The role of pupils in developing student teachers' knowledge of teaching

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Abstract

Teachers' personal understanding of knowledge and how it is acquired has important implications for their approaches to teaching and engaging pupils in learning. This article extends learning about emergent teachers' professional knowledge by critiquing and theorising survey responses detailing student teachers' experience of teaching during their first and last placements in primary classrooms. These members of a cohort of 120 students on a new BEd degree programme in Malaysia were taught to use action (active learning), reflection and modelling (ARM) in their teaching. A keyword search of the students' accounts is used to examine the way they refer to knowledge and describe how knowledge is acquired. Four of the students' narratives are also analysed in depth using a novel 'Eraut-Shulman teacher knowledge framework', which integrates the expositions of Eraut on different types of knowledge and of Shulman on the knowledge base of teaching. The findings contribute to understanding the role of pupils in developing student teachers' knowledge of teaching and the interrelationship between the personal knowledge of teachers and pupils. In particular, it raises questions about developing 'pathic knowledge', conceptualised by van Manen, which is particularly pertinent in settings in which emphasis is placed on socially mediated learning.

Key-words: Action, reflection, modelling (ARM); Malaysia; student teacher; teacher education; teacher knowledge

Introduction

The purpose of this article is to critique Malaysian student teachers' reports of their placement experience in order to reflect, raise questions, share insights and extend learning about the professional knowledge of early career teachers. It examines in a new way the role of pupils in developing student teachers' knowledge of teaching and the interrelationship between the personal knowledge of teachers and pupils. It also considers the development of their 'pathic knowledge' (van Manen 2008, 19), particularly pertinent in constructivist classrooms where socially mediated learning is emphasised (Windschitl 2002). This article contributes to learning arising from research conducted during a new Bachelor of Education (BEd) (Honours) degree programme implemented in Malaysia (Dickerson et al. 2011; Jarvis et al. 2014; Dickerson et al. 2017; Dickerson et al. 2018).

Knowledge in teaching

Acquiring knowledge for teaching

Loughran and Hamilton (2016, 6) argue that if teacher education focuses on students:

> learning how to manage complex, changeable and uncertain situations on a daily basis, if professional growth through a teaching career is based on developing expertise in making informed decisions about practice in ways that are responsive

> to complex situations based on sophisticated knowledge and thinking, then teacher education most certainly places strong demands and high expectations on students of teaching – as well as their teacher educators.

The 'sophisticated knowledge' of teaching to which Loughran and Hamilton (2016, 6) refer is acquired in educational settings before, during and after initial teacher education. However, the entirety of knowledge used *for* teaching, when practising teaching, derives from knowledge teachers develop throughout their life. The terms '"teacher knowledge" or "teacher practical knowledge"' have been used to describe the composite knowledge and perceptions associated with the act of teaching (Verloop, Van Driel, and Meijer 2001, 446). This includes knowledge from a 'personal knowledge base' (Verloop, Van Driel, and Meijer 2001, 443) and from 'a "knowledge base for teaching"'; 'a codified or codifiable aggregation of knowledge, skill, understanding, and technology, of ethics and disposition, of collective responsibility — as well as a means for representing and communicating it' (Shulman 1987, 4). The contextualised nature of learning (Eraut 2000) means each teacher's knowledge is unique. Developing previous work (Collinson 1996a), Collinson (1996b) recognised three areas of expert teacher knowledge: professional, interpersonal and intrapersonal. Collinson's (1996a, 1996b) model included categories from Shulman's (1987) knowledge base and emphasised individual teacher knowledge characterised by Eraut's (2000, 2004) definitions of personal knowledge and qualities integral to pathic knowledge (van Manen 2008).

Eraut and Hirsh (2007, 6, original emphasis) suggested that *'learning is a process'* and *'knowledge is a state'*. Whilst knowledge is often seen 'as a state of being (or product)', in the context of mathematics teacher knowledge, Scheiner et al. (2019, 168) propose that 'knowing is seen as an emergent process—a process of becoming' implying that 'knower, knowledge, and context' are constantly changing. Could conceptions of knowledge as both an evolutionary process (Scheiner et al. 2019) and as *'a state'* (Eraut and Hirsh 2007, 6, original emphasis) co-exist? In learning situations in which knowledge is in continuous flux and undergoes rapid construction, knowledge might be visualised as a process punctuated by multiple, transient episodes of stasis.

Engaging pupils in learning

An important transition occurs as student teachers use the knowledge of teaching they have acquired in the Teacher Education Institute during their placements and begin to engage pupils in learning. Eraut (2004, 256) saw this as a complex five-stage process involving taking knowledge from a higher education setting, understanding the new setting and 'recognizing', 'transforming' and 'integrating' relevant skills and knowledge with others for use in the new context. A teacher's personal view of knowledge and its acquisition is fundamental to the approach they take to teaching. Where this approach is pupil-focused, knowledge of their pupils' experience of learning is a critical component (Brookfield 2015).

Learning can be understood as an entity or thing as well as a process; thus Brookfield (2012, 136) viewed learning as both a noun to mean 'an identifiable change that has occurred in the learner' and a verb to describe 'the process that contributes to that change'. Baxter Magolda (2004, xviii) focused on the activity, describing 'learning as a complex process in which learners bring their own perspectives to bear on deciding what to believe and simultaneously share responsibility with others to construct knowledge'. This view is consistent with social constructivist pedagogies based on learning theories proposed by, for example, Piaget (1954), Bruner (1974) and Vygotsky (1978). There are diverse and contested understandings of constructivism (Sjøberg 2010). Viewing learning as involving construction of knowledge (Baxter Magolda 2004), as active, aligned with the Ministry of Education Malaysia (2006) mathematics curriculum specifications relevant here. Whilst there are multiple conceptualisations of active learning (Drew and Mackie 2011), here, as Watkins, Carnell, and Lodge (2007, 71, original emphasis) explained active was seen as engaging:

'Behaviourally	*actively using and creating materials*
Cognitively	*actively thinking, constructing new meaning*
Socially	*actively engaging with others as collaborators and resources…'*

The requirements for knowledge construction are 'the *experience* and the *means to transform it',* a process involving reflection and which might be described as '"action-reflection learning"' (Watkins, Carnell, and Lodge 2007, 71, original emphasis). *Action* or *active learning* as conceptualised by Watkins, Carnell, and Lodge (2007) was combined with reflection and modelling to form the pedagogical approach, action, reflection and modelling, (ARM), developed for and endorsed throughout the degree programme. Constructivist approaches differed significantly from traditional pedagogical approaches used in Asian schools at the time of this research (Hallinger 2010). Emphasising constructivism presented challenges, particularly, as Confrey (1990, 111) noted, 'A constructivist theory of knowledge has dramatic implications for mathematics instruction'. Traditionally, learning mathematics in schools was often seen as rote learning specific rules leading to knowledge acquired through being told something and repeatedly practicing it (Davis 1990). Relevant here, an alternative view of knowledge involves acquiring and using 'symbol systems'; whilst this also involves practice 'It might better be described as practice in *thinking'* (Davis 1990, 101 original emphasis).

Windschitl (2002, 143, original emphasis) cautioned that 'To *know about* constructivism, then, is difficult enough, but transforming classroom practice in meaningful, coherent ways requires that one also come to *think as* a constructivist.' It might be argued that one needs to *become* a constructivist in order to use constructivist pedagogies in dynamic, unpredictable settings. Here, such *becoming* would require the student teachers to engage in critical reflection and undergo 'transformative learning', which Mezirow (1997, 11) associated with helping an adult 'become a more autonomous thinker by learning to negotiate his or her own values, meanings, and purposes rather than to uncritically act on those of others'. Mezirow (2004, 70) asserted that it was necessary 'to elaborate on the crucially important roles and relationships of affective, intuitive, and imaginative dimensions of the process'. This alludes to clarifying the contribution to transformative learning of types of personal knowledge recognised by, for example, Collinson (1996b), Eraut (2000, 2004) and van Manen (2008). For learning to be

transformative the students needed to engage in critical reflection (Mezirow 1997). There might be different forms of transformative reflection, that is different things are being transformed. That which is being transformed will always be 'deep', but in different ways, for example, values or conceptions of knowledge, as for these students.

Reflection, a component of intrapersonal knowledge (Collinson 1996b), was the second strand of ARM. Described as 'more than a technique; it is an orientation' (Rodgers and LaBoskey 2016, 72), reflection can be seen as a stance in relation to the practice of teaching. This view of reflection was taken here as the student teachers were encouraged to engage in reflective rather than technical teaching; teaching that involves considering the context of practice and questioning personal values and assumptions (Zeichner and Liston 2014). The role of empathy and its concurrent development has been emphasised in critical reflection associated with transformation (Taylor 2014). van Manen (2008, 20) noted empathy (and sympathy) imply understanding that is, as the words suggest, 'pathic: relational, situational, corporeal, temporal, actional'. It might be argued that ARM involved critical reflection because the student teachers' context made it so due to the nature of the gap between the conceptions of knowledge students brought to the programme, and those promoted throughout it. Maybe this stimulates and demands a high level of cognitive change, but also empathy, which Taylor (2014) associated with transformation.

Reflection has a particular place in constructivism for both teachers and pupils and the student teachers were exhorted to reflect on their teaching and to encourage pupils to reflect on their learning. As Confrey (1990, 109, original emphasis) suggested 'not only can we assert that a constructive process is involved in all acts of perception and cognition, but also that we can gain a measure of access to that constructive process through *reflection'*. She emphasised its importance in mathematics where 'Reflection, as the "objectification" of a construct, functions as the bootstrap by which the mathematician pulls her/himself up in order to stabilize the current construction and to obtain the position from which the next construct can be created' (Confrey 1990, 109). This presents images of learners engaging in considered, creative construction of mathematical knowledge. As teachers engage pupils in reflection, they learn about their pupils' understanding of mathematics and about their own knowledge and practice of teaching. Thus, whilst pupils' reflection should relate to the process of knowledge construction (Confrey 1990), the student teachers should engage in the level of reflection required for 'transformative learning' (Mezirow 1997, 11). This involves 'the transformation of existing knowledge structures; and these transformations are not merely cognitive, but involve transformations of the learner's personality, feelings, and relationships to others' (Fuhr, Laros, and Taylor 2017, x). If the critical reflection required for the transformational learning necessary for *becoming* a constructivist teacher involves transforming *personal* as well as *professiona*l knowledge, relational personal knowledge that arises from and is integral to working alongside pupils, as suggested above, the student teachers needed to engage in such learning in schools.

Modelling, the third strand of ARM, involved the teacher educators modelling their teaching practice to the students who then modelled to their teacher educators and peers in the Institute and to pupils in school. Pedagogical modelling involves teacher educators teaching simultaneously about the content and the act of teaching used to convey it (Loughran 2006). Lunenberg, Korthagen, and Swennen (2007) identified three forms of explicit modelling; whilst

they found some examples of explicit modelling in case studies of ten teacher educators, including examples that involved helping students to translate modelled behaviour into their practice, they did not identify any in which the teacher educator linked their practice to theory. This form of modelling they considered 'would have deepened the student teachers' professional learning' (Lunenberg, Korthagen, and Swennen 2007, 597). Auhl and Daniel's (2014, 377) 'cumulative model of transformative practice' included pedagogical modelling by experienced teacher educators and individual learner reflection as the first and fourth stages of cyclical development of pedagogic skills interspersed by stages involving learner practice and peer dialogue. This allows teacher educators and students to engage in co-constructing knowledge about teaching and could enable students to visualise their future role as teachers as recommended by Montenegro (2020). Auhl and Daniel's (2014) model draws attention to both the collaborative and the individual aspects of using modelling and reflection, two essential components of ARM.

Whilst the forms of modelling described so far often take place between teacher educators and student teachers, the teacher-pupil modelling envisaged within ARM could be described as the following feature of a constructivist classroom: a process in which 'Teachers make their own thinking processes explicit to learners and encourage students to do the same through dialogue, writing, drawings, or other representations' (Windschitl 2002, 137). Exemplary teachers also use modelling to reveal to pupils that teachers are also learners (Collinson 1996b).

A particular feature of modelling accepted within Malaysian culture is the concept of a teacher providing a good example for their pupils (Carr 1993). This concept of 'role modelling' (Sanderse 2013, 28), acting as a role model, was included among references to modelling by Sanger and Osguthorpe (2013) when they analysed 92 responses provided during a survey of preservice teachers in the US. An important finding from that survey was that participants commonly identified modelling as an important feature of the moral work involved in teaching (Sanger and Osguthorpe 2013).

This research study

The BEd degree programme

This research was conducted during a four year BEd degree programme in Primary Mathematics, with English and Health and Physical Education as minor subjects for initial teacher training (2006-2009). The Ministry of Education Malaysia sponsored the University of Hertfordshire, UK, to develop the programme with colleagues from two Teacher Education Institutes in Malaysia. The University was also responsible for programme validation, support and quality assurance. All 120 students who enrolled successfully completed the programme, studying within the Institutes and completing placements in Malaysian primary schools. In Malaysia, compulsory primary education begins at the age of seven and lasts for six years.

The action, reflection and modelling (ARM) pedagogical approach (Jarvis et al. 2014), described earlier, was consistent with the mathematics curriculum specifications (Ministry of Education Malaysia 2006), and the students underwent formative and summative assessment throughout the programme. The reform of mathematics pedagogy (Lim and Chew 2007) was supported by the Government's policy to teach mathematics and science in English (Pengajaran dan Pembelajaran Sains dan Matematik dalam Bahasa Inggeris, PPSMI) (Singh and Sidhu 2010). This policy was implemented during the programme and the Malaysian teacher educators and many of the students were bilingual or multilingual.

Research methods

The research reported here sought to elicit the student teachers' views and experiences of using ARM in school. Most (110; 92%) of the students completed questionnaires in English at the end of their first placement (P1, year 2); and almost three-quarters (87; 73%) at the end of their final placement (P2, year 4). Respondents (R) are designated 'student teacher' or 'student'. Three University colleagues, the BEd degree programme director, a senior teacher educator/researcher, and a research fellow, managed the research in consultation with colleagues in Malaysia. Ethical approval processes were managed by the senior teacher educator/researcher from the University and requisite permissions gained from colleagues in Malaysia. These colleagues administered the questionnaires in Malaysia and all 120 members of the student cohort were invited to participate in the research. The handwritten questionnaire responses were anonymous; these were transcribed and coded by the research fellow who did not know the students and was not involved in any aspect of the implementation of the BEd degree programme.

This article includes responses to the following open-ended questions:

Q1. How did you use ARM on your placement? (or final placement)
Q2. How did it benefit you?
Q3. How did it benefit your pupils?
Q4. What challenges did you experience using ARM? (Final placement: If applicable, please describe how you overcame these challenges).
Q5. What have you learned from using ARM that will influence your practice as a teacher?

These five questions comprised the complete questionnaire at the end of the students' first placement. Two further questions were added to the end of the questionnaire during the second survey in year 4. These questions related to the students' views of successful learners and to biographical information. Using self-completion questionnaires provided an opportunity for all students to contribute to the research if they wished and to reflect on their practice during two of their placements. This method was considered appropriate given the emphasis on reflection during the programme. Possible threats to validity of the data include the students' understanding of the questions and the challenges associated with recalling and writing about their views and

practice. Typically, the students' responses suggested that they understood the questions. Responses were contextualised and often 'meaningful and rich in information' (Schreier 2012, 22). They were also consistent with what was known about the way ARM was taught during the programme and with research data collected from teacher educators and the students' school mentors.

In this article, the students' responses are used to address the following research questions sequentially in the findings and discussion section:

- How do the student teachers acquire knowledge of teaching in class? (What approaches do they use? What role do pupils play in their acquisition of knowledge?)
- How do the student teachers refer to knowledge? (What does their language or vocabulary of knowledge suggest about their understanding of knowledge and its acquisition?)
- What categories and types of knowledge do the student teachers describe in their accounts and how are they using this knowledge?
- What can we learn about the role of pupils in developing student teachers' knowledge of teaching and about the interrelationship between the personal knowledge of teachers and pupils?

Data management and analysis

The research fellow transcribed the survey responses with minimal editing mainly to standardise spellings and abbreviations to support electronic searching. The responses were content analysed (Schreier 2012) initially by categorising response extracts into themes and sub-themes. Subsequently, a search for the words 'know', 'knowledge' and 'knowledgeable' was conducted to identify the data presented here. These words were retained in the original text as 'Key Words in Context' (Ryan and Bernard 2003, 96). The search findings were themed to illustrate how the students refer to knowledge and its acquisition (shown subsequently in Table 2); the approaches they use to gain knowledge of teaching; and some categories and types of knowledge they describe.

The research fellow selected four of the responses identified using the keyword search as interesting cases for further, more detailed enquiry relating to teacher and pupil knowledge. These Accounts 1-4 are presented as complete responses rather than excerpts in the findings and discussion section. They were analysed using a novel 'Eraut-Shulman teacher knowledge framework' (Table 1), which provides a structure and 'language of knowledge' to use to reveal and articulate the disparate types of knowledge alluded to in the students' accounts. The framework combines Shulman's (1987) categories of the teaching knowledge base (rows A-G, Table 1) with three types of knowledge noted by Eraut: cultural (2004, 2007); codified (1985, 2000, 2007) and personal (2000, 2004, 2007) (main columns, Table 1). The three columns, headed cultural, codified and personal, are further sub-divided into dimensions of each of these three types of knowledge (Table 1). Of particular interest in this article are the dimensions of personal knowledge (columns e, f and g, Table 1). Eraut (2004, 264) emphasised the importance and nature of this knowledge, which 'includes not only personalized versions of public codified

knowledge but also everyday knowledge of people and situations, know-how in the form of skills and practices, memories of episodes and events, self-knowledge, attitudes and emotions'. Each of the four accounts is accompanied by a commentary linking the text with the framework in order to learn about the students' understanding of knowledge, focussing particularly on the pupils' role in developing the students' knowledge of teaching. Each account is viewed as a *'vignette* … a vivid account of a professional's practice' (Miles 1990, 37, original emphasis) analysed as a way of 'exploring practice through the application of professional judgment' (Angelides and Gibbs 2006, 120).

Table 1 Eraut-Shulman teacher knowledge framework

	Types/dimensions of knowledge (Eraut)					
	Cultural					
	Codified					
				Personal		
	a and b	*c*	*d*	*e*	*f*	*g*
Knowledge category (Shulman)	Cultural knowledge a) uncodified; b) codified (Explicit)	Codified knowledge (e.g. technical[1]) Explicit	Codified theoretical knowledge Explicit	Personalised codified knowledge (e.g. technical[1]) Explicit or tacit	Personal theoretical knowledge Explicit or tacit	Personal knowledge[2] Explicit or tacit
A: Content knowledge						
B: General pedagogical knowledge						
C: Curriculum knowledge						
D: Pedagogical content knowledge						
E: Knowledge of learners and their characteristics						
F: Knowledge of educational contexts						
G: Knowledge						

of educational ends, purposes, and values, and their philosophical and historical grounds.						

[1] Theoretical knowledge listed separately

[2] Includes 'procedural knowledge and process knowledge, experiential knowledge' (Eraut, 2000, 114) 'also everyday knowledge of people and situations, know-how in the form of skills and practices, memories of episodes and events, self-knowledge, attitudes and emotions' (Eraut, 2004, 264)

Using the first two sentences of Account 1 the following example illustrates how the structure and language presented in the teacher knowledge framework (Table 1) was used in analysing the accounts.

> *Account excerpt:* 'They feel free to have the lessons. For instance, they are eager to answer my questions under an enjoyable and relaxable environment while we appreciate their answers and they feel valued, they would speak out their ideas and we would know what they know & don't know.'
>
> *Analysis:*
>
> *Knowledge category:* E: Knowledge of learners and their characteristics
>
> *Knowledge type:* Personal, columns e, f and g.
>
> *Relevant text:* Pupils' 'feel free'; 'are eager'; 'feel valued'; and 'speak out'
>
> *Knowledge category:* F: Knowledge of educational contexts
>
> *Relevant text:* 'enjoyable and relaxable environment'
>
> *Knowledge category:* B: General pedagogical knowledge
>
> *Relevant text:* Questioning and acknowledging pupils' responses

The responses and data extracts have been selected as 'information-rich' examples (Patton 2002, 230) enabling learning about teacher knowledge. The students' words are retained for reasons advanced by White, Woodfield, and Ritchie (2003, 313 original emphasis); in particular they 'demonstrate the type of *language, terms or concepts*' used and '*portray* the general *richness*' of the responses. The responses were written in English. Whilst this can make exploring subtleties of meaning more challenging, the students' language is central to discussions of their vocabulary of knowledge.

Findings and discussion

Acquiring knowledge of teaching

The students' accounts suggest they are 'learning teaching' in class; as they use knowledge they have *already* acquired of teaching they are transforming that knowledge and acquiring *further* knowledge of teaching. Students explain that they are reflecting on areas for professional knowledge development, possibly using a form of technical reflection, for effectiveness, rather than critical reflection leading to transformation. For example, one student implies they can use reflection to learn how to improve their practice: 'As I do reflection, a little bit I know how to improve myself to be the professional and effective teacher for future practice' (P1-R102: Q2). A peer, however, reflecting on a problem, does not know how to deal with it: 'Sometime when I do reflection on the failure, I did not know how to improve it or solve it' (P1-R36: Q4). Another student recognises that they are developing knowledge of teaching through *knowing* their pupils' feedback. They explain that 'It help me to know my pupils feedback and try to improve my teaching strategies' (P1-R110: Q2), highlighting one way in which pupils contribute to their learning. Arguably, this student is engaging in a more sophisticated form of (empathetic, interpretive) reflection. These responses illustrate differences in the nature and outcome of reflection for three of the students (R36; R102; R110). Perhaps these differences are not surprising. Each student is unique and has their own personal knowledge of teaching; and in response to the questions it seems likely that they are recalling one or more of a range of outcomes experienced through reflecting on different episodes of practice.

Although the students have acquired generic 'knowledge of learners and their characteristics' (Shulman 1987, 8), in school they need to develop knowledge of individual pupils, possibly forty or more per class. In the next response a student explains how they are acquiring knowledge of pupils' learning and understanding. Probing the meaning conveyed in this response reveals something of the depth and complexity of constructivist teaching. Knowing each pupil's position in relation to a particular area of learning is an essential precursor to facilitating their further construction of knowledge. As Scheiner et al. (2019, 165) suggest 'the key is not teachers' capacity to unpack mathematics, but their capacity to unpack students' ways of understanding in order to make students' ways of mathematical thinking visible'. This is an iterative process in every lesson; if seen as individualised for each pupil the extent of the knowledge required for teaching becomes more apparent.

> 'I was able to consider what kinds of learning activities are effective to develop pupils' learning. I could know how far the pupils have learnt; what they already know; what they do not understand; and their learning needs' (P1-R49: Q2)

Whilst many of the students' references to knowledge and the implementation of ARM were positive the next response illustrates a constraint. This response also implies developing knowledge of learners. It describes the reciprocal relationship between teacher and pupils in class, but here the pupils' behaviour means the student is not always 'able to know the pupils understanding'. This presents a challenge to engaging pupils in knowledge construction and

might exemplify a tension between the pupils' familiarity with and expectation of transmission teaching approaches and the reform requirements.

> 'Pupils were not really interested in doing presentation. Once it comes to reflection part, they didn't show their interest to recall back the lesson. This discourage me as sometimes I was not able to know the pupils understanding'. (P1-R63: Q4)

Other students reported experiencing similar challenges. For example, one student commented 'Some pupils did not show their response, so that I didn't know whether they understand about my lesson or not' (P1-R85: Q4) and another highlighted 'Limited time to really know my pupils' ability and performance' (P1-R104: Q4).

Referring to knowledge as teachers

Findings from the search of the data for the term 'know', themed to illustrate how the students refer to knowledge and its acquisition are shown in Table 2 (keyword emphasis added). There were some interesting similarities and differences between the way students used the key words in relation to themselves and their pupils.

Table 2 Excerpts from students' responses: examples of references to knowledge and to acquiring knowledge

Student teachers…
Delivering knowledge
- It also help me in teaching progression because by using ARM, I **know** what I should teach and by doing a reflection, I can **know** what I can do to increase my ability to deliver my **knowledges**. (P1-R71: Q2)
Demonstrating knowledge
- Modelling I used to demonstrate the **knowledge** by using concrete materials once it is reasonable. (P1-R53: Q1)
Giving knowledge
- While I was teaching I had took all the action that I had planned to give my pupils' **knowledge**. (P1-R77: Q1)
Making pupils know
- I also did reflection and modelling that I thought it was important to make pupils **know** their achievement through the appropriate approached. (P1-R76: Q1)
Pupils…
Applying knowledge
- I was able to notice the pupils' learning styles and the way they apply **knowledge** to solve problems. (P2-R39: Q2)
Asking for knowledge

- Pupils will indulge in the learning process as they ask for **knowledge** during the lesson (Active learning) and able to make the subject matter still remain in their mind (Reflection). (P1-R104: Q3)

Building knowledge

- I could help pupils to build up their **knowledge** easier through modelling. (P2-R48: Q2)

Constructing knowledge

- Students always being given their own space in learning to construct their own **knowledge**. (P2-R26: Q1)

Gaining and acquiring knowledge

- The pupils will gained the valuable **knowledges** and ensure them to learn with a full of spirit … Indirectly, the pupils will get diverse of information and acquire the better **knowledges** and understanding. (P1-R99: Q3)

Getting knowledge

- After every end of the lesson, I will revise back whether they have got the **knowledge** that I've taught. (P1-R80: Q1)

Learning knowledge

- They feel fun because they have a lot of time to play and directly help them to learn the **knowledge**. (P1-R5: Q3)

Recalling knowledge

- After their active learning, I guided them to recall on their previous **knowledge** and reflected on their strengths and weaknesses on their learning. (P1-R48: Q1)

Receiving knowledge

- By using this ARM, pupils can receive the **knowledge** easily. (P1-R78: Q3)

Seeing knowledge

- Through the teacher's modelling, pupils can see clearly about the **knowledge** they learn. (P1-R51: Q3)

The assertion 'I must know the way to attract my students to learn' (P1-R37: Q5) summarises an important challenge of teaching. The students' vocabulary of knowledge, how they use the terms 'know' and 'knowledge' implies their understanding of knowledge: what it is, how it is acquired and who 'possesses' it. This understanding will influence their approach to engaging pupils in learning. Some students portray themselves as active in delivering, demonstrating and giving knowledge to pupils; and suggest that pupils receive knowledge and that they can 'make pupils know' (Table 2). This positions teachers as 'knowers', not in the dynamic sense described by Scheiner et al. (2019), but in the sense that they hold 'fixed' knowledge. These concepts are illustrated in the next two responses.

> 'It benefits me a lot in making sure my pupils understood on what they've been taught. Using ARM affect me in achieving clear learning intentions for pupils. In addition, I can deliver the input and appropriate knowledge using new approaches rather than traditional ways. Besides, my teaching and learning sessions become

more fun, enjoyable, entertain, attractive and interesting. Furthermore, it bring up an active learning and I've two-way communications within teacher and pupils.' (P1-R73: Q2)

'By using this ARM, the lesson in a class will running smoothly. It help me to deliver the knowledge to pupils in a easy way that make pupils enjoy and feel comfortable to learn in my class. Besides that, it also help me to create an effective activity that give benefits to them.' … 'By using this ARM, pupils can receive the knowledge easily. Then, it can help them to improve their thinking skill when teacher ask them to make a reflection about the lesson. It also help them to be independent when teacher always make the activity in pupil's centered.' (P1-R78: Q2, Q3)

Other students assert that pupils are asking for, building and constructing knowledge (Table 2), suggesting different understandings of the *nature* of knowledge. Requirements to use constructivist pedagogies meant that the students needed an understanding of teaching as 'co-constructing knowledge *with* students' (Windschitl 2002, 135 original emphasis); an understanding of teacher and pupils as 'us' mentioned in the next response, in which a student views pupils as independent learners. The reference to knowledge construction and the assertion that a pupil's 'reflection can connect their previous knowledge to the new one' illustrates the knowledge-reflection relationship evoked by Confrey (1990, 109) who described using reflection to 'stabilize the current construction' (*'the new one'*) by linking it to previous knowledge so that the learner is in a 'position from which the next construct can be created'. If reflection is a component of intrapersonal knowledge (Collinson 1996b), this student is suggesting that pupils are using personal knowledge to engage in developing mathematical (content) knowledge as they report that ARM:

'… supported my pupils' learning. They constructed new knowledge by their own during the active learning. The reflection can connect their previous knowledge to the new one. The good example showing by me, especially in solving the problem can show us how to solve the problem' (P1-R43: Q3).

Whilst the reference to helping pupils 'build up their knowledge' in the next response might not refer to the knowledge construction associated with constructivism, the knowledge-modelling link is interesting. How might modelling, a constituent of ARM, contribute to developing pupils' knowledge as this student asserts? Noddings (1990, 17) explained that teachers sometimes 'model by asking questions, following leads, and conjecturing rather than presenting faultless products' suggesting that teachers and pupils journey together as pupils construct unique knowledge they create themselves; not 'replicated' knowledge learned by rote:

'I was able to establish a lively learning atmosphere for pupils. I managed to improve my teaching and learning strategies. I could help pupils to build up their knowledge easier through modelling.' (P2-R48: Q2)

Describing knowledge and using knowledge in teaching

Knowledge of ARM is seen here as an example of 'potentially relevant knowledge' (Eraut 2004, 256) taken from the taught course into school where, as pedagogical reformers, the students were expected to teach differently from their school mentors and colleagues and probably from the way they had been taught as pupils. This involved students identifying relevant knowledge of ARM learned in the Institute; understanding their placement setting; and identifying, modifying and blending knowledge and skills from this setting and the Institute in their teaching. One student provides a succinct overview of the highly complex process Eraut (2004) described:

> 'Apply the skills (ARM) in my lesson planning, reflection on the teaching & learning occurred in the classroom. Relate my knowledge learnt from the course with the practical stuff.' (P2-R45: Q1)

The complexity of the knowledge used for teaching means the students' responses reflect multiple categories and types of knowledge depicted in the Eraut-Shulman framework (Table 1), emphasised using italic text in the commentary that accompanies the following accounts, two per placement. Each account has a title that describes its theme. The framework is used to examine the accounts, which are mostly collated descriptions of practising ARM rather than discrete episodes of practice. They draw attention to the students' 'personal practical knowledge', which Clandinin (1985, 363) suggested is 'found in practice. It is knowledge which is experiential, embodied and based on the narrative of experience'. Here, the students are starting to develop their narrative as teachers.

Account 1: Knowing what pupils know and don't know

> 'They feel free to have the lessons. For instance, they are eager to answer my questions under an enjoyable and relaxable environment while we appreciate their answers and they feel valued, they would speak out their ideas and we would know what they know & don't know. I usually ask them to act out something to let them have a better impression on what to be learned. I have to attire as neat as possible and I always care about my image/appearance in front of my pupils.' (P1-R35: Q3)

This account foregrounds the author's *personal knowledge*, particularly of *learners and their characteristics*, as directed by the question. Pupils are said to: 'feel free'; 'are eager'; 'feel valued'; and 'speak out'; observations drawing on both interpersonal and intrapersonal knowledge (Collinson 1996b). They reflect elements of '"People-sense" … a kind of empathic sensibility and wisdom about people and how they tend to feel, act, or react in specific situations' (van Manen 2016, 77), which suggests 'pathic knowledge' (van Manen 2008, 19). There are also indications of *knowledge of educational contexts* ('enjoyable and relaxable environment') and *general pedagogical knowledge* (questioning and acknowledging pupils' responses). Conceptualising the teacher as a role model for pupils, implied in the final sentence,

and in the curriculum specifications (Ministry of Education Malaysia 2006), reflects *knowledge of educational ends, purposes, and values…; cultural knowledge* that has become *personal* for this student. This might indicate tensions between this more traditional concept and references to pupils' freedom and eagerness.

The ARM principles represented *codified theoretical knowledge* the students were taught. Although the principles are not named, modelling is apparent, both teacher 'modelling' of the questioning form Noddings (1990) suggested and student-led pupil modelling: 'I usually ask them to act out something to let them have a better impression on what to be learned'. These activities might be considered forms of active learning as 'Action and modelling are related to each other' (P1-R77). Whilst not explicit, pupils' consideration of their answers might involve reflection. Their responses lead to teacher learning: 'we would know what they know & don't know'. The interim stages of transferring knowledge of ARM are especially dependent on the student's interpersonal and intrapersonal knowledge, their *personal knowledge*, particularly of *learners and their characteristics*, and on pupils' personal knowledge. Thus, whether ARM achieves its intended aim in school depends on the *codified theoretical knowledge* of ARM each student learned in the Institute, how they personalise and integrate this knowledge in class, and how the pupils respond.

Account 2: Guiding pupils in learning

> 'By using ARM models, I think that as the teacher we need to use every approaches to guide our pupils in their learning as we know that every children had their own multiple intelligences. So by doing Actions, I can use my own ideas and resources to teach my pupils and using the Modelling, I can guide my pupils by using verbal or demonstration so that they can get the idea of how to solve their problems. Lastly, by doing reflection, the teacher can overcome their weaknesses and improves their strengths by identifying the critical events that happened in their previous lessons.' (P1-R75: Q5)

Codified theoretical knowledge dominates this account*;* the 'ARM models' and references to each principle, alongside 'multiple intelligences', a theory proposed by Gardner (1983). Although the extent to which this knowledge is *personal* is not clear, phrases such as 'I think' and 'I can' and descriptions of practice imply it is becoming personalised. On careful reading this account illustrates the nature and value of the *theoretical knowledge;* the ARM principles, which are designed to prompt towards using constructivist pedagogies and particular ways of developing knowledge. The phrase 'guide our pupils' might represent an explicitly theory-based representation of teaching, which is being practised and personalised. Whilst the ARM principles seem to be used to frame practice their value in class depends on the student's understanding and interpretation of each principle and how they can work with their pupils to use them. Thus, what is important is how they recognise, and are able to put into practice, the nature of practice that represents this theory.

Once again, this student might be engaging in a technical rather than a transformative type of reflection. This might be expected, as reflection close to practice, at this early stage of teacher

development, is likely to focus on this construct of practice as technical, as focusing on how to 'overcome' weaknesses. However, the transformative learning, and reflection this would support, are evidenced in the reference to guiding pupils' learning, a construction of learning that was not traditionally held in Malaysia during this research. Thus, 'guide my pupils' might be seen to represent an explicitly theory-based representation of teaching, which is being practised and personalised.

Account 3: Using group activities, reflecting and modelling

> 'A – I used a lot of group activities as it promoted pupils' talk. I also assigned some "little teachers". They helped me a lot in handling the weak pupils. I also can evaluate their understanding through their explanation.
>
> R – After each lesson, I did reflection on my area of development in teaching and children's learning. When the pupils seem not understand the day's lesson, another same L.O lesson will be carried out but in different way.
>
> M – Each and every "new" knowledge need to be modelled to the pupils. This always came with "examples". Besides content knowledge, I did also model good behaviour.' (P2-R37: Q1)

Theoretical knowledge, threaded throughout, is revealed in *personal* form as this student explains how they have used each ARM principle in teaching, exemplifying several of Shulman's (1987) categories. Using 'group activities as it promoted pupils' talk' supports active learning (Leu and Price-Rom 2006), an understanding of *codified theoretical knowledge* (action), which exemplifies *general pedagogical knowledge* in personal form (cell Bf, Table 1). Grimmett and Mackinnon (1992, 387) proposed a further category of knowledge acquired through reflective response to experience in practice: 'pedagogical learner knowledge', combining Shulman's (1987) categories of *general pedagogical knowledge* and *knowledge of learners*. Together, *pedagogical content knowledge* and pedagogical learner knowledge comprise 'craft knowledge'; this is 'Crafty (in the dexterous, ingenious sense) teachers seek to know their students, to listen and reach out to them with care and understanding' (Grimmett and Mackinnon 1992, 429). Whilst aspects of *general pedagogical knowledge*, such as using group activities, can be learned in the Institute, student-focused knowledge of the form Grimmett and Mackinnon (1992) envisaged is only acquired when working with pupils. It happens as knowledge is transferred into practice and amalgamated with knowledge learned through practice. Thus, craft knowledge might reside in selected personal knowledge areas of Table 1 (dimensions e, f, g of categories B, D, E).

The intriguing reference to 'little teachers' provides an interesting point of reflective discussion, potentially revealing the author's view of teachers' and pupils' roles in developing knowledge. What does engaging pupils as teachers imply about their theories of learning and teaching? Might it suggest a form of distributed teaching, just as there is distributed leadership in schools, which 'is best understood as a distributed practice, *stretched over* the school's social and situational contexts' (Spillane, Halverson, and Diamond 2001, 23, original emphasis). Here, it might suggest that pupils are being given opportunities to teach other pupils and to model their

knowledge with other pupils by becoming 'little teachers'. The modelling phraseology, which includes '"new" knowledge' and '"examples"' *might* suggest that this student views *content knowledge* as fixed and transmitted to pupils rather than constructed with them. They allude to *cultural knowledge,* codified in the curriculum specifications; the suggestion that teachers are role models for pupils (Ministry of Education Malaysia 2006). The dependence of this form of knowledge on students' own beliefs and practice of 'good behaviour' illustrates the importance of what teachers bring to teaching.

Account 4: Pupils discussing and discovering concepts

> 'Active learning – I gave the group activity to pupils who are divided into several group. They discuss and discover the concepts I want them to know.
>
> Reflective – As usual, during the group presentation, I might request the pupils to reflect their learning process during their discussion and sharing.
>
> Modelling – I usually do demonstration and explanation before I introduce the topic I want the pupils to know.' (P2-R39: Q1)

Using the knowledge framework (Table 1) to examine this fourth account again highlights the *theoretical knowledge* represented by ARM. Although active learning, seen here as using *personal theoretical knowledge* categorised as *general pedagogical knowledge* (cell Bf, Table 1), seems to involve group activity, the student also describes 'conceptual learning', emphasising pupils discussing together, presenting, and learning through discovery (Leu and Price-Rom 2006). This student seems to be engaging pupils in reflection on their learning. As students use reflective dialogue to learn about their pupils' understanding of mathematical concepts (Confrey 1990) they can acquire further *personal knowledge of learners; general* and *pedagogical content knowledge;* and perhaps *knowledge of educational contexts*. The reference to modelling, however, implies a traditional construct of this term; modelling as instruction, associated with telling, demonstrating or showing (Desforges 1995).

This critique of the account illustrates the richness of even small episodes of teaching for reflective learning; the diversity of knowledge represented; and pupils' contribution to teacher learning. It also highlights the contribution of pupils' interpersonal and intrapersonal knowledge (Collinson 1996b) to their construction of subject knowledge, their teacher's knowledge of teaching and the way codified knowledge is integrated into practice.

Strengths and limitations of the research

Although the student teachers' accounts of their early experience of teaching should be interpreted within the setting of this teacher education reform project and the limitations of using self-completion questionnaires, they do provide valuable opportunities for learning. The dataset is extensive, comprising more than 950 individual question responses relating to the students' use of ARM and here these responses have been used to reflect on and question the nature of the

development of emergent teachers' professional knowledge and the role of pupils in that important process. Further research in these areas would be of value and in that context collecting feedback from pupils in the present study would have been of particular interest.

Conclusions and implications for theory and practice

The role of pupils in developing student teachers' knowledge of teaching

Seeking to develop teachers who could engage pupils 'to become problem-solving, flexible, innovative and creative thinkers' (Koo 2008, 126) meant enabling each student to '*think as* a constructivist' Windschitl (2002, 143, original emphasis); perhaps to *become* a constructivist. This required 'transformative learning' (Mezirow 1997, 11); a different understanding of knowledge from that of teachers using strategies such as learning by rote (Davis 1990). The students' understanding of constructivism began in the Institutes where they learned codified theoretical knowledge, particularly of ARM, to frame their teaching. Students described how they reflected to identify areas for professional development whilst on placement and explained how they learned about teaching through listening to pupils' feedback and reflections and through observing their responses to learning activities. Examining students' reports of 'learning teaching' reveals that as they used ARM they were constructing their own unique knowledge of teaching, often through or arising from interactions with pupils. This knowledge was not fixed or static, not 'pieces' of knowledge they were given but knowledge they created. Is there any evidence that this was associated with the 'transformative learning' involving knowledge acquisition *and* 'the transformation of existing knowledge structures' (Fuhr, Laros, and Taylor 2017, x)? Arguably, the students required this level of learning to *become* constructivists. It is acknowledged that the move to this is patchy, and that there are different forms of reflection, not all of which are transformative, just as not all the students will have been transformed in all areas of practice by their learning. If such a transformation involves 'personality, feelings, and relationships to others' as well as cognitive changes (Fuhr, Laros, and Taylor 2017, x), it requires significant changes in interpersonal and intrapersonal knowledge (Collinson 1996b). Whilst the changes required for students to *think* as constructivists might be predominantly cognitive; changes in personal knowledge, including pathic knowledge, might assume greater importance for them to *become* constructivists. These processes entail 'reconstructing' existing knowledge rather than 'constructing' new knowledge, the process they sought to engage in with pupils. To develop personal knowledge of teaching in this way seems to be at variance with some students' understanding of the nature of knowledge and how pupils develop knowledge as they refer to knowledge, presumably content knowledge, being delivered, given and received. Conversely, other students refer to pupils constructing knowledge, suggesting a developing understanding of knowledge acquisition that parallels the process they themselves need to engage in as they develop their knowledge of teaching. This is knowledge constructed with pupils (e.g. Windschitl 2002) and reconstructed through working with pupils.

The interrelationship between the personal knowledge of teachers and pupils

In this article, the Eraut-Shulman framework (Table 1) has been used to draw attention to the importance and nature of the personal knowledge of pupils, as well as teachers. This has led onto consideration of particular aspects of personal knowledge such as 'attitudes and emotions' (Eraut 2004, 264), and 'pathic knowledge' (van Manen 2008, 19) and whether these permeate all pedagogical encounters in class. Such forms of knowledge might be visualised as longitudinal warp threads, which are overlaid during some teaching encounters by more discrete categories, such as content knowledge, as transverse weft. It seems inherent in the nature of constructivism that the character and qualities of the personal knowledge of teachers and pupils assumes greater importance in constructivist classrooms, in which knowledge creation is socially mediated. Thus, the balance of the contribution of the personal knowledge of teachers and pupils might vary such that the pupils' contribution becomes greater as they assume more responsibility for their learning. This raises interesting questions about the development of pathic components of personal knowledge. Although there are distinctions between pathic and cognitive understanding (van Manen 2008), 'pedagogical empathy' can be taught as a 'cognitive skill'; that is via a cognitive route. This might lead to cognitive or semi-cognitive constructions of empathy; a combination of the pathic and the cognitive. Whilst each student enters teacher education with unique pathic knowledge, might the quality or value of such knowledge differ from the pathic knowledge they gain from practice? Are there discernible differences in pedagogical empathy between those teachers that bring extensive pathic knowledge to their programme and those that learn more pathic knowledge during the programme and whilst practising teaching? With the significant caveat that both the presence and the expression of pathic qualities are highly complex and nuanced, this might, for clarity, be visualised as the 'balance' between the pathic knowledge brought into teaching ('outside-in') and the pathic knowledge gained through teaching ('inside-out'). Recognising the importance of such knowledge of both teachers and pupils is important, leading onto considerations of strategies teachers might use to develop their own pathic knowledge and that of their pupils. This is particularly pertinent in constructivist classrooms where social interactions are central to learning (Bruner 1974); where learners often engage with multiple ideas that are different from their own; and where teachers need to know, as one student suggests, what individual pupils 'already know; what they do not understand; and their learning needs'.

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References

Angelides, P., and P. Gibbs. 2006. “Supporting the Continued Professional Development of Teachers Through the Use of Vignettes.” *Teacher Education Quarterly*, 33: 111–121.

Auhl, G., and G.R. Daniel. 2014. “Preparing pre-service teachers for the profession: creating spaces for transformative practice.” *Journal of Education for Teaching*, 40:4, 377-390.

Baxter Magolda, M.B. 2004. ‘Preface’. In: *Learning Partnerships: Theory and Models of Practice to Educate for Self-authorship*, edited by Baxter Magolda, M. B. and P. M. King, xvii-xxvi. Sterling, Virginia: Stylus Publishing, LLC.

Brookfield, S.D. 2012. Critical Theory and Transformative Learning. In *The Handbook of Transformative Learning. Theory, Research, and Practice*, edited by Taylor, E.W. and P. Cranton, and associates, 131-146. San Francisco, CA: Jossey-Bass.

Brookfield, S.D. 2015. *The skillful teacher. On technique, trust, and responsiveness in the classroom*. 3rd ed. San Francisco, CA: Jossey Bass.

Bruner, J.S. 1974. *Toward a Theory of Instruction.* Cambridge, MA: Harvard University Press.

Carr, D. 1993. “Moral values and the teacher: beyond the paternal and the permissive.” *Journal of Philosophy of Education*, 27(2): 193–207.

Clandinin, D.J. 1985. “Personal Practical Knowledge: A Study of Teachers' Classroom Images.” *Curriculum Inquiry*, 15(4): 361-385.

Collinson, V. 1996a. *Reaching Students: Teachers' Ways of Knowing*. Thousand Oaks, CA: Corwin Press.

Collinson, V. 1996b. “Becoming an Exemplary Teacher: Integrating Professional, Interpersonal, and Intrapersonal Knowledge.” Paper presented at the Annual Meeting of the Japan-United States Teacher Education Consortium, Naruto, Japan, July 15-18.

Confrey, J. 1990. "What Constructivism Implies for Teaching." *Journal for Research in Mathematics Education*. Monograph 4: 107-122+195-210.

Davis, R.B. 1990. “Discovery Learning and Constructivism.” *Journal for Research in Mathematics Education.* Monograph 4: 93-106+195-210.

Desforges, C., ed. 1995. *An Introduction to Teaching: Psychological Perspectives*. Oxford: Blackwell.

Dickerson, C., A. Binti Abdullah, J. Bowtell, S. Graham, J. Jarvis, S. Jarvis, R. Levy, et al. 2011. *Learning Together through International Collaboration in Teacher Education in Malaysia. Report of a Project to Develop a Bachelor of Education (Honours) in Primary Mathematics.* Hatfield: University of Hertfordshire Press.

Dickerson, C., J. Jarvis, R. Levy, and K. Thomas. 2017. “Using Action, Reflection and Modelling (ARM) in Malaysian Primary Schools: Connecting ‘the ARM theory’ with Student Teachers’ Reported Practice.” *Teachers and Teaching: Theory and Practice*, 23(4): 494–514.

Dickerson, C., K. Thomas, J. Jarvis, and R. Levy. 2018. “Changing Practice in Malaysian Primary Schools: Learning From Student Teachers’ Reports of Using Action, Reflection and Modelling (ARM).” *Journal of Education for Teaching.* 44(2): 194-211.

Drew, V., and L. Mackie. 2011. “Extending the constructs of active learning: implications for teachers’ pedagogy and practice.” *The Curriculum Journal*, 22(4): 451-467.

Eraut, M. 1985. “Knowledge Creation and Knowledge Use in Professional Contexts.” *Studies in Higher Education,* 10(2): 117-133.

Eraut, M. 2000. “Non-formal Learning and Tacit Knowledge in Professional Work.” *British Journal of Educational Psychology,* 70: 113–136.

Eraut, M. 2004. “Informal Learning in the Workplace.” *Studies in Continuing Education,* 26(2): 247-273.

Eraut, M. 2007. “Learning from Other People in the Workplace.” *Oxford Review of Education*, 33(4): 403-422.

Eraut, M., and W. Hirsh. 2007. *The Significance of Workplace Learning for Individuals, Groups and Organisations.* Oxford: Skope.

Fuhr, T., A. Laros, and E.W. Taylor. 2017. “Transformative Learning Meets *Bildung*: Introduction.” In *Transformative Learning Meets Bildung An International Exchange,* edited by Laros, A., T. Fuhr and E.W. Taylor, ix-xvi. Rotterdam: Sense Publishers.

Gardner, H. 1983. *Frames of Mind: The Theory of Multiple Intelligences*. New York: Basic Books.

Grimmett, P.P. and A.M. Mackinnon. 1992. “Craft Knowledge and the Education of Teachers.” *Review of Research in Education,* 18(1): 385-456.

Hallinger, P. 2010. “Making Education Reform Happen: Is There an ‘Asian’ Way?” *School Leadership & Management.* 30(5): 401–418.

Jarvis, J., C. Dickerson, K. Thomas, and S. Graham. 2014. “The Action–Reflection–Modelling (ARM) Pedagogical Approach for Teacher Education: a Malaysia-UK Project.” *Australian Journal of Teacher Education,* 39(3): 89-118.

Koo, Y.L. 2008. *Language, Culture and Literacy: Meaning-Making in Global Contexts*. Bangi: Fakulti Sains Sosial Dan Kemanusiaan, Universiti Kebangsaan Malaysia.

Leu, E. and A. Price-Rom. 2006. *Quality of Education and Teacher Learning: A Review of the Literature.* Washington, DC: USAID Educational Quality Improvement Program.

Lim, C.S., and C.M. Chew. 2007. “Mathematical Communication in Malaysian Bilingual Classrooms.” Paper presented at the APEC-Tsukuba International Conference, Tokyo, Japan, December 9–14.

Loughran, J. 2006. *Developing a Pedagogy of Teacher Education.* Abingdon: Routledge.

Loughran, J. and M.L. Hamilton. 2016. Developing an Understanding of Teacher Education. In *International Handbook of Teacher Education. Volume 1,* edited by Loughran, J. and M.L. Hamilton, 3-22. Singapore: Springer.

Lunenberg, M., F. Korthagen, and A. Swennen. 2007. “The teacher educator as a role model.” *Teaching and Teacher Education*, 23(5): 586-601.

Mezirow, J. 1997. “Transformative Learning: Theory to Practice.” *New Directions for Adult and Continuing Education*, 74: 5-12.

Mezirow, J. 2004. “Forum Comment on Sharan Merriam's "The role of Cognitive Development in Mezirow's Transformational Learning Theory".” *Adult Education Quarterly*, 55(1): 69-70.

Miles, M.B. 1990. “New Methods for Qualitative Data Collection and Analysis: Vignettes and Pre-structured Cases.” *International Journal of Qualitative Studies in Education*, 3: 37–51.

Ministry of Education Malaysia. 2006. *Integrated Curriculum for Primary Schools. Curriculum Specifications. Mathematics Year 6.* Putrajaya: Curriculum Development Centre Ministry of Education Malaysia.

Montenegro, H. 2020. "Teacher educators' conceptions of modeling: A phenomenographic study." *Teaching and Teacher Education,* 94. doi: 10.1016/j.tate.2020.103097.

Noddings, N. 1990. "Constructivism in Mathematics Education." *Journal for Research in Mathematics Education*. Monograph 4: 7-18+195-210.

Patton, M.Q. 2002. *Qualitative Research and Evaluation Methods*. 3rd ed. Thousand Oaks, CA: Sage.

Piaget, J. 1954. *The Construction of Reality in the Child*. Abingdon: Routledge & Kegan Paul.

Rodgers, C., and V.K. LaBoskey. 2016. Reflective Practice. In *International Handbook of Teacher Education. Volume 2*, edited by Loughran, J. and M.L. Hamilton, 71-104. Singapore: Springer.

Ryan, G.W., and H.R. Bernard. 2003. "Techniques to Identify Themes." *Field Methods*, 15: 85–109.

Sanderse, W. 2013. "The meaning of role modelling in moral and character education." *Journal of Moral Education*, 42(1): 28-42.

Sanger, M.N., and R.D. Osguthorpe. 2013. "Modeling as moral education: Documenting, analyzing, and addressing a central belief of preservice teachers." *Teaching and Teacher Education* 29: 167-176.

Scheiner, T., M.A. Montes, J.D. Godino, J. Carrillo, and L.R. Pino-Fan. 2019. "What Makes Mathematics Teacher Knowledge Specialized? Offering Alternative Views." *International Journal of Science and Mathematics Education.* 17(1): 153–172.

Schreier, M. 2012. *Qualitative Content Analysis in Practice*. London: Sage.

Shulman, L.S. 1987. "Knowledge and Teaching: Foundations of the New Reform." Harvard Educational Review, 57(1): 1-22.

Singh, P., and G.K. Sidhu. 2010. "Teaching Mathematics and Science in English: Looking Through the Eyes of Teachers." Paper presented at the International Conference on Science and Social Research (CSSR), Kuala Lumpur, Malaysia, December 5–8.

Sjøberg, S. 2010. Constructivism and Learning. In *International Encyclopedia of Education*, edited by Peterson, P., E. Baker and B. McGaw, volume 5: 485-490. Oxford: Elsevier.

Spillane, J.P., R. Halverson and J.B. Diamond. 2001. "Investigating School Leadership Practice: A Distributed Perspective." *Educational Researcher*, 30(3): 23-28.

Taylor, E.W. 2014. "Empathy: The Stepchild of Critical Reflection and Transformative Learning." *Educational Reflective Practices*, 2: 5-22.

van Manen, M. 2008. "Pedagogical Sensitivity and Teachers Practical Knowing-in-action." *Peking University Education Review,* 1(1): 1-23.

van Manen, M. 2016. *Pedagogical Tact. Knowing What to Do When You Don't Know What to Do.* London: Routledge.

Verloop, N., J. Van Driel, and P. Meijer. 2001. "Teacher Knowledge and the Knowledge Base of Teaching." International Journal of Educational Research, 35(5): 441-461.

Vygotsky, L. 1978. *Mind in Society,* 79–91. Cambridge, MA: Harvard University Press.

Watkins, C., E. Carnell, and C. Lodge. 2007. *Effective Learning in Classrooms.* London: Sage.

White, C., K. Woodfield, and J. Ritchie. 2003. "Reporting and Presenting Qualitative Data." In *Qualitative Research Practice,* editors J. Ritchie and J. Lewis, 287-320. London: Sage.

Windschitl, M. 2002. "Framing Constructivism in Practice as the Negotiation of Dilemmas: An Analysis of the Conceptual, Pedagogical, Cultural, and Political Challenges Facing Teachers. *Review of Educational Research*, 72(2): 131–175.

Zeichner, K.M., and D.P. Liston. 2014. *Reflective Teaching: An Introduction*. 2nd ed. New York: Routledge.