

Using an Inquiry Approach to Support Teacher Knowledge Development

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The recent AAMT position paper on Professional Learning (AAMT, 2013) advocated that professional learning for mathematics teachers should be relevant, collaborative, evidence-based, sustained and evaluated. The design and delivery of two professional learning (PL) programs focused on these principles for deepening middle school teachers' content and pedagogical content knowledge in place value, fractions and decimals. This paper documents the approach taken by the professional learning providers, reports on feedback received from the teachers who participated in the PL, and raises questions in relation to provision of ongoing support. In fitting with the discussion-based format of the conference, conversation prompts are positioned throughout the paper.

A culture of professional learning (PL) is critical to the ongoing development of educator skills, knowledge, and practice, and situating PL in practice is considered one of the keys to successful PL as it connects the educator, learner and pedagogy (AAMT, 2013). Teacher knowledge continues to be a focus of research, with the recognition that teacher knowledge is filtered through the social and cultural context of teaching (Bobis, Higgins, Cavanagh & Roche, 2012). Questions are still being considered however, in relation to how much knowledge is required, what is the nature of this knowledge and how best to provide teachers with this knowledge. It is now generally accepted that one off PL sessions are relatively ineffective in bringing about sustained changes in teachers' practice, yet how many teachers have access to, or engage in, sustained PL opportunities? A number of studies have focused on investigating specific areas of teacher knowledge (e.g., Brown, 2009; O'Keefe & Bobis, 2008; Muir & Livy, 2012), with many concluding that teachers lacked a deep understanding of fundamental mathematical concepts, and that many struggled to articulate their content knowledge. To some extent this lack of understanding is recognised by practising teachers, especially primary teachers, who are then motivated to attend PL sessions that will develop their mathematical content knowledge (Anderson, 2008).

Background and Context

If one-off PL sessions are not perceived as being effective mechanisms for bringing about desired changes in teachers' practice, then what does appropriate PL look like? AAMT (2013) believe that all educators of mathematics must have the opportunity to access high quality PL that promotes a culture of inquiry into teaching practice. Their recent position paper advocated a number of principles that should be incorporated into effective PL and these principles were taken into account when designing the inquiry PL that is discussed further in this paper. In particular, AAMT believe that PL should be:

- Relevant: directly related to educators; include a focus on mathematical knowledge; personalised to meet the needs of the educator

- Collaborative: systematic focus on student learning; professional learning communities involving teachers, leaders, students and parents; collaboratively plan, apply, and inquire into their classroom practices
- Evidence based: informed by current knowledge about effective mathematics teaching, learning and pedagogy
- Sustained: Ongoing; inquiry into practice, trialling and implementing new approaches and evaluating results; ongoing cycle of learning
- Evaluated: Ongoing inquiry and reflection to determine effectiveness

Figure 1 in the Appendix shows how the inquiry cycle is enacted.

Conversation prompts:

- To what extent does this model encapsulate appropriate PL for mathematics teachers?
- To what extent do current PL providers take these principles into account?

Overview of the Professional Learning

The researchers were involved in two action research projects: ‘Improving Literacy and Numeracy across Years 5 to 8 in response to the outcomes of the NAPLAN results in Years 7 and 9’ and ‘Engaging Pedagogies in the Middle Years’. Each project was initiated through a perceived need of the Department of Education, involved engagement in PL, opportunities to trial and implement approaches and an evaluation of results. Each of the projects will now be briefly discussed, along with some feedback received from the participants.

‘Improving Literacy and Numeracy across Years 5 to 8 in response to the outcomes of the NAPLAN results in Years 7 and 9’

This project involved approximately 25 secondary and Grade 5/6 teachers from a cluster of two urban High Schools and three feeder primary schools. Most of the teachers participated in the project over two years and attended three spaced full day PL sessions each year. In the second year, inter-school observation visits were made between each of the three PL sessions. The overarching goal of the project over the two years was focused on improving student understanding and application of place value across grades 5-8. To this end, the PL days in 2013 involved identifying the focus area (place value) and building teacher knowledge and understanding of this area through PL. This focus continued throughout 2014, together with a shift towards effective and consistent implementation of the learning across schools and across Grades 5-8. Interschool visits were also organised and conducted in order for teachers to observe, reflect and provide feedback on the teaching of place value.

Each of the PL days held in 2014 contained the following common elements:

- Building content and pedagogical content knowledge
- Task design: planning in teams for the teaching of place value – based on the professional learning
- Observation and feedback: planning for, reflecting on and refining the process.

'Engaging Pedagogies in the Middle Years'

This project was initiated by the Department of Education as a way in which to build teacher capacity in pedagogical content knowledge (PCK) of numeracy in key areas for middle year teachers. The aim was to develop effective classroom practice through a cycle of inquiry (learning-action-reflection) across years 5-8. The core content was focused on fractions and decimals and the key practices that were examined included explicit instruction, scaffolding, differentiating the learning and formative assessment strategies, including task design. The project was conducted over three terms in 2014, and involved a total of 32 participants from 14 different primary, secondary and district schools. Three full day and three after school PL sessions were held. Each session had a heavy emphasis of learning content and increasing teacher knowledge, with a focus on developing the 'big ideas' of fractions and decimals. Each session also included participation in practical activities, opportunities for discussion and identification of activities and experiences to trial in the classroom before attending the next session.

Conversation prompts:

- Who decides on the design of the PL? Who makes the decision about what is 'key' to learn?
- What happens if participants do not trial suggested approaches between PL sessions?

Evaluating the projects

One of the challenges associated with conducting PL sessions is how to determine the effectiveness of the approaches used, particularly in terms of gauging impact upon teachers' practice and student outcomes. Both projects utilised pre and post teacher surveys which contained a number of items focused on teachers' content knowledge and PCK. The following is illustrative of the items included:

2. Which of the following numbers is closest to 54.8? [54.1978; 54.775; 54.8102; 54.9189; 55.87]

a. Explain why.

b. A student is having difficulty with this problem. Would your explanation be any different to the one you gave above? What alternative explanation do you have?

Participants' perceptions about the value of the projects, including the observation visits, were also sought through surveys and interviews. Other data collected included field notes from classroom observations and samples of students' work, including responses to diagnostic fraction and decimal interviews.

Conversation prompts:

- What are effective ways of evaluating teachers' content and PCK?
- How do we, as researchers, assess responses and determine changes in thinking?
- To what extent is self-reportable data valid?
- How can we best include student evaluation data and determine its validity?

Feedback from participants

Feedback was generally positive, with many participants being specific about how their knowledge had developed, as the following responses illustrate:

Really clarified some thinking and processes around fractions and decimals ... ‘just add a zero’ – will not use terms such as this

Will use concrete aids more to explain... understand how the linear decimal rods work and have used them with good effect in the classroom

Conversation prompts:

- Will teachers continue to implement change in their practice without ongoing support or more opportunities for sustained PL sessions?

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Appendix

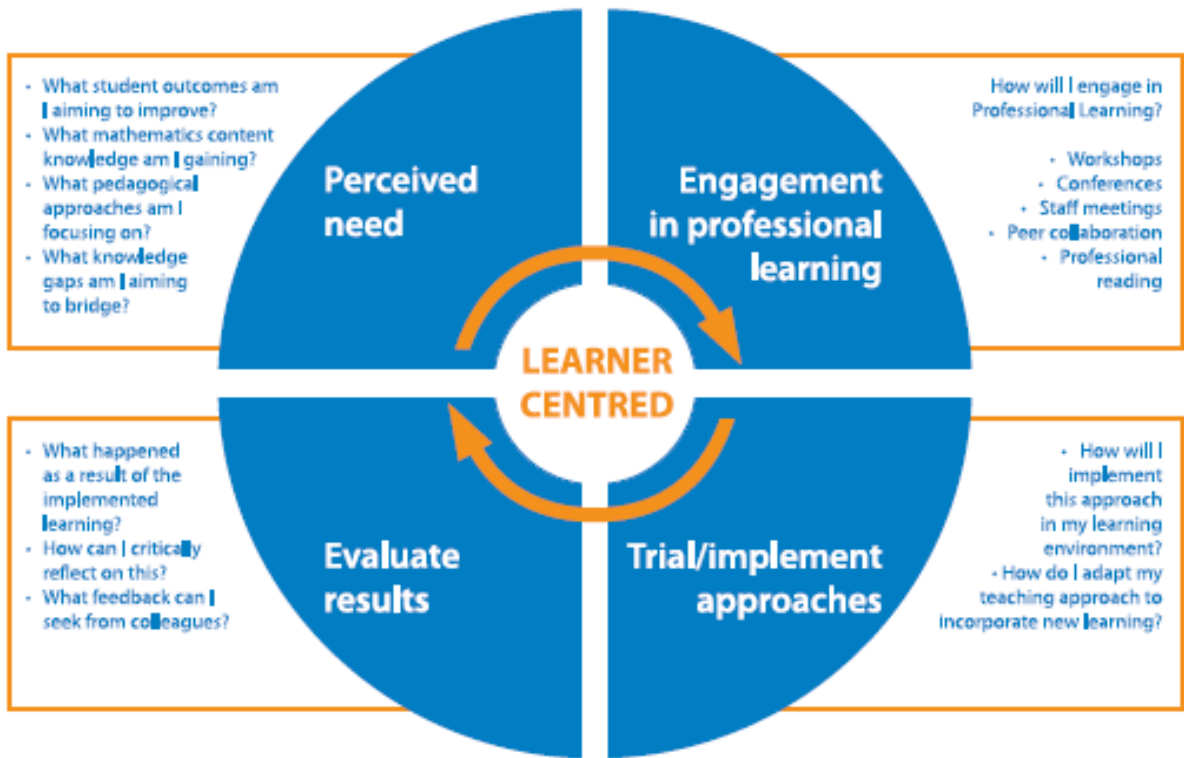


Figure 1. Inquiry cycle (AAMT, 2013)