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Using a teacher knowledge framework to connect teaching practice with theory

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ABSTRACT

The process Shulman described as 'teacher-knowledge growth' is complex, particularly for student teachers. This article presents an 'Eraut-Shulman teacher knowledge framework' that provides a structure and language to use to extend student teachers' learning about knowledge. The article describes how the framework was created and draws on student teachers' accounts of their teaching whilst on placement to demonstrate how it could be used to connect personal experiences of teaching with theoretical understandings of teacher knowledge. The students' accounts were written whilst they were completing a new BEd degree programme in Malaysia. Seven accounts are presented, each with two 'focus points', to illustrate how a teacher educator could use the knowledge framework to engage the student teacher in dialogue that links their experience of teaching with theory. Issues explored in these examples include categories and types of knowledge; conceptions of knowledge; sources of knowledge; theories of knowledge and learning; and the nature of personal knowledge in teaching. Significantly, this article presents a practical approach that provides opportunities for teachers to relate their practice to theory; contributes to the conceptualisations of teacher knowledge; and extends our ability to unpack the nature, development and use of knowledge in teaching.

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Introduction

The integration of student teachers' experiences of teaching with theoretical knowledge is a problematic issue for teacher educators (Tigchelaar and Korthagen 2004). Recently, King (2020, p. 106, original emphasis) identified 'How to *explore and understand the gap* between theory and practice, between what is learned in pre-service education and what is practised in the classroom … ' as one of 'the key burning issues' in professional learning. One challenge is to find ways 'to connect theory and practice in such a way that teachers would be able to handle the problems of everyday teaching through theory-guided action' (Korthagen *et al.* 2006, p. 1021). The purpose of this article is to show how teacher educators could use an 'Eraut-Shulman teacher knowledge framework' (Dickerson *et al.* 2021, p. 475) as a practical tool to support this integrative process. First, the framework is contextualised using literature on different conceptions of

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knowledge. Then, examples collected during research conducted in Malaysia are provided to demonstrate how teacher educators could use the framework to link an emergent teacher's account of placement practice with theory in a learning conversation with the student. Using Shulman's (2004, p. 467) description of the use of case methods in teacher education, these examples demonstrate how practitioners could engage in valuable professional learning as they move to and fro between 'memorable particularities' of practice and 'powerful generalizations and simplifications of principles and theories'.

Knowledge of teaching

Acquiring knowledge of teaching

Verloop *et al.* (2001, p. 443) defined 'the knowledge base of teaching' 'as all profession-related insights that are potentially relevant to the teacher's activities' whilst Shulman (1987, p. 4) considered it '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'. The knowledge base is seen as evolutionary (Shulman 1987). So too is the knowledge base of an individual teacher, what Verloop *et al.* (2001, p. 443) described as their 'personal knowledge base'. Each teacher's knowledge base of teaching is unique, as suggested by Eraut's (2000) understanding of the contextualised nature of the way knowledge is acquired. Verloop *et al.* (2001, p. 446) used the terms "teacher knowledge" or "teacher practical knowledge" . . . to indicate the whole of the knowledge and insights that underly teachers' actions in practice'. This knowledge is acquired prior to, during and after initial teacher education.

Categories and types of knowledge for teaching

Shulman (1987, p. 8) identified seven categories of the teaching knowledge base: 'content knowledge'; 'general pedagogical knowledge'; 'curriculum knowledge'; 'pedagogical content knowledge'; 'knowledge of learners and their characteristics'; 'knowledge of educational contexts'; and 'knowledge of educational ends, purposes, and values, and their philosophical and historical grounds'. Shulman's (1987) views, particularly of pedagogical content knowledge, have been critiqued (e.g. Banks *et al.* 2005, Depaepe *et al.* 2013). Banks *et al.* (2005, p. 333) asserted that Shulman's (1986, 1987) work emphasised 'teacher-centred pedagogy' rather than the learning process. Instead, they conceptualised teachers' professional knowledge as a model in which *'personal constructs'* are central in a process of active interchange between 'subject knowledge, school knowledge and pedagogic knowledge' and suggested that professional knowledge arises through the interaction of these components (Banks *et al.* 2005, pp. 335, 336, original emphasis). More recently, Herold's (2019) research supported Shulman and Shulman's (2004, pp. 258, 259) critique of their earlier ideas, including Shulman's (1986, 1987) 'constructs that were strictly cognitive and individual' to instead 'frame a more comprehensive conception of teacher learning and development within communities and contexts'. Further extensions of Shulman's (1987) views of knowledge in teaching have included consideration of the environment, arising from work involving active learning in higher

education (Donnelly and Berry 2019). Nevertheless, Shulman's (1987) conceptualisation of the teaching knowledge base provides a valuable starting point for a discussion of teacher knowledge. Whilst there is some overlap between the categories and types of knowledge recognised by Shulman (1986, 1987, 1998) and Eraut (1985, 2000, 2001, 2004, 2007) there are also differences and here their work is seen as complementary. With a mutual interest in professional knowledge, Shulman focused mainly on teacher knowledge, whilst Eraut emphasised professional knowledge and learning in different workplaces, including schools. Eraut and Hirsh (2007, p. 6, original emphasis) argued that *'learning is a process'* and *'knowledge is a state'*.

An 'Eraut-Shulman teacher knowledge framework'

Creating the framework

The framework was created by combining Shulman's (1987) seven categories of teacher knowledge with three of Eraut's (1985, 2000, 2004, 2007) types of knowledge (Table 1) (Dickerson *et al.* 2021). These three types of knowledge: cultural (Eraut 2004, 2007); codified or 'public knowledge' (Eraut 2000, p. 113); and personal (Eraut 2000, 2004, 2007) are used as overarching headings in the framework with lower level differentiation (Table 1).

The framework draws particular attention to different types or dimensions of personal knowledge (columns e, f and g, Table 1). Eraut (2004, pp. 263–264, original emphasis) highlighted the importance and nature of this knowledge, characterising:

> '*personal knowledge* as what individuals bring to situations that enables them to think, interact and perform … it 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'.

Eraut (2000, p. 114) also viewed 'procedural knowledge and process knowledge, experiential knowledge' as dimensions of personal knowledge. Described by van Manen (2008, pp. 15, 16) as a type of 'practical knowledge', tact, or in the teaching context 'pedagogical tact' might be encompassed by Eraut's (2004) definition; in this case a form of *tacit* personal knowledge. Tact might be considered inherently personal even if it is also intersubjective, social, cultural, ethical and moral (as it relates to the good of others). It seems to relate to and possibly depends upon 'personal qualities' such as sensitivity, empathy and sensibility. Such qualities align with 'personal pedagogies (interpretative sensibilities, attentiveness, existential values, life meanings, ways of standing in life, ontotheologies, etc.)' (van Manen 2016, p. 79) and are integral to what van Manen (2016, p. 77) termed '"People-sense" … a kind of empathic sensibility and wisdom about people and how they tend to feel, act, or react in specific situations'. Collectively, these qualities might be thought to contribute to 'pathic knowledge' (van Manen 2008, p. 19), where pathic knowledge itself is a constituent of personal knowledge.

Thus, the nature of the personal knowledge envisaged within the framework is expansive. As such it might extend beyond the concept proposed by Banks *et al.* (2005, p. 336, original emphasis) of '*personal constructs* of the teacher' described as 'a complex amalgam of past knowledge, experiences of learning, a personal view of what constitutes

Table 1. Eraut-Shulman teacher knowledge framework.

	a	b	c	d	e	f	g
	Types/dimensions of knowledge (Eraut)						
	Cultural knowledge →						
		Codified knowledge → → → → → → → → → →					
							Personal knowledge → → → → →
Knowledge category (Shulman)	Cultural knowledge: uncodified	Cultural knowledge: codified *Explicit*	Codified knowledge (e.g. technical[a]) *Explicit*	Codified theoretical knowledge *Explicit*	Personalised codified knowledge (e.g. technical[a]) *Explicit or tacit*	Personal theoretical knowledge *Explicit or tacit*	Personal knowledge[b] *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.							

[a]Theoretical knowledge listed separately

[b]Includes 'procedural knowledge and process knowledge, experiential knowledge' (Eraut 2000, p. 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, pp. 263–264)

"good" teaching and belief in the purposes of the subject'. It is not clear whether the emotional aspects of teaching (Hargreaves 1998) and qualities associated with pathic knowledge have been omitted from their model or whether they reside within 'pedagogic knowledge' (Banks *et al.* 2005, p. 336). Grimmett and Mackinnon (1992) argued that one of Shulman's (1987) categories, pedagogical content knowledge, is developed through reflective response to experience in practice and is distinct from the other categories in its nature and origin. They proposed an additional category of knowledge acquired in this way: 'pedagogical learner knowledge', a combination of Shulman's (1987) categories of general pedagogical knowledge and knowledge of learners (Grimmett and Mackinnon 1992, p. 387). Together pedagogical content knowledge and pedagogical learner knowledge are seen to comprise 'craft knowledge', which 'relies heavily on intuition, care, and empathy for pupils' (Grimmett and Mackinnon 1992, p. 428), a description that suggests craft knowledge draws on pathic knowledge.

Other complex frames that shape personal and personalised knowledge and the understanding of knowledge, knowledge making and learning have significant implications for teachers. Shulman (1987) and Eraut (2000, 2007) both drew attention to context and culture in their conceptualisations of knowledge and Shulman and Shulman (2004) and Eraut (2000) addressed the importance of community and social settings for learning. This article touches on the relationship between these influences and ideas about knowledge and learning in two geographical and cultural contexts: Malaysia and the UK. Whilst Malaysia was the primary location for the research, teacher educators from both settings co-created the BEd degree programme that was the focus of study and participants saw the need to gain 'intercultural knowledge and awareness' (Jarvis *et al.* 2016, p. 409). The exploration of knowledge here draws on generalisations; nevertheless, it reveals some of the intricacies of international engagement in this field. The degree programme, sponsored by the Ministry of Education Malaysia, was enacted against a backdrop of mathematics curriculum requirements for active learning (Ministry of Education Malaysia 2006) and a Government focus on developing a knowledge-based economy (Ministry of Education Malaysia 2001). The Malaysia Education Blueprint 2013–2025 (Ministry of Education Malaysia 2013) includes an aspiration for students to be able to connect, create and apply knowledge and recommends pedagogical approaches that involve learning that is active, student-focused, and project- and inquiry-based. Such pedagogies are often associated with constructivist, socially mediated learning (Windschitl 2002) and relate to a different understanding of knowledge and knowledge making from the form of learning Koo (2008) described in Malaysia at the time of the programme. Koo (2008, p. 124) noted 'dominant models of transmissive, top down learning as the key model of learning' and suggested 'Inquiry based learning is a rare pedagogic practice'. Although some Malaysian teacher educators involved in the degree programme described previous use of active learning approaches (Dickerson *et al.* 2011), using constructivist pedagogy represented change for others and for the student teachers. Borrowing the phrase 'double knowing' from Singh and Shrestha's (2008, p. 66) work in international education might help with visualising the challenge for these teacher educators and students. Whilst the initial 'knowing', the personal knowledge and understanding of knowledge and knowledge making they brought to the programme was embedded in Malaysian cultural experiences and histories they were expected to adopt a new 'knowing', a constructivist theory of knowledge and apply that in teaching. This

new knowing, promoted by the Ministry of Education Malaysia (2006) and espoused by many of the teacher educators from the UK, had significant implications for teaching, particularly for teaching mathematics (Confrey 1990). Although the UK teacher educators needed to gain greater understanding of conceptualisations of knowledge in Malaysia they were not expected to use this understanding to change their practice of teaching. Using knowledge as an example here provides a glimpse of the challenge of seeking to change practice in teaching and suggests, as Goh and Blake (2015, p. 472) emphasise, the importance of recognising 'the need for a culture-sensitive pedagogy in teacher education programs'.

Cultural influences on pedagogy (Goh and Blake 2015) and on conceptualisations of knowledge (Shulman 1987, Eraut 2000, 2007) are complex and multi-layered. Whilst some national and 'local cultural imperatives that influence and shape the preparation of quality teachers' (Darling-Hammond and Lieberman 2012, p. i) have been considered in relation to Malaysia, the UK context is also of interest as the secondary setting for this research. Schools and education policies differ across the four constituent nations of the UK (England, Northern Ireland, Scotland, and Wales) and there is 'a very clear divide in curriculum approaches' (Sibieta and Jerrim 2021, p. 37). A national curriculum, introduced in primary schools in England in 1989 was reviewed and revised over the next two decades (Roberts 2021). Then, in 2010 the UK government published *The Importance of Teaching* White Paper, which advocated 'a new approach to the National Curriculum' in England 'specifying a tighter, more rigorous, model of the knowledge which every child should expect to master in core subjects at every key stage' (Department for Education 2010, p. 10). This national curriculum would provide a 'body of knowledge' comprising 'essential knowledge' or 'core knowledge' (Department for Education 2010, pp. 40, 41); this 'is predetermined knowledge, stable and unproblematic' (Winter 2014, p. 285). This view of knowledge suggested a closer relationship with the transmissive learning noted by Koo (2008) than with the constructivist, socially mediated learning discussed by Windschitl (2002) and promoted during the degree programme.

Using the framework

The breadth of cover of the framework means it can be used to critique and theorise 'the whole of the knowledge and insights that underly teachers' actions in practice' (Verloop *et al.* 2001, p. 446). It combines categories that describe the 'codified or codifiable aggregation of knowledge' (Shulman 1987, p. 4) underpinning the profession of teaching and dimensions that describe knowledge that is often uncodified and uncodifiable. Whilst the framework is based on the work of Eraut and Shulman, the personal knowledge envisaged is given greater detail and depth by considering the views of educators such as Grimmett and Mackinnon (1992) and van Manen (2008, 2016). Together, they highlight the complex personal knowledge used in teaching. Teachers working alone or with peers, mentors or teacher educators could use the framework to link their experiences of teaching with theory relating to teacher knowledge.

Olson (2000, p. 109, italics in original) recognised the importance of students' 'personal narrative knowledge of teaching' and the value of their comments and journal reflections on placement experiences as 'openings for inquiring into taken-for-granted assumptions about teaching and learning' (p. 113). Here, examples are provided to show

how a teacher educator could engage an emergent teacher in dialogue informed by the framework and a documented episode of the student's practice. Drawing on Shulman's (2005, p. 52) concept of 'signature pedagogies', Parker *et al.* (2016, p. 137) identified 'critical dialogue' as one of three such pedagogies in the context of teacher professional learning. In this article, the envisaged one-to-one discussions are informed by elements of Goldenberg's (1991, p. 6) lesson-wide approach; student-focused '"Instructional conversations"' in which student participation is encouraged through open and probing questions and by using restatements. Such conversations draw on students' views and experiences; develop understanding; and 'assume that students themselves play an important role in constructing new knowledge and in acquiring new understandings about the world' (Goldenberg 1991, p. 6). There are opportunities for mutual learning as each participant is both 'learner' and 'knower'.

Based on analysis of student-tutor conversations about significant incidents in practice, Chambers *et al.* (2003, p. 119) reflected on the contribution to professional learning of 'such affective skills as sensitivity, adaptability, self-awareness, particularly of one's own values …'. In the context of the framework these affective qualities might be seen as aligned with, or constituents of, the 'personal pedagogies' envisaged by van Manen (2016, p. 79). This raises interesting questions about the uniquely individual nature of professional learning and its complexity and the way existing knowledge, particularly personal knowledge, influences and interrelates with, a professional's process of learning and their acquisition of knowledge.

The research study

This section describes the research basis of the student teachers' accounts of teaching used in this article to demonstrate how the teacher knowledge framework could be used to support professional learning. It describes the Malaysian context for the research and the way the accounts were collected, managed, and analysed. Finally, it explains how seven of the accounts were prepared as illustrative examples to show how a teacher educator could use the framework as a practical tool to link a student teacher's practice with theory.

The setting for the accounts

The students' accounts were collected during a longitudinal research study conducted as they completed 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) in Malaysia (Dickerson *et al.* 2011, 2017, 2018, 2021, Jarvis *et al.* 2014, Jarvis *et al.* 2016). Development of the degree programme was sponsored by the Ministry of Education Malaysia. The University of Hertfordshire, UK, was responsible for designing the programme collaboratively with colleagues from two Teacher Education Institutes in Malaysia, and for programme validation, support and quality assurance. Colleagues from the University aspired to develop interactions with 'respectful, reciprocal and transcultural mindsets' (Ryan 2020, p. 1).

A cohort of 120 students enrolled on and graduated from the programme, studying at the Institutes and completing placements in Malaysian primary schools. The Malaysian mathematics curriculum specifications promoted components of active learning

(Ministry of Education Malaysia 2006). For the duration of the programme the reform of mathematics learning and teaching strategies (Lim and Chew 2007) was supported by the Malaysian Government's policy to teach mathematics and science in English (Pengajaran dan Pembelajaran Sains dan Matematik dalam Bahasa Inggeris, PPSMI). The Malaysian teacher educators and many of the students were bilingual or multilingual and English was the learning and teaching medium throughout the programme. The students' work was assessed formatively and summatively as they acquired the requisite knowledge, understanding and skills to teach in Malaysian primary schools.

The pedagogical approach developed and used during the degree programme involved action, reflection and modelling (ARM) (Jarvis *et al.* 2014). The rationale for selecting each principle was as follows:

- *Action* represented the Malaysian Government's stipulation for pupils to engage in active learning (Ministry of Education Malaysia 2006), which was understood 'as anything that "involves students in doing things and thinking about the things they are doing"' (Bonwell and Eison 1991, p. 2). Learners are central and are responsible for their own learning (Faryadi *et al.* 2007). Strategies associated with active learning align with social constructivist pedagogies, based on work of theorists such as Piaget (1954), Bruner (1974) and Vygotsky (1978). At the time of this research such pedagogies differed considerably from those traditionally used in Asian schools (Hallinger 2010). Windschitl (2002) highlighted significant complexities associated with understanding the meaning of constructivism and with using constructivist approaches.
- *Reflection*, reflective learning or critical reflection (e.g. Schön 1983), was emphasised as student teachers were encouraged to reflect on their teaching and to engage pupils in reflection on their learning. When critiquing Schön's view of reflection, Grimmett (1989, p. 22, original emphasis) suggested that where reflection is seen 'as the *reorganization* or *reconstruction of experience*' then 'knowledge, including personal understandings of practice situations, *transforms* practice'.
- Pedagogical *modelling* involves teacher educators teaching simultaneously about content and the act of teaching used to convey it (Loughran 2006). Most productive modelling involves explicit modelling of new learning and making links both to the student's practice and to theory (Lunenberg *et al.* 2007). During the degree programme staff modelled their teaching practice to the student teachers who then modelled to the teacher educators and their peers in the Institute and to pupils in school. Pupils were, in turn, encouraged to model or demonstrate their learning in the classroom.

The collection of the accounts

The student teachers' accounts of practice were collected during the research study as responses to questionnaires designed to explore their views and experiences of using ARM during two school placements. These accounts form part of a much larger dataset arising from the study, which was designed to investigate participants' views and experiences of learning and teaching and of the collaborative approach to the project (Dickerson *et al.* 2011). The full dataset for the study comprises responses collected

through face-to-face interviews and self-completion questionnaires from more than 180 participants: Malaysian senior managers, teacher educators, student teachers and school mentors. Engaging different groups of participants allowed some 'data triangulation' (Denzin 2009, p. 306) and contributed to the validity of the findings.

The student teachers completed self-completion questionnaires comprising open-ended questions, which enabled them to choose the manner and length of their contributions (Terry and Braun 2017) and meant that all members of the cohort could be invited to take part. The questionnaires encouraged the students to use structured reflection on their practice; they were administered and collected by Malaysian senior managers and teacher educators. Of the 120 students, 110 (92%) responded at the end of their first placement (P1, year 2) and 87 (73%) at the end of their final placement (P2, year 4). The students' responses were anonymous and hand-written in English, which was their second or third language. Here, respondents (R) are referred to as 'student teachers' or 'students' and those they taught as 'pupils'.

This article includes responses to the following questions*: How did you use ARM on your placement? (or final placement)* (QA); *How did it benefit your pupils?* (QB); *What challenges did you experience using ARM? (Final placement: If applicable, please describe how you overcame these challenges)* (QC); and *What have you learned from using ARM that will influence your practice as a teacher?* (QD).

The students' responses are used to contextualise the illustrative examples by addressing the research question: *What can we learn about the students' views and understanding of knowledge?* Selected responses are also used to develop the illustrative examples.

Managing and analysing the accounts

The research team included senior colleagues in Malaysia; and three colleagues from the University: the programme director; a research fellow; and a senior teacher educator/researcher. The complete dataset comprised more than 1000 individual hand-written question responses; whilst some responses were brief, others were more detailed and have been characterised here as 'accounts of practice'. During the transcription process some spellings and abbreviations were standardised to enable electronic searching.

The following two approaches or 'data analysis tools' (Leech and Onwuegbuzie 2008, p. 587) were used to analyse the data:

1) The 'Key Words in Context' approach (Ryan and Bernard 2003, p. 96). The data used to respond to the research question were identified using a search for the key words 'know', 'knowledge' and 'knowledgeable'. These words are presented in short extracts of text to provide context (Ryan and Bernard 2003). The findings from this key word search are interpreted in the findings and discussion section of the article to provide some context for the illustrative examples.

2) The Eraut-Shulman teacher knowledge framework (Table 1) (Dickerson *et al.* 2021). The data were content analysed using the framework. '*Content analysis is a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use*' (Krippendorff 2019, p. 24, original emphasis). The research fellow identified response/s or response excerpts thought to

reflect dimensions of knowledge for most of the 42 cells within the framework. Whilst the research fellow was not familiar with the students' placement settings, they had a good understanding of the context of the degree programme and the ARM pedagogy as well as expertise in managing the research dataset and in creating and theorising the framework. Findings from the research fellow's initial analysis were reviewed and finalised in consultation with the senior teacher educator/researcher. Thus, the process of using the framework as an analytic research tool was informed by the knowledge and understanding of two members of the research team. Table 2 illustrates the data analysis approach using a reference to *passive learning*, interpreted here as a form of general pedagogical knowledge that is cultural. Gaining pupil participation in class is seen as one of the 'broad principles and strategies of classroom management and organization that appear to transcend subject matter', that is *general pedagogical knowledge* (Shulman 1987, p. 8). Then, the student's reference to 'passive learner' and the perceived link between this and pupils' 'previous learning' suggests pupils might have experienced 'a passive, rote-learning-dependent academic culture' often associated with the Malaysian context (Ali *et al.* 2011, p. 163). This was categorised as *cultural knowledge*.

Preparing the accounts as illustrative examples

The framework can be used both to support content analysis of research data as described above and to connect teaching practice with theory. Selected responses identified using content analysis were prepared as examples to show how the framework could be used to support this second purpose: professional learning in teacher education. Seven responses or 'accounts of practice' were chosen, one account thought to represent each of Shulman's (1987) categories of the teaching knowledge base (Table 1, Knowledge categories A-G). These responses were seen as interesting cases for development as illustrative examples, a process that involved critiquing the responses in relation to the literature and identifying possible areas of learning about teacher knowledge. The illustrative examples are presented in the findings and discussion section. Each example has the same structure: the account; contextualisation using literature; and two focus points for using the framework to support conversations about knowledge.

Ethical issues in international research

The complex and nuanced nature of ethical issues associated with any research means that researchers need to adopt an ethical stance throughout the inquiry process. Ethical approval processes for this study were managed by the senior teacher educator/researcher from the University and requisite permissions were gained from colleagues in Malaysia. All members of the student cohort were eligible to complete questionnaires anonymously on two occasions during the programme. The responses were transcribed

Table 2. Example of data from the completed analysis framework.

Knowledge category (Shulman)	Types/dimensions of knowledge (Eraut) Cultural knowledge – a) uncodified; b) codified *Explicit*
B: General pedagogical knowledge	I find that, It was difficult to get pupils participation because they more comfortable to be passive learner as the result from previous learning (P2-R24: QC)

and coded by the research fellow who did not know the respondents or contribute to implementing the degree programme.

International research such as the study described here presents additional ethical dimensions and poses critical challenges associated with considerations of decolonisation. The decolonising process in international collaboration and research could be supported by developing practices informed by reflecting on areas such as power relationships, contextualisation and access to knowledge (Adriansen and Madsen 2019). In relation to research in particular, the decolonising process could be further supported by consideration of additional areas identified by Keikelame and Swartz (2019, p. 5) who suggested ways of engaging to ensure that research is both 'ethically and culturally appropriate'.

Findings and discussion

In this section the students' responses are used first to address the research question: *What can we learn about the students' views and understanding of knowledge?* This learning provides some context for the seven illustrative examples, which are presented and critiqued to show how the teacher knowledge framework could be used to relate personal experiences of teaching with theory relating to teacher knowledge.

The student teachers' views and understanding of knowledge

The students' classrooms became important sources of knowledge of teaching and of teacher knowledge. Through planning and teaching lessons they were developing personal knowledge including personal theoretical knowledge, drawing particularly on codified theoretical knowledge; the theory of ARM (Table 1). The way the students use the terms 'know' and 'knowledge' in their accounts provides insights into their views and understanding of knowledge and has important implications for their approach to teaching. For example, students suggest that knowledge can be delivered, given and received: 'I can deliver the input and appropriate knowledge' (P1-R73); 'give my pupils' knowledge' (P1-R77); 'pupils can receive the knowledge' (P1-R78). They also refer to knowledge being acquired and requested: 'students are able to acquire the knowledge' (P2-R36); 'they [pupils] ask for knowledge' (P1-R104); and to knowledge being built and constructed: 'I could help pupils to build up their knowledge' (P2-R48); 'pupils had opportunity to construct their own knowledge' (P2-R19). If the pupils were used to transmission approaches and 'memory based learning' (P1-R40) then as Kabilan and Izzaham (2008) suggested they would expect the teacher to provide knowledge for them to accept. This view of learning might be consistent with students' reports of knowledge being delivered, given and received whereas references to pupils constructing knowledge might suggest that the students are developing different understandings of learning and of the *nature* of knowledge.

Using the framework to connect teaching practice with theory: illustrative examples

The examples in this section show how the teacher knowledge framework could be used to support learning conversations with students. The teacher educator could either choose to look at the framework with the student during the conversation or use it as a personal aide-memoire. Similarly, they could refer to published literature including sources cited in this article. Conversations might begin with an opportunity for the student to talk about their account as a way of encouraging recall of the setting.

A: Content knowledge

> For example when I teach my pupils about addition, first I need to explain and modelling what exactly is addition. I give a lot of example to them to show that is addition. Then after they look like understand or see it I ask them to answer the question on the worksheet or whiteboard based on the way that I had showed to them. (P1-R77: QA)

The Malaysian practice of subject-specific primary teaching meant that these emergent teachers might have greater confidence in knowledge of content than in some other categories. However, the expectation that they would use constructivist pedagogies meant they needed more extensive content knowledge than might be required for some teaching and learning approaches (Windschitl 2002). This student describes how they combined content knowledge and pedagogical knowledge (Wilson *et al.* 1987, Scheiner *et al.* 2019). The content knowledge might typify codified knowledge of mathematics (personalised codified knowledge) that the student has learned. As content knowledge is transformed in the practice of teaching it represents pedagogical content knowledge (Shulman 1987). The student's reference to recognising when the pupils 'understand or see it' suggests aspects of personal knowledge that Eraut (2004, p. 264) described as 'everyday knowledge of people'. This might be tacitly held knowledge made explicit whilst teaching.

Focus points for using the framework to support conversations about knowledge:

1: To promote understanding of the way content knowledge is transformed in the act of teaching. Using addition as an example, a teacher educator and student could consider content knowledge the student was taught (codified knowledge); and pedagogical content knowledge, the knowledge they use in teaching (personalised codified knowledge). Are these types of knowledge different and if so, how and why?

2: To develop understanding of categories and types of knowledge. A teacher educator could enquire further into what the student means by referring to when the pupils 'look like understand or see it'; why did they think this? This exploratory conversation could be followed by shared reflections on different types of knowledge used in teaching and the nature and value of explicit and tacit personal knowledge (e.g. Cianciolo *et al.* 2006).

B: General pedagogical knowledge

> I applied active learning in my placement by organising the group work. I am sure when pupils work in group, they will learn better. It is because, they will try to do the task in their group, make discussion to get the final answer and here, I can see that they are actually in learning process. (P1-R101: QA)

This response, categorised as general pedagogical knowledge, illustrates general understandings of practice that support active learning such as engaging pupils in group work and discussion (Leu and Price-Rom 2006). Implementing pedagogies that were not traditionally used in Asian schools (Hallinger 2010) required fundamentally different understandings of what it meant to be primary teachers and pupils. The student's assertion 'I can see that they are actually in learning process' hints at their use of wisdom and judgement. This relates to Grimmett and Mackinnon's (1992, p. 428) understanding of general pedagogical knowledge as a constituent of craft knowledge, 'accumulated wisdom' that 'emphasizes judgment'.

Focus points for using the framework to support conversations about knowledge:

1: To reveal personal theories of learning and enhance understanding of active learning. This response provides openings for dialogue about different understandings of active learning (e.g. Bonwell and Eison 1991, Leu and Price-Rom 2006). Then, a teacher educator could probe into the student's own theories of learning; explore how these theories relate to active learning, seen as codified theoretical knowledge taught as part of ARM; and how the student has personalised this knowledge ('applied active learning') in their teaching.

2: To develop understanding of the roles of teachers and pupils in the acquisition of knowledge. The pedagogies described here have important implications for the roles of teachers and pupils in learning and the acquisition of knowledge (Vighnarajah *et al.* 2008). A teacher educator could explore what the student understands by the 'learning process', pupil learning, and the part teachers play in pupils' acquisition of knowledge. The teacher educator and student could then use the framework to reflect on different types of knowledge of teaching (cultural and codified) that influence personal understanding of the roles of teachers and pupils in class.

C: Curriculum knowledge

> Regarding modelling, I used different types of teaching aids based on the learning objectives which I have set. I would show and asked open questions whenever I used a particular teaching aid. Wait time was given so that the pupils were able to think and learn through the teaching aids provided. (P1-R20: QA)

Alexander (2009, p. 16, original emphasis) described the curriculum 'as a series of *translations, transpositions* and *transformations* from its initial status as a set of formal requirements'. Here, using teaching aids to support implementation of the process Alexander (2009) described is seen as illustrative of curriculum knowledge. The student suggests they chose teaching aids to align with learning objectives established in the national curriculum, which was designed 'to provide opportunities for pupils to acquire mathematical knowledge and skills and develop the higher order problem solving and decision making skills that they can apply in their everyday lives' (Ministry of Education Malaysia 2006, p. vii). Their final sentence might be categorised as personal knowledge. It suggests a particular patience and sensitivity towards the pupils and an understanding of the nature of learning and of using teaching aids to support learning; the focus moves from student as teacher to pupils as learners.

Focus points for using the framework to support conversations about knowledge:

1: To reflect on the scope and complexity of the knowledge required for teaching. This example provides opportunities for a teacher educator to start to unpack the categories and types of

knowledge required to transition from nationally set learning objectives to classroom teaching. Discussions could cover what is involved in this process; what the student knows and does each time they teach. As the teacher educator and student reflect on categories and types of knowledge they use for teaching, including curriculum knowledge, they might map a few examples of practice with cells in the framework.

2: To explore the nature of personal knowledge in teaching. Most reports of practice facilitate discussions about the nature of personal knowledge and a teacher educator could use the extensive conceptions of personal knowledge envisaged in the framework to inform such discussions. They could explore this idea further using examples of personal knowledge in this response, perhaps in the reference to 'wait time' (Mahmud 2019).

D: Pedagogical content knowledge

As a future teacher, I will practice using ARM. Because it give positive impact on teaching and learning in Maths. I will stress more on pupils hands-on experience. It will secure their understanding. (P2-R54: QD)

Grimmett and Mackinnon (1992) argued that pedagogical content knowledge is developed through reflective response to experience in practice and is distinct from Shulman's (1987) other categories in its nature and origin, constituting a component of craft knowledge. This suggests that pedagogical content knowledge cannot be taught but must be learned by reflecting on personal practice. Here, the student describes *how* they combined content and pedagogy; they seem to report from experience and are therefore drawing on personal knowledge.

Focus points for using the framework to support conversations about knowledge:

1: To extend understanding of the breadth of knowledge required for teaching and how this knowledge can be developed. A teacher educator could use the student's reference to outcomes of teaching mathematics to enquire further into why they think using ARM has this impact on teaching and learning and on pupils' understanding. This could lead onto a discussion about the forms of knowledge the student might be drawing on in their teaching and how they could develop their knowledge further.

2: To identify the influence of prior experience and knowledge on the practice of teaching. Using the student's reference to ARM a teacher educator could probe into the nature of the teaching approaches the student experienced in school (as a pupil and during their placement), seen as cultural knowledge of teaching, and those they learned about in the Institute, described as codified (theoretical) knowledge of ARM. Reflecting together on some of the similarities and differences between the approaches used in these settings they might then discuss how a teacher's practice is influenced by their prior experience and knowledge of teaching.

E: Knowledge of learners and their characteristics

I noticed that children were eager to attend mathematic class than previous. Even the slow learner children were tried to complete some exercises that I had given. Positive encouragement persisted giving to build up their confident in doing mathematics without giving up easily. (P1-R55: QB)

This report illustrates the 'intuition, care, and empathy for pupils' (Grimmett and Mackinnon 1992, pp. 428–429) that suggest pathic knowledge. It documents this student's awareness of learners and their needs; inter- and intrapersonal knowledge that is

essential for teaching. Their account suggests qualities that contribute to 'personal pedagogies' (van Manen 2016, p. 79) as this student reports that they notice children's attitudes towards mathematics and the behaviour of particular pupils, and support attitudinal change by the way they teach.

Focus points for using the framework to support conversations about knowledge:

1: To encourage reflection on experience of practice over time to develop knowledge of teaching. The student's reference to 'previous' alludes to the way they are drawing on their experience over a period of time to develop their knowledge of teaching. A teacher educator could use this idea to enquire into the student's understanding of and approach to reflecting on their practice, learned as part of ARM.

2: To promote the use of noticing with reflection to develop knowledge of teaching. The student refers to noticing: the pupils' attitude to the mathematics class (their eagerness); differences in learning between pupils; and pupils' developing confidence and persistence, which the student attributes to their encouragement. A teacher educator might probe further into what the student means by noticing, how they notice. They could discuss Eraut's (2000) understanding of experiential knowledge, a component of personal knowledge, in the context of Mason's (2011, p. 35) 'discipline of noticing'. This centres on the view that 'noticing is a collection of practices designed to sensitize oneself so as to notice opportunities in the future in which to act freshly rather than automatically out of habit' (Mason 2011, p. 35). Reflection, a principle of ARM, is integral to noticing, which involves readiness to notice and reflecting on recent experiences (experiential knowledge) to identify issues to notice and be able to practice in a different way (Mason 2011).

F: Knowledge of educational contexts

> Actually, many challenges that I have faced in using ARM. The pupils are not ever exposed that kind of teaching practice before. It is difficult to me to organise the group work, to ask them present their answer, to ask them sharing the idea and their resources. The pupils were not very confident and not motivated to experience the ARM. (P1-R101: QC)

This student describes disparities between 'what they learned *about* teaching', their present knowledge of teaching, and their practicum experience of what 'is required *in* the practice of teaching' (van Manen 2008, p. 10, original emphasis). The challenges are accentuated, and perhaps expected, as these students were charged with pedagogic reform in schools. Here, the student suggests they are developing their personal knowledge of teaching through using ARM, a 'new' pedagogical approach during their placement. This account of their struggles in class has parallels with an example from Kessels and Korthagen (1996, p. 20), who suggested a teacher educator might enquire 'further into what the student is actually aware of, what details he sees in the problem-situation, what his own reactions were, how he felt, what he thought, and the like'.

Focus points for using the framework to support conversations about knowledge:

1: To model ways of using challenges in practice to acquire knowledge of teaching. The one-to-one learning conversation provides opportunities for the teacher educator to model reflective critique of challenging experiences in practice. They could follow the approach advocated by Kessels and Korthagen (1996) in order to develop aspects of the student's personal knowledge of teaching.

2: To reveal and develop understanding of conceptions of knowledge and the nature of knowledge. A teacher educator could use this example to talk about different conceptions

of knowledge (e.g. Eraut and Hirsh 2007, Scheiner *et al.* 2019) and factors that influence understandings of the nature of knowledge (cultural, codified and personal factors). They could use this to reveal and develop the student's understanding of the characteristics of knowledge and how knowledge is acquired.

G: Knowledge of educational ends, purposes, and values, and their philosophical and historical grounds

> My pupils becomes good problem solvers who able to create ideas, communicate effectively, reasoning logically, find appropriate strategies in tackling problems and have their own views and beliefs. (P1-R19: QB)

References to problem solving, communicating, logical reasoning and creativity in this example are consistent with the mathematics curriculum (Ministry of Education Malaysia 2006) and the Eleventh Malaysia Plan, 2016–2020 (Economic Planning Unit, Malaysia 2015). Whilst this student expresses alignment with some views of learning and knowledge expressed in national documents, they also suggest conceptions of beliefs and thinking as individualised that seem more compatible with constructivist views of learning (e.g. Windschitl 2002).

Focus points for using the framework to support conversations about knowledge:

1: To develop awareness of factors that influence knowledge of educational aims and values. A teacher educator could use this response to reflect on areas of overlap and dissonance between the student's knowledge and understanding of the purpose and values of education promoted culturally (nationally and locally in settings such as their Teacher Education Institute, placement school and family). How do these views influence their practice of teaching?

2: To promote understanding of theories of knowledge and learning. This example provides opportunities to look at different theories of knowledge and learning (e.g. Confrey 1990, Illeris 2009). Drawing on the student's experience a teacher educator could talk primarily about theories relating to knowledge transmission and the social construction of knowledge and explore how the student's personal knowledge of teaching is influenced by their national and local context and through teacher education (cultural and codified dimensions of knowledge).

Implications for theory and practice

Students entering teacher education programmes bring a wealth of culturally situated, socially developed personal knowledge that informs and shapes the way they use the knowledge they acquire during their studies. Here, the students' accounts illustrate the complex nature of the knowledge they are developing and using in class; as van Manen (2008, p. 20) asserted 'Teacher knowledge does manifest itself in practical actions . . . we may "discover" what we know in how we act and in what we can do . . . '. Their reports of episodes of practice show how different forms of knowledge assume more or less importance depending on context. As practice changes, for example, prior tacit knowledge loses value (Eraut 2004) and new tacit knowledge develops once different ways of working are established.

The examples provided in this article show how the Eraut-Shulman teacher knowledge framework could be used as a practical tool to support deep reflection on and dialogue about knowledge. It can be used to consider 'discrete' dimensions of knowledge or to discuss the nature of knowledge itself; understandings of knowledge reflected in written,

verbal or recorded examples of teaching. It can also be used to discuss explicit knowledge and reveal tacit knowledge and to critique practice in different settings and when teaching different subjects. However, whilst the framework enables particular dimensions of knowledge to be brought forward for closer inspection, it is important to recognise that teaching practice involves complex, contextualised, never-repeated processes in which knowledge is used, acquired and created. It is 'a dynamic interpersonal, interactive process', which 'requires the improvisational skill of instantly knowing how to interpret ever changing situations . . . ' (van Manen 1991, p. 187). The spectrum of knowledge integral to episodes of practice means the students' reports do not reflect 'single' dimensions of knowledge. Each report is open to interpretation and affords opportunities for professional dialogue and learning. The framework provides different perspectives for this dialogue; different ways of looking at knowledge associated with practice and of linking that practice with theory.

Cultural, codified and personal knowledge are differentiated in the framework, providing relief, such that different dimensions of knowledge are considered to greater or lesser extent when looking across the grid. This highlights the culturally located nature of understandings of teaching and teacher knowledge; at individual, classroom and school, national and international levels. Pertinent to this research conducted in Malaysia, Eraut (2009, p. 65–66) emphasised the importance of such cultural knowledge suggesting that it could be argued 'that all knowledge is cultural knowledge and is socially situated'. The framework also emphasises the importance of personal and personalised knowledge. Indeed, one could contend that all knowledge is personal knowledge too in the sense that cultural and codified knowledge comprise composites of the knowledge of individuals. Significantly, the framework provides opportunities for teachers to use personal experiences of practice as the foundation for their professional learning about the nature, development and use of knowledge in teaching.

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