitely affecting my ability to teach. (...) I feel that I know what I need to do. I just need to be able to do it in front of the class and also be in the right headspace to do it.

The above excerpts represent only a few of many examples of the participants' elaborations on their affective moments in the classroom which, although were not directly related to the act of doing itself, affected the pre-service teachers' TSE appraisal. This provides a new perspective on PAS as a TSE source, which goes beyond action-related affect; a perspective which, if accepted, helps explain the scarcity of evidence of PAS in TSE development. The act of narrativising around PAS can go easily unnoticed since it becomes apparent mainly during a conscious or prompted meaning-making process. On the one hand, the meaning-making processing of affective moments is not always actively brought to our consciousness, particularly with growing level of competence and automatization of routinised action (Cohen et al., 2011; Markus, 1977). Indeed, with growing competence individuals are likely to experience more positive affect, which tends to have less significance for cognitive processing. As emphasised by Bruner (1990), if things are as they should be active reflections and sense-making are unnecessary. On the other hand, even when brought to our consciousness, negative PAS is not always imminently considered as relevant to TSE, due to not being seen as action related. As this study shows, however, this broader conceptualisation of PAS is necessary in helping us understand better the role of PAS in TSE appraisal.

5. Conclusions and implications

This phenomenological study, which focused on pre-service mathematics teachers' reflections on and meaning-making of their experiences, contributes to furthering our understanding of TSE sources in ITE. It brings to light many results which, in different methodological designs, could have remained unnoticed, even by the teachers themselves (Philippou & Pantziara, 2015). The findings reiterate that although ME might be considered to be the most significant TSE source (Gale et al., 2021; Ma & Cavanagh, 2018; Neumayer DePiper et al., 2021; Usher & Pajares, 2008; Yada et al., 2019), they are not sufficient for TSE to develop effectively. In other words, ME are rarely considered alone in teachers' TSE appraisal, since they are involved in a continuous iterative loop with the other three sources—and this interaction and co-influence between the four sources must not be underestimated (Glackin, 2019).

Speaking specifically, ME were seen as providing the most authentic and tangible evidence of teachers' capabilities in carrying out an action (Bandura, 1997), particularly when they were

challenging and enacted with limited support from others. In addition to that, ME played a significant role in influencing other TSE sources. First, despite previous suggestions that early ME can be experienced as stressful and overwhelming (Gale et al., 2021), in this study ME were seen to help alleviate negative arousal building up when the pre-service teachers had limited opportunities to enact practice while being exposed to too many VE. Secondly, ME were seen to influence the significance and the nature of VE. With greater understanding of one's own limitations through ME, VE grew more diagnostically-focused, meaningful and useful as the year progressed. Thirdly, accumulation of ME increased their significance while decreasing the significance of VP. That is perhaps since, with growing experience and the development of diagnostic and reflective skills, the pre-service teachers' understanding of the profession was increasing, making them more self-reliant in their learning. The exception seems to be for individuals who, due to their particular vulnerabilities (like in the case of Katie—ongoing and Laura—episodic), are likely to distrust their successful enactive experiences, and trust more social validations and feedback than their own judgements (Bandura, 1997).

This leads to further implications regarding earlier conceptualisation of VE and VP as TSE sources. As this study suggests, the conceptualisation of the former should necessarily include VE of knowledge in action, modelling effectiveness of pedagogies in specific contexts (Gunning & Mensah, 2011; Siwatu, 2011) and illustrating tasks' manageability. The conceptualisation of the latter should include two aspects: the elements of social verification and social support (Guan & So, 2016), which mediate the interaction between TSE and narrative identity in the development of competent self (Marschall, 2021; Marschall & Watson, 2022), as well as verbal feedback which provides individuals with opportunities to develop their attentive and reflective skills.

The findings of the study also help explain gaps in previous research related to scarcity of evidence supporting the significance of PAS in TSE appraisal (e.g. Mohamadi & Asadzadeh, 2012; Poulou, 2007), by suggesting the necessity to broaden the conceptualisation of PAS beyond those related directly to classroom actions (Morris et al., 2017) towards all those which contribute to individuals' disfunction and vulnerability in the moment. The narrative perspective on TSE (Marschall & Watson, 2022) helps explain how all aspects of individuals' lives (personal, social and professional) are intertwined in an ongoing narrative, which one needs to continuously reconcile with (Archer, 2000; Marschall & Watson, 2022). As such, dealing with affect in the moment is not episodic but ongoing (Morris et al., 2017), and can easily transfer into the unconscious unless explicitly prompted, particularly with growing competence and skill automatization (Markus, 1977). This perspective on PAS also helps explain the scarcity of data related to positive affect, which reminds us that when things are as they should be we do not tend to explicitly reflect on them, since there is no imminent need to adapt (Bandura, 1989; Bruner, 1990).

To conclude, what we see in this study is a dynamic interaction between the four TSE sources—an interaction hinging on reflective meaning-making processes previously pronounced as the core of teacher learning (Bosman et al., 2021; Harrington & Walsh, 2020; Siwatu et al., 2016; Thomson et al., 2021). This emphasises that considering TSE sources must necessarily go beyond a simple collective of different experiences and towards a dynamic reflective-experiential model in which those experiences influence TSE appraisal and one another. These findings are particularly important in the profession which tends to reduce opportunities for observational learning, social support and reflective practice once individuals move into the field following their ITE. That is despite teachers reporting negative changes in their TSE between the end of their ITE and a completion of their first year of teaching (e.g.

Woolfolk Hoy & Burke-Spero, 2005), reflecting the need for further developmental opportunities, support and guidance while in the profession (Gale et al., 2021). They are important since even teachers themselves continue to pronounce ME as the most significant source of their TSE, potentially underestimating other social, cognitive and affective aspects of their learning (Marschall & Watson, 2019).

The study has further implications specifically for mathematics teacher education, in aspects related to the relationship between TSE and teacher subject knowledge. While it is frequently emphasised that strong mathematics teacher knowledge has a positive effect on TSE (Bates et al., 2011; Hossain et al., 2013; Newton et al., 2012; Stevens et al., 2013; Thomson et al., 2017, 2021), the results of this study emphasize the importance of exercising caution in extrapolating this to a direct causal link between the two. Despite having strong mathematics subject knowledge, all four participants of the study experienced fluctuations of their TSE throughout the year (i.e. their mathematics subject knowledge did not make them immune to experiencing doubts about their capabilities in the classroom). What is evident is that a complex interaction of enactive, social and affective factors was a significant mediator in the relationship between pre-service teachers' knowledge and their TSE; and this is an aspect which must not be ignored.

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Data availability

The data that has been used is confidential.

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