Changing practice in Malaysian primary schools: Learning from student teachers' reports of using action, reflection and modelling (ARM)

Claire Dickerson[*], Kit Thomas, Joy Jarvis & Roger Levy
School of Education, University of Hertfordshire, Hatfield, UK

[*] Corresponding author:
Email: j.e.c.dickerson@herts.ac.uk

Abstract

Curricular and pedagogical reforms are complex inter-linked processes such that curricular reform can only be enacted through teachers teaching differently. This article reports the perspective of emergent Malaysian primary teachers who were expected to implement a Government reform that promoted active learning. The 120 student teachers were members of a single cohort completing a new BEd degree programme in Primary Mathematics designed by teacher educators from Malaysia and the UK. They were taught to use a tripartite pedagogical framework, ARM, involving action or active learning, supported in practice through reflection and modelling. Drawing on findings from surveys carried out with the student teachers at the end of their first and final placements this article examines evidence for the premise that the student teachers were teaching differently; illustrates how they reported using active learning strategies; and identifies factors that enabled and constrained pedagogic change in the primary classroom. The students' accounts of using ARM are critiqued in order to learn about changing learning and teaching practice and to contribute to understanding teacher education and early teacher development. The students' reports suggest diversity of understanding that emphasises the need to challenge assumptions when working internationally and within national and local cultures.

Key-words: Action, reflection, modelling (ARM); Malaysia; changing practice; student teacher.

Introduction

This article reports the perspective of emergent Malaysian primary teachers who were expected to implement a Ministry of Education Malaysia (2006) reform of mathematics curriculum specifications that promoted active learning. Curricular and pedagogical reforms are complex processes that cannot be addressed in isolation from other elements of the education system and from political, economic and social settings (Westbrook et al. 2013). They are inter-linked such that curricular reform can only be enacted through pedagogical reform, that is, teachers teaching differently. In this study, student teachers completing a newly designed BEd degree programme, were taught to engage pupils in active learning through using ARM: action, reflection and modelling (Jarvis et al. 2014). Thus, action or active learning, arising from the reform, was supported through reflection and modelling. Students were required to reflect on their practice; to enable pupils to reflect on their learning; and to model both active learning and reflection and encourage pupils to model with their peers. This article highlights the requirement for implementers of reform to thoroughly understand the reform and what it means in terms of pedagogical practice in their own context. It also emphasises the need to look for, consider, and challenge assumptions in teacher education when working internationally and within national and local cultures.

This article introduces the reform within three areas identified as important elements in the change process: the change itself; its context; and the role of the agent of change (Badley 1986). It then describes the BEd programme and research method before critiquing students' accounts of practising ARM during two school placements in order to learn about pedagogical change and contribute to understanding teacher education and early teacher development.

Curricular and pedagogical reform: the proposed change

The BEd programme described here was designed to support implementation of national primary mathematics curriculum specifications (Ministry of Education Malaysia 2006, viii), which stated: 'The learning of mathematics at all levels involves more than just the basic acquisition of concepts and skills. It involves, more importantly, an understanding of the underlying mathematical thinking, general strategies of problem solving, communicating mathematically…' This curriculum was implemented alongside the Malaysian Government policy Pengajaran dan Pembelajaran Sains dan Matematik dalam Bahasa Inggeris (PPSMI) (Singh and Sidhu 2010) or Teaching and Learning Science and Mathematics in English. This was considered necessary for Malaysia to keep up-to-date with developments in science and technology and remain competitive in a globalised economy (Heng and Tan 2006). PPSMI was subsequently reversed due to challenges associated with implementation and impact (Singh and Sidhu 2010) and since 2012 mathematics has been taught mainly in Malay (Tatto et al. 2012).

PPSMI was designed to reform mathematics learning and teaching strategies (Lim and Chew 2007) in line with the curriculum specifications, which advocated 'Ensuring active learning' as a way to 'create an effective communication environment' (Ministry of Education Malaysia 2006, xii). Understandings of active learning are contested; the understanding within the BEd programme was consistent with Bonwell and Eison's (1991, 2) 'working definition' of active learning 'as anything that "involves students in doing things and thinking about the things

they are doing"'. This understanding was contextualised using what Leu and Price-Rom (2006, 15) suggested are generally agreed aspects of effective teaching that support active learning, which include:

> '…conceptual learning that goes beyond memorization, the use of cooperative learning through which students construct knowledge together, the ability to communicate independently, students' original work used to demonstrate learning (often displayed in classrooms), minimal teacher lecturing or direct transmission of factual knowledge, multiple small group activities that engage students in discovery learning or problem-solving, and frequent student questions and discussions.'

These strategies relate to social constructivist pedagogies based on theories of learning such as those proposed by Piaget (1954), Bruner (1974) and Vygotsky (1978). These theories emphasise the importance of social interaction, cooperative relationships and language in learning seen within the BEd programme as inherent in activities supporting active learning. Pupils are seen as central in learning and learners have responsibility for their own learning (Faryadi et al. 2007). In practice, constructivism is inherently complex. Windschitl (2002) viewed it as four dilemmas (conceptual, pedagogical, cultural and political) associated with the teacher's understanding of the underlying concepts; the need for more complex approaches to developing learning experiences; changing roles and expectations for both teacher and pupils in class; and resistance from within school communities.

The IEA Teacher Education and Development Study in Mathematics (TEDS-M 2008) (Tatto et al. 2012) explored beliefs relating to constructivist pedagogies among teacher educators and future teachers in 17 countries. Tatto et al. (2012, 158) reported a pattern across countries of greater support for a belief statement compatible with 'conceptual and cognitive-constructivist views of mathematics learning (mathematics is a process of enquiry; learning mathematics requires active involvement)' than with statements compatible with 'conceptual and calculational views of mathematics learning (mathematics is a set of rules and procedures; learning mathematics requires following teacher direction)'. The overall picture was complex, however, and in some countries, including Malaysia, the latter two beliefs were more prevalent than the former (Tatto et al. 2012). However, the extent to which future teachers in Malaysia endorsed the belief scale 'Learn Mathematics through Active Involvement' (61.0%, primary specialists; 62.2%, secondary, grade 11+) (Tatto et al. 2012, 160), implied that the beliefs of many of these teachers differed from the vision proposed in the Government reform (Ministry of Education Malaysia 2006).

Whilst PPSMI would have constrained any educational reform, this was especially so for social constructivism, which is mediated primarily through language (Westbrook et al. 2013). The degree of implementation of PPSMI depended on teachers and pupils' fluency in English (May Tan 2007) and communicating effectively in mathematical language in English presented a particular challenge (Cheah 2007). Although discussed within the context of the science curriculum rather than mathematics, Koo (2008, 114) emphasised the importance of academic, discipline-specific proficiency as well as general proficiency in English and suggested most learners 'are struggling on two cognitive fronts, linguistic and content' and need linguistic as well

as pedagogic scaffolding. In this article, the challenge associated with communicating in English is identified as an important contextual factor; however, the main focus is pedagogical change.

A clear vision of the nature of the reform is essential for implementation and several authors (e.g. Saxe et al. 1997) have stressed the importance of differentiating between form and function in understanding changes in learning and teaching mathematics. Drawing on this work Spillane (2000) reported that district leaders in Michigan, USA, engaged in reforming mathematics education, emphasised pedagogical forms such as activities and instructional resources rather than functional understandings such as what is seen as mathematical knowledge and learning and doing mathematics. Spillane (2000, 154) suggested 'reformers' principled-based goals for mathematics were understood chiefly in terms of procedural-based mathematics'. Leu and Price-Rom (2006, 15) highlighted such challenges relating to engaging elements of teaching that support active learning, which are often interpreted in relation to the form rather than the 'substance of teaching', for example, group work is used alongside rote learning. Analysis of the relationship between beliefs and practices in the TALIS survey revealed that teachers who reportedly 'involved students working in small groups frequently or in all their lessons have stronger constructivist beliefs when compared with teachers who report using these types of practices never or occasionally' (OECD 2014, 165). Although this implies some alignment between beliefs and practices, Leu and Price-Rom's (2006) reference to using active learning strategies alongside rote learning is cautionary when interpreting the BEd students' reports.

Malaysian teacher education and teaching in schools: the context of change
Recent Malaysian reforms included setting a minimum target of fifty per cent of teachers in primary schools with graduate teacher status by 2015 (Tatto et al. 2012). Primary teaching is subject-specific enabling teachers to use particular teaching approaches within a subject. The Ministry of Education sets common curriculum requirements for all teacher education institutes, including a practicum (Tatto et al. 2012). For most students starting their first practicum their experience of teaching comes from being a learner rather than from direct involvement in teaching (Furlong 2000) and this experience has an important impact on how they teach (Brookfield 1998). Cheng, Cheng and Tang (2010) identified three main areas of influence on students' conception of teaching: teacher education experiences; school placement context; and school, family and background. Of these, experience of being taught in school was identified as the main influence on students' pedagogical beliefs and the origins of those beliefs (He, Levin and Li 2011).

The BEd students' prior experience as learners had important implications because the traditional pedagogical model adopted in Asian schools differed significantly from the constructivist approaches promoted during the programme (Hallinger 2010). In addition, contested understandings of terms central to the programme, such as active learning, were compounded by differences that can arise when working internationally. For example, Hallinger (2010, 412, original emphasis) reported one respondent from Thailand who observed that 'English terms such as *student-centred learning'* did not have local equivalents and were open to different interpretations.

Teacher educators and student teachers: agents of change

Teacher educators, teachers and student teachers are expected to implement newly developed curricula within schools; that is to act as agents of change. According to Alexander (2009, 16, original emphasis) 'the curriculum is probably best viewed as a series of *translations, transpositions* and *transformations* from its initial status as a set of formal requirements'. It is implemented through teachers' 'pedagogic approaches, strategies and practices', where 'pedagogy comprises what teachers do in the classroom, but also their ideas, knowledge and attitudes in relation to the learners, the teaching and learning process and the curriculum' (Westbrook et al. 2013, 12, 25). The nature of pedagogic practice means that individual teachers use their unique blend and spectrum of strategies and approaches, providing mosaics of practice re-configured within and between settings. This complexity raises questions about what nationally mandated educational 'change' means for individual teachers; exacerbated if, as Hill (2001) reported, words that hold particular meanings to policy makers are interpreted differently by teachers.

Implementing the Ministry of Education Malaysia (2006) vision of the curriculum has important implications for the roles of teacher and pupils (Vighnarajah, Luan and Bakar 2008) because it entails pupils' active involvement in constructing and using mathematical ideas and skills, presenting a challenge for developing teachers with the necessary skills and confidence (Cheah 2010). Westbrook et al. (2013) developed a conceptual framework setting out factors that enable and constrain pedagogic change in teaching practice in which the areas of interest are visualised as two concentric rings. The core is teacher's pedagogy, encompassing 'teacher thinking, doing and their impact on student learning outcomes'; this core relates to components in an outer ring (teacher education, and curriculum and assessment), which are set within a particular context 'and can be conceptualised as enabling or disabling teachers' thinking and doing' (Westbrook et al. 2013, 15). This conceptual framework (Westbrook et al. 2013) provides a basis for critiquing findings from the study presented here.

This study

The BEd degree programme

The Ministry of Education Malaysia sponsored development of a four year BEd degree programme in Primary Mathematics, with English and Health and Physical Education as minor subjects during an educational reform involving four overseas universities. The University of Hertfordshire, UK, designed the programme with colleagues from two Institutes of Teacher Education in Malaysia; and was responsible for programme validation, support and quality assurance. All 120 students who enrolled on the programme graduated in 2010. They studied at the Institutes and taught in Malaysian primary schools during their practicums. The Malaysian teacher educators and many of the students were bilingual or multilingual, and in adherence to the PPSMI policy, English was the learning and teaching medium throughout the programme. The students' work was assessed formatively and summatively as they gained the requisite knowledge, understanding and skills to teach within Malaysian primary schools. Pedagogies were consistent with the revised mathematics primary curriculum so that the students could change practice in schools.

Curriculum and pedagogical reform in Malaysia has been subject to a myriad of changes since independence and is highly politicised, especially regarding the status of the Malay language. This study casts light on one major reform by revealing the views and understandings of teacher educators and student teachers involved and providing an opportunity to learn from those positioned at the forefront of a change designed to contribute towards modernising Malaysian education.

The pedagogical framework

Development of the action, reflection and modelling (ARM) framework by UK and Malaysian teacher educators provided opportunities to explore individual pedagogical experience and beliefs (Jarvis et al. 2014). The time available for them to understand the nature of the reform was constrained and there were important differences between the teams. The Malaysian educators, experienced secondary teachers, emphasised theory whereas their UK counterparts, former primary teachers, emphasised practice. Working together they threaded ARM throughout module and assessment design and teaching and learning activities. The Government mandate to use active learning in primary mathematics classrooms required a theory-led teacher education programme that emphasised epistemic knowledge (Korthagen and Kessels 1999), in this case ARM. Acronyms are popular in Malaysia and ARM provided teacher educators, mentors and students with a readily recalled and simple way of articulating their pedagogical principles.

Action represented the Ministry of Education Malaysia (2006) requirements for pupils to engage in active learning; and reflection or reflective learning (e.g. Schön 1983), and modelling supported this engagement. Students were encouraged to reflect on their teaching and engage pupils in reflection on their learning. Modelling involved teacher educators teaching simultaneously about the content and the act of teaching used to convey it (Loughran 2006). They modelled to the students; who modelled to the teacher educators and their peers in the Institute; and to pupils in schools. ARM provided an explicit framework for the students' learning and teaching experience enabling them to reflect on and articulate their practice. These emergent teachers accepted ARM as the 'right way' of teaching; it derived from a Government directive and formed part of a programme co-developed with a Western university.

Research Methods

Aims, participants and data collection

The research aims were to investigate the student teachers' views and experiences (Pope and Mays 1995) of using ARM during two school practicums (placements). The data, derived from a large dataset (Dickerson et al. 2011), are used to explore the following research questions, focusing on active learning:

- Is there evidence for the 'newness' of ARM? (Do the accounts suggest that the student teachers *were* teaching differently?)
- How did the student teachers promote active learning in the classroom? (Which learning and teaching strategies do they describe? What evidence is there that pupils were engaging in active learning?)

- What are the factors that enabled or constrained them as they promoted active learning in the classroom?
- What can we learn about pedagogical change from the student teachers' accounts of promoting active learning?

The research team included: senior programme participants in Malaysia; the University Programme Director; and a senior teacher educator/research lead and a research fellow from the University. University team members were responsible for day-to-day management, consulting as required with colleagues in Malaysia. Ethical approval processes were managed by the University research lead and requisite permissions gained from colleagues in Malaysia. All 120 student teachers were eligible to participate. Responses were anonymous, and although handwritten, data transcription and respondent coding were completed by the research fellow who was not involved in implementing the programme. Data were collected using the survey method (McColl et al. 2001). Students completed questionnaires in English at the end of their first placement (P1, year 2), and final placement (P2, year 4); 110 (92%) of 120 members of the cohort responded in year 2 and 87 (73%), in year 4. Respondents (R) are referred to as 'student teacher' and 'student' throughout. This article includes responses from the open-ended questions shown in Table 1. Using self-completion questionnaires provided an opportunity for all students to contribute to the research and to reflect on their practice at two stages of the programme. The chosen methods were deemed suitable, given the students' emerging confidence with reflection. Potential threats to validity of the data include respondents' understanding of the questions and challenges of recalling and documenting their views and experiences. Typically, responses indicated that students understood the questions. Responses were often rich and were consistent with what was known about the way ARM was taught and with data collected from teacher educators and mentors.

Table 1.   Survey questions: end of first and final placements

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? (P1)
Q5. What challenges did you experience using ARM? If applicable, please describe how you overcame these challenges (P2)

Data management and analysis
The research fellow managed and analysed the data in consultation with 'advisory' team members (research team members and other University colleagues with relevant expertise). The process of transcribing and verifying the students' responses enabled familiarisation with the data

(Patton 2002). The transcription comprised more than 1000 individual question responses; some spellings and abbreviations were standardised, facilitating electronic searching.

Year 2 responses (Table 1) were content analysed, a process that 'involves identifying, coding, categorizing, classifying, and labeling the primary patterns in the data' (Patton 2002, 463). The research fellow repeatedly read the data-texts, identifying themes or codes which resonated with teacher educators and refining them through discussion with other advisory team members so the texts were analysed and/or reviewed by at least two colleagues. Response extracts were collated into four main themes and then into sub-themes using rigorous checking and editing processes to refine categorisation. The themes and sub-themes were derived from the questions, the responses and the subject area, thus involving elements of induction and deduction (Patton 2002). The *'richly descriptive'* (Merriam 2002, 5, original emphasis) and complex nature of the data meant that some extracts fitted within more than one theme/sub-theme. The sub-themes defined what Zhang and Wildemuth (2009, 310) termed 'The unit of analysis' for extracts of data in which examples of the theme were identified. These extracts varied in length from phrases to one or more sentences.

Data theming example. The following example from the marked-up copy of the data-text illustrates the excerpting and theming process; 'de-contextualization' usually combined with 're-contextualization' (Tesch 1990, 115).

Student teacher response (R102, P1):
Question: 'What challenges did you experience using ARM?'
'It is a little bit challenge for me when my pupils didn't understood my explanation well because of using the English language. Thus, sometimes I spoke more on using Malay language to let them understand the lesson. Other than that, sometime as I reflect them via asking questions, mostly all of them didn't know how to answer it.'

Theming
Main theme 4: Professional attributes.
Sub-theme 4e. English language (and communication)
Extract: It is a little bit challenge for me when my pupils didn't understood my explanation well because of using the English language. Thus, sometimes I spoke more on using Malay language to let them understand the lesson.

Main theme 1: Learning and teaching.
Sub-theme 1b. Learning and teaching strategies
Extract: Other than that, sometime as I reflect them via asking questions, mostly all of them didn't know how to answer it.

The research fellow subsequently content analysed both datasets to identify references to 'action' and 'active learning' and associated key words and phrases in the students' responses to the first question, Q1 (Table 1). Table 2 shows some examples, with illustrative excerpts from the responses (P1). The research fellow also recorded the number and percentage of respondents

using these terms; this quantification was tentative due to the complexity of the data. The findings suggest a range of understanding and illustrate how and why the students introduced active learning. They are of particular interest in the context of implementing reform through an initial teacher education programme.

Table 2. Excerpts from students' responses (P1): examples of key words and phrases associated with active learning

Active learning - I make sure my lesson involve active learning. I used to make my students to involve actively through group works and hands-on activities. (R1)
Action - …I use action normally while introducing new topic. Eg. how to read the scale of weighing scale therefore I do some actions on reading the scale then let pupils do later. (R89)
Activity, activities - Designed activities that involved pupils actively in the lesson. Drew questions to pupils in order to provoke them to think. (R10)
Group work, group activities - …I have created some activities in groups, pair or individually. From that, my pupils can learn by their own and their peers. In addition, I made interesting activities in order to avoid them bored and encourage them to learn. (R103)
Discuss, discussion - I used to promote active learning by encouraging the pupils to do group works and discussions… (R62)
Teaching resources, aids, concrete materials - …I used lot of materials to help me to demonstrate the concept that I want to teach on that day. Sometimes, I have to bring a concrete materials such as fruits, marbles and candy in order to make my pupils understand better… (R93)

Patton (2002) highlighted the importance of quotations in qualitative research and whilst content analysis was used to visualise patterns or 'make sense' of the data, complete responses are included here as well as extracts collated into sub-themes. These extracts and responses have been selected using purposeful sampling as 'information-rich' examples (Patton 2002, 230) to enable a critique of the students use of active learning strategies within the context of changing classroom practice. According to Patton (2002, 230), 'Studying information-rich cases yields insights and in-depth understanding rather than empirical generalizations'. The richness of the data influenced the decision to present pieces of the data in an attempt to honour the participants' voices. Using their own words serves to illustrate; provide evidence and voice; explain; and enhance understanding of their views and experiences (Corden and Sainsbury 2006).

Findings and discussion
This section examines the premise that the students *were* teaching differently; illustrates how they reported engaging pupils in active learning; and identifies factors that enabled and constrained pedagogic change, before collating learning about using new pedagogies in school. It concludes with some implications for practice. There are few relevant studies conducted in the specific context of Malaysia. This study therefore makes a significant contribution to the research in Malaysia. The findings presented and critiqued here are selected rather than representative to enable discussion and reflection, raise questions and learn about pedagogic change.

Evidence for the 'newness' of ARM
Several students' accounts suggest that they *were* using 'new' learning and teaching approaches. One student suggests a trajectory from 'traditional' teaching approaches to a 'new' style (ARM), in which pupils are 'actively involved', discuss, reflect and become 'critical and independent learners', possibly suggesting a new end-point in learning. This account suggests that pupils were taught communication skills to support effective interaction with others (Le Cornu and Peters 2005); pupils were encouraged to develop their voice, to discuss, to share opinions and ideas.

> 'There have been long time that the teachers in the school are using the same traditional or old methods to teach the pupils. I think by using ARM, I did expose and demo to the pupils a new and more effective teaching style. The pupils are encouraged to be actively involved in the class with more discussion and opinions sharing. They have to do the reflection as well as what I have to do on they own. The pupils became very active and willing to share their thinking. This causes them became a critical and independent learners.' *(R18, P1: Q3)*

> Other students acknowledged pupils' prior experience of learning, asserting they 'were used to the memory based learning, where they were spoonfed all the time' (R40, P1) and 'they more comfortable to be passive learner as the result from previous learning' (R24, P2). The students' assertions about the newness of ARM were corroborated by school mentors and Malaysian teacher educators who contributed to the research (Dickerson et al. 2011; Jarvis et al. 2014).

The student teachers' language of active learning
During the BEd programme, the terms 'action' and 'active learning' were used synonymously to represent the approach to learning mathematics endorsed by the Ministry of Education Malaysia (2006). Content analysis of the students' responses suggests that many of them were using the 'language' of active learning and indicates some differences in the way they used these terms when questioned about their use of ARM on placement (Table 2). Students generally used the phrase 'active learning' (31, 28% P1; 29, 33% P2), in association with pupils. Their references to 'action' (37, 34% P1; 14, 16% P2) at the end of their first placement, however, often related to themselves as teachers rather than to their pupils; an association that was less apparent at the end of the final placement. Student teachers showed their pupils how to engage in action or active learning; as one explained 'Action and modelling are related to each other. So when teaching process happen, I had modelling first and then I had asked my pupils to do it as action' (R77, P1).

Many students referred to using an activity or activities in their lessons (51, 46% P1; 25, 29% P2) and pupils were engaged in group work (19, 17% P1; 14, 16% P2) and discussion (4, 4% P1; 5, 6% P2), approaches often associated with active learning environments. Students also reported using various teaching aids and resources, including concrete materials (Table 2).

How the student teachers promoted active learning

The students' accounts suggest they were developing their own meanings of teaching through engaging with pupils (van Huizen, van Oers and Wubbels 2005). As they involved pupils in constructivist learning approaches, they were constructing their own understanding of teaching. They described strategies they thought exemplified action or 'active learning' and variations between responses illustrate the range of understandings and the complexity of teaching, and learning to teach. There were references to pupils working in groups, discussing and solving problems (R101, P1; R102, P1). One student's assertions '*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…' (R101, P1, emphasis added) implies 'constructivist teaching beliefs' (OECD 2014, 165) and their account illustrates the way these beliefs related to their practice. Although the question wording (*How* did you use ARM…?) might encourage description of 'behavioral' aspects of active learning, exemplified here as discussion, 'the cognitive dimension' relating to the extent to which thinking is encouraged (Ginsburg 2009, 6) is implicit in this discussion, which enabled the pupils to '"think together"' (Mercer 1995, 104) and 'get the final answer'.

> 'During I'm teaching Mathematics with the topic of 'time', to create the active learning in the classroom. I have done several interesting activities such divide pupils into groups and asked them to discuss to solve problems given. Thus, I distributes some resources that I've created to each group and let them used it by their own as they can touch and feel it. The resources are such as clock, flashcards and so on.' *(R102, P1: Q1)*

Students described themselves as facilitators (e.g. R26, P2), a role cited in the 'index of constructivist beliefs' (OECD 2014, 165) and emphasised by Vighnarajah et al. (2008) in encouraging pupils to become inquirers, active participants in learning and teaching. Together the pupils and the student created the social setting in class, changing roles in learning and teaching (Cobb, Wood and Yackel 1990). Students (e.g. R40, P2) also reported using '*realistically* situated' learning opportunities that are part of constructivism (Edward 2001, 431, original emphasis). It is not clear whether these were examples of embedding learning in everyday life or a more engaging way to learn the same thing (Spillane 2000). Thus, drawing on Spillane's (2000) work they might suggest a change in form only or of both form and function of mathematics education. A student who described teachers as facilitators (R26, P2) refers to pupils constructing knowledge, which might imply a deeper change in understanding of the nature of knowledge, contrasting with the traditional concept of teachers as knowledge providers, possibly reflecting a change in function.

> 'Encourage active learning. Students always being given their own space in learning to construct their own knowledge. Teacher work as the facilitator.' *(R26, P2: Q1)*

'As one of the element is active learning. Pupils feel excited and are engaged in learning in my lesson as they delighted with the activities I planned. For example, pupils like "Shopping Activities" where they will buy their favourite things with their friends. It makes the learning of money fun and interesting!' *(R40, P2: Q3)*

Whilst many responses suggest active learning, some are reminiscent of transmission approaches, familiar to students from their experience as pupils. In reporting that pupils took on 'their' role as teacher in the classroom as they explained to their peers, one student (R9, P1) described a change in focus that required a 'renegotiation of social norms' (Cobb et al. 1990, 133). However, here, questioning and providing a solution might align more closely with knowledge transmission, as in the second example below (R75, P1).

'Children get to play the role of a teacher when they presented a question. They explained the question and explained how to solve it.' *(R9, P1: Q3)*

'By making own reflection, I had discovered that lots of my pupils need to be guided through their activities so they can do it more effectively and save more time to wait for them to complete it on their own. Besides that, I noticed that by using Modelling, I can teach my pupils about how to solve the questions more easier by guiding them to collect information and make their calculations.' *(R75, P1: Q2)*

Through engaging pupils actively in class students reported that they could assess their learning needs and plan appropriate teaching (R38, P1), and know their 'pupils' thinking and understanding' (R57, P1). These observations are consistent with using pedagogies to promote active learning that involve frequent pupil-teacher and pupil-pupil activities and communication.

'I can encourage my pupils to participate actively in the classroom. From there I can evaluate the level of each pupils and I can plan the teaching that suit with the pupils.' *(R38, P1: Q2)*

'Active learning help me to know what my pupils' thinking and understanding.' *(R57, P1: Q2)*

Factors that enabled or constrained the student teachers as they promoted active learning
The students' accounts suggest several factors that seem to have enabled or constrained the promotion of active learning and some examples are explored here. However, the picture is complex and a factor supporting change for one student might seem to constrain another in a different context.

Understanding the nature of active learning and the role of the ARM framework
Whilst some students refer to strategies associated with active learning, others report that pupils took part in physical activity, seen as necessary for active learning by some members of the

cohort (Dickerson et al. 2016). Complexities of language, and including the term 'action' within ARM, might have contributed to apparent differences in understanding. The second author, who subsequently worked in a senior role in Malaysian higher education, became aware that the term 'action' in local parlance could describe someone who was 'showing off' or 'full of themselves'. This located meaning was probably known and used by younger members of the population, such as the students and pupils, and not by the teacher educators. Such subtleties of language highlight the need to consider assumptions that reflect differences both within and between cultures. However, the framework itself was seen as helpful for planning for active learning by providing a simple structure or checklist that could be applied to each lesson, supporting change:

> 'ARM help me to plan the well lesson plan. A remind me need to plan the interesting activity which can active the pupils' learning.'*(R51, P1: Q2)*

Pupils' prior experience and response to active learning
Pupils' prior experience of 'memory based learning' (R40, P1) was thought to constrain active learning. If pupils were used to transmission approaches then as Kabilan and Izzaham (2008) suggest they would expect the teacher to take a central position and provide knowledge which they would accept.

> 'Since, students were used to the memory based learning, where they were spoonfed all the time, it was quite hard for me to foster active learning in the classroom.'*(R40, P1: Q4)*

At the end of their final practicum two students explained how they encouraged pupils who did not engage readily in active learning (R14; R24). Here, the 'problem' these students identify is seen to be within their control and can therefore be addressed (Loughran 2002); the student is the learner (Loughran 2006) who implements a change in practice. Pupils who responded however, provided positive reinforcement for maintaining change. According to Guskey (1985) change in pedagogical practice in class can precede a change in teachers' attitudes and beliefs if positively reinforced through evidence of change in students' learning outcomes. Whereas an experienced teacher can compare students' learning outcomes before and after the change, this opportunity is not available to students who might focus instead on their experience as a learner or perhaps compare outcomes for pupils in their class who engage in active learning with those who do not.

> 'I can say that my pupils enjoy the lesson since they are keenly and actively involve during the teaching and learning activity. However, there are still a few pupils cannot go along with the process. Thus, I will do kind of reflection to create different activity for those pupils.' *(R14, P2: Q3)*

> a) 'I find that, It was difficult to get pupils participation because they more comfortable to be passive learner as the result from previous learning.
> b) 'From my experience, took time to cultivate active participation. Finally I manage to encourage them to be active in the classroom.' *(R24, P2: Q5)*

PPSMI

Goh and Matthews (2011) reported that student teachers on placement in Malaysian secondary schools were particularly concerned about teaching using English, expressing anxieties about using words or grammar incorrectly or being unable to recall a word. The following accounts suggest that both pupils and students found ways of adapting to facilitate understanding. The first (R41, P1) illustrates practical complexities associated with PPSMI and the importance of the linguistic proficiency of all parties; the student and perhaps forty or more pupils. These challenges seem to arise from using English rather than implementing ARM per se and the pupils adapt by speaking in 'mix language'. In the second report (R81, P2) the student adopted 'code-switching' (Lim and Chew 2007, 5). This provided a way of balancing between meeting policy requirements and supporting pupils' understanding and using strategies such as translating from English to the Malay language and conducting bilingual lessons, reported in Malaysian secondary schools (May Tan 2007). This is of value when communication provides a way of accessing pupils' thinking (Cheah 2007).

> 'Also, my pupils can't understand English because it wasn't our mother tongue language but they showed me improvement when they brave to speak in mix language'. *(R41, P1: Q4)*

> a) 'Language barrier, where sometimes my pupils cannot really understand the English terms that used by me.
> b) 'Initially, I used to make use of simple words to deliver my instruction in a good manner. If it still does not work, I choose to make use of our mother tongue language, that is Malay to support them.' *(R81, P2: Q5)*

Despite apparent challenges of teaching using English however, using ARM, particularly active learning, helped one student (R75, P1) in the context of PPSMI and suggests these two reforms could be complementary. This student uses actions rather than words so that pupils gain understanding through observing rather than listening in order to minimise use of Malay language. In their study of secondary teachers and students who implemented PPSMI in mathematics lessons, Clarkson and Idris (2006, 89) highlighted the importance of 'listening carefully' to pupils, which is more challenging during group-work.

> 'ARM were benefit to me when to give clear explanations and instructions to my pupils. It is because almost of my pupils were lacked in their English proficiency so I had to use my body language to minimise the use of native language (Malay language) in my classroom. So, indirectly my pupils understand what has been told to them by seeing my actions and not listening to the translations in Malay language.'*(R75, P1: Q2)*

Learning about pedagogical change through using ARM

Understanding the reform and its operationalisation in terms of pedagogical practice is a fundamental requirement for introducing change. How does the *new* approach relate to current practice? What *is* current practice given the spectrum of pedagogic approaches in each class? What will the new approach look like in class? How can pupils be encouraged to engage?

Drawing on Spillane's (2000) work, is the change one of form or of form *and* function? The first suggests that although the route for learning is different it leads to the same destination; whereas the second implies that both route and destination are different. Thus, if reform is functional and assessments are aligned with the original learning target, teaching reaching the new target might be deemed less successful, undermining the reform. In practice, the purpose of reform, pedagogical approaches, and assessment need to be aligned.

The BEd programme was developed to support implementation of Government-led curricular reform, enacted through primary teachers teaching differently. There was no evidence for, or discussion about, changing examinations, which would have been beyond these students' remit. Indeed, change extended to school assessment means new approaches should be simultaneously extended to both emergent and practising teachers to avoid a mismatch of pedagogy and assessment. Reflecting on the research findings in the light of relevant literature raises questions about the extent to which the reform was understood by those, who drawing on Alexander's (2009) phraseology were involved in translating, transposing and transforming it in practice. For example, although using ARM, a 'generic pedagogical strategy' represented a change from traditional practices, it is not clear whether the understandings of the reform were inadvertently 'demathematized' (Spillane 2000, 162) resulting in changes in the *'behavioral regularities'* not the *'epistemological regularities'* of teaching (Spillane and Zeuli 1999, 19, original emphasis). Could a framework such as ARM that is arguably form-focused and transferable across subjects provide a vehicle to facilitate functional reform?

As emerging teachers, the students tested ARM during their placements. Korthagen, Loughran and Russell (2006) emphasised the value of such learning immersed in the students' experience of learning to teach. Whilst ARM provided a structured framework for learning and teaching, as the students moved from procedural to practical understanding during their placements they developed phronetic knowledge (Korthagen and Kessels, 1999). Although students could plan lessons to engage pupils in active learning, it was in class that they learnt how to use and adapt this in a multitude of discrete teaching situations. They were expected to be active learners themselves, developing gestalts based on practical experiences of teaching that they could develop through reflection into schema and theory (Korthagen and Lagerwerf 1996; Korthagen and Kessels 1999; Korthagen 2010). The integrated theory, ARM, underpinned many of the students' practical experiences. Might this theory be reinforced through the gestalt, schema and theory sequence described by Korthagen and Lagerwerf (1996) and developed from taught theory into personal theory? Might ARM as *'epistemic* knowledge' or 'theory with a big T' be incorporated into *'phronesis'* or 'theory with a small t' (Korthagen and Kessels 1999, 7, original emphasis)?

Drawing on the conceptual framework developed by Westbrook et al. (2013) the students' reports suggest several factors that could enable or constrain them in changing practice in schools. Although some examples in Table 3 are specific to this programme others are relevant to different contexts. There was dissonance between the students' teacher education programme and both their school experience and placement setting (Cheng, Cheng and Tang 2010). A critical factor was their understanding of active learning; if they didn't understand the reform requirements then they too would become teachers who needed to change their practice. This would not be surprising; Spillane and Zeuli (1999) reported that only four of 25 teachers who

reported practice more oriented towards mathematics reform were actually teaching in ways that approximated the reformers' intentions. Given the plethora of factors involved in moving from top-down reform to classroom learning there are likely to be significant dilutions and diversions en route. Another contextual factor is the Malaysian practice of subject-specific primary teaching, which enables a teacher to use different teaching approaches for pupils within one subject. The teacher-learner interrelationship is a generic factor; the intentions and actions of students or teachers are shaped by their pupils. Whilst some pupils enabled the students to use ARM, changing as learners, others constrained them, encouraging the students to seek alternative approaches. A significant constraint to change was the requirement to teach using the medium of English given the importance of classroom communication, which is accentuated when adopting social constructivist approaches. Because each lesson comprises a multitude of learning and teaching interactions, planned and unplanned, it seems likely that teachers will use strategies across a spectrum from constructivism to transmission, underscoring the messiness of what it means to 'change' practice.

Table 3. Factors that can enable or constrain changing practice

National context – curricular change (primary mathematics – active learning)
Government sponsored enterprise leading to the BEd programme (designed to link the curriculum and teacher education)
PPSMI*
Teacher education programme – teaching new pedagogy
Teacher educator experience
Teacher educator understanding of the reform
ARM pedagogical approach
PPSMI*
Schools – using new pedagogy
Student teacher experience from school, family, background
Student teacher experience in teacher education
Student teacher understanding of the reform (particularly active learning)
Student teacher role (subject-specific)
School practicum context e.g. school mentors and colleagues
Pupils' prior experience
Pupils' responses to active learning
PPSMI*

* Influential throughout

Implications for practice

In his exploration of the 'special' nature of primary class teachers, Eaude (2014, 8) argues that several factors combine to mean 'that the expertise required to teach young children successfully

is especially complex and demanding'. This demanding nature of teaching was amplified for these emergent teachers who were expected to contribute to changing pedagogic practice in class; introducing ways of engaging the pupils to take 'an active role in "constructing" their own meaning' (Le Cornu and Peters 2005, 50). Such constructivist approaches differed significantly from the pedagogical model traditionally used in Asian schools (Hallinger 2010). The findings should be interpreted within the context of this complex international project and the limitations of survey methods. However, the quality, richness and number of responses together with data collection at two time-points make a useful contribution to learning about changing practice and understanding teacher education and early teacher development. The eloquence and vibrancy of the students' reports and the pictures these create of their learning and interaction with pupils illustrate their individuality and uniqueness and point to some important implications for practice. One such implication is a requirement for implementers of reform to have a thorough understanding of the reform and what it means in terms of pedagogical practice in their context. These students were taught to use action, reflection and modelling (ARM) as a cohesive framework throughout the BEd programme. This framework enabled them to articulate the concepts that underpinned the way they had been taught and how they themselves were learning to teach as they prepared to become agents of change in Malaysian primary schools. Some students' accounts suggested that having an explicit learning and teaching framework was of value to them (Dickerson et al. 2016). However, whilst including a clear structure might facilitate pedagogical change in schools, the students' reports suggest diversity of understanding, highlighting inherent complexity. This was exemplified by apparent differences in the meaning and understanding of the word 'action', used both as a pedagogical term and locally as a colloquial expression. This emphasises the need to look for, consider and challenge assumptions in teacher education when working across international settings and within national and local cultures.

References

Alexander R. J. 2009. Pedagogy, culture and the power of comparison. In Daniels H, Lauder H and Porter J (eds) *Educational theories, cultures and learning: A critical perspective*. London: Routledge.

Badley, G. 1986. The teacher as change agent. *British Journal of In-Service Education*, 12(3), 151-158

Bonwell, C. C., and Eison, J. A. 1991. Active learning: Creating excitement in the classroom (ASHE-ERIC Higher Education Report). Washington, DC: The George Washington University. Accessed 12 October 2017. http://files.eric.ed.gov/fulltext/ED336049.pdf

Brookfield, S. 1998. Critically Reflective Practice. *The Journal of Continuing Education in the Health Professions,* 18, 197-205.

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

Cheah, U. H. 2007. Conceptualizing a Framework for Mathematics Communication in Malaysian Primary Schools. Paper presented at the APEC-Tsukuba International Conference, Tokyo, Japan, December 9-14.

Cheah, U. H. 2010. Assessment in primary mathematics classrooms in Malaysia. Paper presented at the APEC-Tsukuba International Conference, Tokyo, Japan, February 18-21.

Cheng, M. M. H., A. Y. N. Cheng, and S. Y. F. Tang. 2010. Closing the gap between the theory and practice of teaching: implications for teacher education programmes in Hong Kong. *Journal of Education for Teaching,* 36(1), 91-104.

Clarkson, P. C., and N. Idris. 2006. Reverting to English to teach mathematics: How are Malaysian teachers and students changing in response to a new language context for learning? Journal of Science and Mathematics Education in S.E. Asia, 29(2), 69-96

Cobb, P., T. Wood, and E. Yackel. 1990. Classrooms as Learning Environments for Teachers and Researchers. *Journal for Research in Mathematics Education. Monograph,* 4, 125-146.

Corden, A., and R. Sainsbury. 2006. Using verbatim quotations in reporting qualitative social research: researchers' views. ESRC 2136. York: University of York.

Dickerson, C., J. Jarvis, R. Levy, and K. Thomas. 2016. 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*. Doi: 10.1080/13540602.2016.1211101

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.

Eaude, T. 2014. What makes primary classteachers special? Exploring the features of expertise in the primary classroom. *Teachers and Teaching: Theory and Practice,* 20(1), 4-18

Edward, N. S. 2001. Evaluation of a constructivist approach to student induction in relation to students' learning styles. *European Journal of Engineering Education*, 26(4), 429-440

Faryadi, Q., A. Muhamad, Z. A. Bakar, and H. Maidinsah. 2007. Welcome Constructivism, Bye-Bye Every Ism! Paper presented at the International Conference on Science and Mathematics Education, Penang, Malaysia, November 13-16.

Furlong, J. 2000. School Mentors and University Tutors: Lessons from the English Experiment. *Theory Into Practice* 39(1), 12–19

Ginsburg, M. 2009. Active-learning pedagogies as a reform initiative: Synthesis of case studies. Washington, DC: Academy for Educational Development.

Goh, P. S., and B. Matthews. 2011. Listening to the Concerns of Student Teachers in Malaysia During Teaching Practice. *Australian Journal of Teacher Education,* 36(3), 92-103.

Guskey, T. R. 1985. Staff development and teacher change. *Educational Leadership,* April, 57-60.

Hallinger, P. 2010. Making education reform happen: is there an 'Asian' way? *School Leadership & Management*, 30(5), 401-418.

He, Y., B. B. Levin, and Y. Li. 2011. Comparing the content and sources of the pedagogical beliefs of Chinese and American pre-service teachers. *Journal of Education for Teaching*, *37*(2), 155-171.

Heng, C. S., and H. Tan. 2006. English for mathematics and science: Current Malaysian language-in-education policies and practices. *Language and Education*, *20*(4), 306-321.

Hill, H. C. 2001. Policy is not enough: Language and the Interpretation of State Standards, *American Educational Research Journal,* 38(2), 289-318

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 [5]. 10.14221/ajte.2014v39n3.2.

Kabilan, M. K., and R. I. R. Izzaham. 2008. Challenges faced and the strategies adopted by a Malaysian English Language teacher during teaching practice. *English Language Teaching,* 1(1), 87-95.

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

Korthagen, F. A. J. 2010. How teacher education can make a difference. *Journal of Education for Teaching,* 36(4), 407-423

Korthagen, F. A. J. and B. Lagerwerf. 1996. Reframing the Relationship Between Teacher Thinking and Teacher Behaviour: levels in learning about teaching. *Teachers and teaching: theory and practice* 2(2), 161-190.

Korthagen, F. A. J., and J. P. A. M. Kessels. 1999. Linking Theory and Practice: Changing the Pedagogy of Teacher Education. *Educational Researcher*, 28(4), 4-17

Korthagen, F., J. Loughran and T. Russell. 2006. Developing fundamental principles for teacher education programs and practices. *Teaching and Teacher Education.* 22, 1020-1041.

Le Cornu, R. and J. Peters. 2005. Towards constructivist classrooms: the role of the reflective teacher. *Journal of Educational Enquiry,* 6(1), 50-64.

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., 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. J. 2002. Effective reflective practice: In search of meaning in learning about teaching. *Journal of Teacher Education,* 53(1), 33-43.

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

May Tan. 2007. Teaching math and science in English in Malaysian schools: Profiles of teacher learning within the context of educational reform. Paper presented at the International Conference on Science and Mathematics Education, Penang, Malaysia, November 13-16.

McColl, E., A. Jacoby, L. Thomas, J. Soutter, C. Bamford, N. Steen, and R. Thomas. et al. 2001. Design and use of questionnaires: a review of best practice applicable to surveys of health service staff and patients. *Health Technol Assess* 5(31).

Mercer, N. 1995. The Guided Construction of Knowledge: Talk Amongst Teachers and Learners. Clevedon, UK: Multilingual Matters Ltd.

Merriam, S. B. 2002. Introduction to Qualitative Research. In S.B. Merriam (Ed) *Qualitative Research in Practice: Examples for Discussion and Analysis* (pp. 3-17). San Francisco, CA: Jossey-Bass.

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

OECD. 2014. TALIS 2013 Results: An International Perspective on Teaching and Learning, OECD. Accessed 12 October 2017. http://dx.doi.org/10.1787/9789264196261-en

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.* London: Routledge & Kegan Paul.

Pope, C., and N. Mays. 1995. Reaching the parts other methods cannot reach: an introduction to qualitative methods in health and health services research. *BMJ.* 311:42-5.

Saxe, G. B., M. L. Franke, M. Gearhart, S. Howard, and M. Crockett. 1997. Teachers' Shifting Assessment Practices in the Context of Educational Reform in Mathematics, CSE Technical Report 471. Los Angeles, CA: National Center for Research on Evaluation, Standards, and Student Testing.

Schön, D. A. 1983. *The Reflective Practitioner: How Professionals Think in Action.* New York: Basic Books.

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.

Spillane, J. P. 2000. Cognition and Policy Implementation: District Policymakers and the Reform of Mathematics Education, *Cognition and Instruction,* 18(2), 141-179

Spillane, J. P., and J. S. Zeuli. 1999. Reform and Teaching: Exploring Patterns of Practice in the Context of National and State Mathematics Reforms, *Educational Evaluation and Policy Analysis,* 21(1), 1-27

Tatto, M. T., J. Schwille, S. L. Senk, L. Ingvarson, G. Rowley, R. Peck, K. Bankov, et al. 2012. Policy, Practice, and Readiness to Teach Primary and Secondary Mathematics in 17 Countries. Amsterdam, the Netherlands: International Association for the Evaluation of Educational Achievement (IEA)

Tesch, R. 1990. *Qualitative Research: Analysis Types and Software Tools.* Abingdon: Routledge.

van Huizen, P., B. van Oers, and T. Wubbels. 2005. A Vygotskian perspective on teacher education. *Journal of Curriculum Studies,* 37(3), 267-290.

Vighnarajah, W. S. Luan, and K. A. Bakar. 2008. The shift in the role of teachers in the learning process. *European Journal of Social Sciences*, *7*(2), 33-41.

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

Westbrook, J., N. Durrani, R. Brown, D. Orr, J. Pryor, J. Boddy, and F. Salvi. 2013. Pedagogy, Curriculum, Teaching Practices and Teacher Education in Developing Countries. Final Report. Education Rigorous Literature Review. Department for International Development.

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

Zhang, Y., and B. M. Wildemuth. 2009. Qualitative analysis of content. In B. Wildemuth (Ed.). *Applications of Social Research Methods to Questions in Information and Library Science* (pp. 308-319). Westport, CT: Libraries Unlimited.