The challenge of supporting a beginning teacher to plan in primary mathematics

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Effective lesson planning is a real challenge for many beginning teachers. This paper presents a case study of one such teacher, and the author's efforts to support her in the planning process. Results show supporting the beginning teacher's planning by (a) providing access to resources such as web-sites and teaching handbooks, (b) modelling, and (c) providing an explication of planning were insufficient to create substantive and necessary changes in the teacher's planning during the period of research. Implications for supporting beginning teachers are considered.

The New Zealand primary classroom is a multi-faceted, complex context in which beginning teachers are required to learn how to teach mathematics, a subject the New Zealand government places particular emphasis on (see Ministry of Education, 2004, 2007 & 2009). Not only is the teaching and learning of mathematics just one of eight learning areas, curriculum expectations also require beginning teachers to learn how to (a) embed values such as excellence and inquiry; (b) develop key competencies such as thinking and relating to others; and (c) embody principles such as cultural diversity and inclusion within their day-to-day teaching practice (Ministry of Education, 2007). The everyday demands of classroom organisation and management are yet another important focus for the beginning teacher. It is thus understandable that identifying ways to support the learning of beginning teachers is seen as vital (Desimone, Hochberg, Porter, Polikoff, Schwartz & Johnson, 2014).

Planning and preparation are considered to have a central role in teacher practice (Neill, Fisher & Dingle, 2010; Roche, Clarke, Clarke & Sullivan, 2014). Planning is concerned with knowing what and how to teach (such as sequencing content), while preparation involves organisational elements including the getting and/or designing of materials (Fernandez & Cannon, 2005, as cited in Roche, Clarke, Clarke & Sullivan, 2014). Roche, Clarke, Clarke and Sullivan (2014) suggest that, "… it is difficult to imagine that teachers of mathematics can perform their role without substantial planning" (p. 854). These researchers have proposed a theoretical framework for teacher planning. The framework begins with four 'elements'. The first two of these interconnected elements include teachers checking (a) web and text resources, and (b) school and curriculum documents. The second set of two interconnected elements relates to teachers drawing on (c) their own and colleagues' experience, and (d) assessment data. All of the information thus generated is used to establish specific learning goals, which in turn inform the selecting and sequencing of tasks and finally planning the teaching and assessment, including differentiating tasks for particular students (Roche, Clarke, Clarke & Sullivan, 2014).

There is great variation in the way teachers plan (John, 2006; Roche, Clarke, Clarke & Sullivan, 2014) reflecting teachers' (and teacher educators') varied perspectives about learning, teaching, curriculum and education. For example, John (2006) outlines how rationalistic, technical curriculum planning has been the dominant model underpinning lesson-planning in teacher education for many years. Within this model planning begins

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with the setting of objectives, and then follows a set order finishing with lesson evaluation. It exemplifies a focus on outcomes-based education (John, 2006). Given that such planning does not take into account the context or contingencies of teaching, John (2006) offers an alternative dialogical model where constructing the plan (as a product) is seen as secondary to the planning process (although the end product of a plan is not ignored). Roche, Clarke, Clarke and Sullivan (2014) also refer to the process of creating a plan as key, rather than the plan as a product. John furthers justifies his alternative planning model on the basis of learners being agents in their own learning. In his words, "…the negotiated nature of learning needs to be added to the planning equation if spontaneity and improvisation are to be allowed" (John, 2006, p. 487). The main core of the alternative model is fixed by the aims, objectives and goals of the plan, and around this are a large number of 'nodes' such as subject content, national curriculum, classroom control, and tasks and activities. Each of these in turn is subdivided; for example, factors relating to subject content include a consideration of conceptual understanding, representations, depth and breadth and schemes of work. Unlike the rationalistic model, John's model does not privilege a fixed order for the process of planning, and recognises that the planning process will change as teachers become more experienced.

Lesson planning is regarded as difficult for teachers to learn, with a problematic range of outcomes (John, 2006; Mutton, Hagger & Burn, 2011; Steketee & McNaught, 2007). John (2006), for instance, found that once novice teachers are planning on their own, their responses range from creativity to bewilderment and anxiety. More experienced teachers' planning is likely to involve a concurrent consideration of a wide number of elements, rather than a linear progression of decision-making (John, 2006). However, a teacher's level of experience is only one factor influencing a teacher's planning. Others include depth of subject knowledge and pedagogical knowledge, teaching style, and perceptions and knowledge of pupils (Roche, Clarke, Clarke & Sullivan, 2014). Novice teachers are likely to engage in short-term planning, and generally describe planning as time-consuming and complex (John, 2006; Mutton, Hagger & Burn, 2011). Once exposed to teaching, novices begin to realise that planning and preparation are concepts associated with unpredictability, flexibility and creativity (John, 2006).

Research literature on effective mathematics teachers is mainly centred on teaching practices and tends not to emphasise planning (Roche, Clarke, Clarke & Sullivan, 2014). A recent publication by the New Zealand Education Review Office (2013) on developing a responsive curriculum for priority learners in mathematics also focuses on learning tasks and teaching strategies, referring to the planning aspect of teaching only briefly. Although it is argued that the described practices of effective teaching are likely to be underpinned by sound planning (Roche, Clarke, Clarke & Sullivan, 2014, p. 854) learning how to plan is critical to the development of teaching expertise (Mutton, Hagger & Burn, 2011).

Teaching is a profession that involves continual learning by teachers and children alike (Gorodetsky & Barak, 2009), and it is recognised that pre-service teacher education provides just a beginning in learning to teach (Feiman-Nemser, 2012; Mutton, Hagger & Burn, 2011). There has been little research that explores how beginning teachers are best supported in the development of their planning expertise (Mutton, Hagger & Burn, 2011). Considering the complex demands made of beginning teachers and the importance of supporting their ongoing learning, the small study reported in this paper was designed to explore the research question: what form of support enables a beginning teacher to plan effectively in primary mathematics?

Methodology

This small study occurred within a wider two-year project focused on raising school wide achievement in mathematics in a relatively large urban primary school (catering for children aged 5 – 11 years) within a middle socio-economic city suburb. This paper reports on data relating to the author, a university mathematics educator and researcher, working alongside a beginning teacher. The beginning teacher, Rebecca (a pseudonym), had completed a three-year Bachelor of Teaching degree that included a range of professional practice and curriculum papers. Within the three professional practice papers (one in each year of the degree) planning is discussed with a focus on theoretical aspects, for example, why planning is important. A range of models and formats are encountered during three practicum placements (one in each year of the degree) drawing on associate teacher's expertise with planning. In curriculum papers key aspects such as learning intentions, progression of lessons, and activities are discussed. Within the one and a half mathematics education papers, two (of five) assignments included a planning requirement, one on lesson planning and the other on unit planning. Additional mathematics education assignments explored and assessed content knowledge, pedagogical content knowledge, and the use of worthwhile teaching activities for supporting learning in mathematics.

The class Rebecca was teaching at the time of this study was a co-educational composite class of year three-four (seven and eight year-old) children. Rebecca was in her second year of teaching but it was her first year working with children this age. A group of nine children in the class were achieving below expected levels and regarded by the teacher as a concern.

Over a period of two terms (terms three and four of the second year of the school-wide mathematics development project) Rebecca and the author met to discuss how Rebecca could provide effective support within her daily mathematics programme for the nine lower-achieving children. Informal discussions between Rebecca and the author took place in the classroom, usually after school, on nine occasions. One of these discussions was audio-taped; and field notes were recorded for all meetings. Rebecca also invited the author to observe her teaching, and during one lesson she asked the researcher to teach the class so she could observe a more experienced teacher in action. This led to a short series of lessons (over a two-week period) where both Rebecca and the author took turns in teaching, with each observing the other. The planning for these lessons was initially led by the author but later, ideas for planning and teaching were shared and discussed. Communication was also maintained via e-mails. Some of these were organisational, others extended face-to-face discussions and provided a forum for the sharing of ideas, and the asking and answering of questions.

For four weeks at the beginning of the following year (an informal continuation of the two year project) the author and Rebecca kept in touch via e-mail sharing ideas about how the learning of another group of year three-four children not achieving at expected levels could be supported in a small group environment, but this time outside of the normal mathematics programme. The research was curtailed when ill-health led to Rebecca leaving teaching for the remainder of the year.

Data include e-mail communications and field notes of oral discussions; the author's planning for the lessons she taught (within a two-week number unit); planning shared by the teacher; and field notes of all taught and observed teaching sessions. An additional electronic journal recording the author's thinking was kept throughout the research period, and also maintained as data were analysed. This process aligns with the ideas of St. Pierre (2011) who states data are collected during thinking and writing and suggests, "if we don't

read the theoretical and philosophical literature, we have nothing much to think with during analysis except normalised discourses that seldom explain the way things are" (St. Pierre, 2011, p. 614).

Data analysis has occurred in the reading, re-reading, listening to audio-tapes, some transcribing of the audio-tapes, chronological organising of data, and the author's ongoing thinking and writing, and reading of literature (St. Pierre, 2011). An emergent analytical approach (Borko, Liston and Whitcomb, 2007) was also employed. As data were read and re-read, and audio-tapes listened to, the author made notes about issues and themes that emerged from the data. One of these was 'planning'. As this issue emerged, all data were re-read to explicitly search for all references made to planning by the researcher and teacher, and analyse these against the useful framework for teacher planning proposed by Roche, Clarke, Clarke and Sullivan (2014). Thus evidence was sought of the beginning teacher: (a) checking the web and texts, and (b) school and curriculum documents as planning resources; (c) drawing on the teacher's own and colleagues' experiences; (d) drawing on assessment data; (e) establishing specific learning goals; (f) selecting and sequencing tasks; and (g) planning the teaching and assessment, including differentiating tasks.

Results and Discussion

Checking School or Web Documents, Teacher Resources and/or Student Texts

The resource Rebecca most relied on for her planning was a unit plan, consisting of a list of topics and associated activity sheets, provided by another teacher within her syndicate. She explained that as a beginning teacher she would be given activities for teaching and the colleague responsible for planning the unit would find these. In Rebecca's words, the teacher "who plans the unit finds all the resources with them". Rebecca also said that available text-books were not helpful because they were written to align with a nation-wide mathematics project that was not followed in her school. She mentioned that, "the text books which aren't very helpful… not very helpful… because these pretty much align with the … project, but of course we don't go near there, and I struggle to match them all up again". This comment suggests it was difficult for Rebecca to reconcile the activities in the textbooks with the learning needs of the children in her class. She did, however, refer to using the 'Figure It Out" series (a Ministry of Education publication of approximately 80-90 separate titles for supporting mathematics teaching and learning from levels 2-5 of the New Zealand Curriculum) and also explained that she usually "forgets" about the teacher resource website, nzmaths.co.nz for planning support. A teacher resource she did find helpful was a handbook that listed and briefly outlined ideas children at each level of the curriculum are expected to learn (see Biddulph, 2011). She said,

> It's all off the check-list … . By the end of year 4… because we know the year 4s are going to be there. And the year 3s will have got a good grounding and really have it drilled in next year.

Of the planning resources referred to in Roche, Clarke, Clarke and Sullivan's (2014) framework, Rebecca accessed only some of these, namely, school documents in the form of the syndicate unit plan, and some teacher resources. Web documents and student textbooks were not consulted on a regular basis or were regarded as unhelpful.

Examining Curriculum Content Descriptions to Identify the Important Idea(s)

Rebecca did not make any references to curriculum expectations within the recorded conversations, or in any of the written planning she shared during the research period. She seemed unaware that the handbook she found useful was a detailed clarification of curriculum requirements. Thus, there was no evident link in the teacher's planning (oral or written) to the framework element, "examining curriculum content descriptions to identify the important ideas" (Roche, Clarke, Clarke and Sullivan, 2014, p.862).

Drawing on Experience (Self and Colleagues)

Teachers drawing on their own and others' experience is another aspect of the planning framework proposed by Roche, Clarke, Clarke and Sullivan (2014). As a beginning teacher Rebecca clearly had limited experience on which to draw. She recognised this, and was also aware of the possibilities of drawing on collegial support. She explained that support, "would be helpful cos I've really never gone back that far. Last year I had senior kids…". Rebecca was open and keen to learn all she could to more effectively cater for all of the children's learning needs in her class. She frequently asked questions such as, "How long would you spend on …?", and her willingness to learn and receive guidance from colleagues was exemplified by her comment, "I'm just really wanting to know where to go from here". Rebecca was appreciative of working alongside more experienced colleagues. In one conversation, she stated, "I found it very beneficial watching you today so I would love it if you would like to teach tomorrow… . Would it be ok if you took the whole lesson then I can see the sequence that you go with?". She referred to a similar process with her more experienced syndicate colleagues as being a supportive part of her learning to teach.

Drawing on Assessment of Student Readiness

Rebecca had assessed and identified children who were not achieving at expected levels. One-to-one interviews conducted by the author during the period of research verified Rebecca's previously determined assessment of all nine children. Assessment tools used by Rebecca included the standardised 'Progressive Achievement Tests' conducted at the beginning of the school year; and her own ongoing overall teacher judgments of the children's learning. These were based on informal observations of the children's learning, and children's more formal written assessments.

Establishing Specific Learning Goals

Rebecca appeared to find it difficult to establish specific learning goals. In one conversation she said, "It will be fine once I get a clear idea of what… I think I need a check-list of basically what they need to know… basically teach to the test". Rebecca actually already had access to a check-list of what children need to learn at years 3-4, and made reference to this resource a little later in the same conversation. While the list outlined concepts and ideas to be taught, this on its own did not appear to be enough to support Rebecca in determining the finer details of planning and teaching. Six months later there was still a similar state of uncertainty about what to teach, and how to go about it. She wrote in an e-mail:

> I would appreciate any help possible really. I feel like im (sic) kind of doing this blind. I have assessed the children's thinking ….. My year 3's (5 of them) need the following help….. My year 4's (5 of them) need the following help…Now I have this information I am stuck on what order to do it in?

These challenges in establishing specific learning goals when planning lessons were also evident in the observed taught lessons, with ideas being introduced that were not closely connected to what appeared to be the main idea of the lesson. For example, in a lesson about the number of tens in two-digit numbers (eg. there are 9 tens in 93) Rebecca began listing different combinations of coins to make a particular amount ($4), and also noted the colours of different dollar bills. While she recognised and verbally acknowledged to the children that she had lost focus, there remained an overall lack of clarity or purpose within that particular lesson.

A similar lack of clarity about specific learning goals was evident in Rebecca's oral and written communications. Typical of the challenge in articulating the ideas being taught is this comment, "I think that last group has definitely grasped the concept of working with under $100 and I think the next step would be working towards the numbers in the hundreds". While there is evidence of Rebecca learning to sequence ideas the actual idea being taught is not clearly expressed, and often, she was not able to move beyond re-stating an idea from the list of ideas being taught to the children.

Selecting and Sequencing Tasks including adapting them for your Students

The next aspect of the framework proposed by Roche, Clarke, Clarke and Sullivan (2014) focuses on the selecting, sequencing and adapting of tasks. Rebecca found it challenging to do this beyond following the list of activities and worksheets that were provided with the syndicate plan. Some progress began to be made with sequencing ideas but this was not secure six months after the beginning of the research. For example, after assessing the second group of children achieving below expected levels (at the beginning of the second year of the research) she wrote, "now I have this information I am stuck on what order to do it in? I have started the year 3's on counting in 2's which will lead to doubles and odd and even numbers".

Some progress was also made with selecting tasks. Two months into the research period she wrote, "Tomorrow I plan to carry on with doubles to 20 and I have found some activities on nz.maths [a web-site] to support this" indicating some move towards being able to independently locate tasks for teaching and learning. However, this was not secure, as indicated by her writing at four months, "I am after as much advice as possible in regards to activities and equipment that I can use". Later on, at about six months, similar comments and requests were being made. For example, "I am still working on making 10 with the year four group so I can move on to addition and subtraction but they can not understand the concept! Do you have any ideas on efficient ways of teaching this?".

Planning the Teaching and Assessment including Differentiating for Particular Students:

Rebecca was aware early on in the research period that differentiating tasks would be one way of supporting this group of children's particular learning needs. She initially wondered about having to plan separate programmes saying,

> I'm going to have to go right back, aren't I with them? So, do I carry on with my normal programme with the majority but have this as completely separate? Not touch on the whole syndicate's plan, and not even touch those on them…..

After discussions and observing the author's planning and teaching of the whole class followed by the use of differentiated tasks, Rebecca was keen to trial this way of catering

for the learning needs of the whole class. She later commented that it appeared to be a manageable way of catering for the diversity in learning needs.

During the research the author shared her written planning with Rebecca, and during the audio-recorded discussion, and later on in email conversations, explications and modelling of the planning process was provided. During these the author outlined key elements of what might be helpful to consider when planning including identifying the key idea(s) that children could learn, thinking about the sequencing of ideas, planning key questions that could be asked of the children to support their learning, carefully choosing appropriate numbers for equations, as well as considering what equipment could be used. Tasks and the differentiating of these to cater for diversity in learning needs were also discussed. On one occasion Rebecca shared her teaching 'notes' with the author. These notes included an explanation of an activity, modelled on some of the author's previous planning, and were annotated with the children's learning over a period of two days. All other written communications listed the ideas Rebecca wanted the children to learn, but beyond this she did not appear to formalise or extend the planning provided in the unit. Several respectful requests asking for Rebecca's planning, with the hope of it informing and guiding discussions, were made during the research period, but nothing further was offered. It must be acknowledged that much teacher planning is done mentally (Roche, Clarke, Clarke and Sullivan, 2014), and perhaps this was the case for Rebecca. Learning to make pre-existing plans and schemes for teaching 'one's own' is also an important aspect of learning to plan (Mutton, Hagger and Burn, 2011), and it appears this is an aspect that Rebecca could be supported to develop.

Conclusion and recommendations:

When analysing Rebecca's planning practice against the framework proposed by Roche, Clarke, Clarke and Sullivan (2014) it is evident that some aspects were present in her planning. She was able to draw on assessment data of student readiness; used the unit plan written by another teacher, and was aware of and consulted an appropriate teacher handbook outlining the lists of concepts/ideas to be taught. Remaining aspects of the framework proposed by Roche et. al. were absent. Neither the provision of numerous resources (by the school; and during discussions with the author) including handbooks, web-sites and various text books nor an explication and sharing of the planning process were enough to support Rebecca, within the six-month research period, to confidently and consistently address the questions she had about what to teach, and how to sequence the ideas the children needed to learn. Rebecca's focus on activities rather than identifying mathematical learning goals or objectives is consistent with findings by Roche et.al (2014) who determined that teachers did not rate 'establishing specific learning goals' as a high priority.

Given the importance of planning on what happens in the classroom (Roche, Clarke, Clarke & Sullivan, 2014), and the contention that "it is through planning that teachers are able to learn about teaching" (Mutton, Hagger & Burn, 2011, p. 399) it is possible that engaging in more planning and/or exploring alternative models of planning such as that proposed by John (2006), may have enhanced Rebecca's learning about meeting the needs of all children in her class. Bearing in mind the clear limitations of drawing conclusions from a small and truncated case study (due to the teacher's ill health), it appears the provision of resources such as text-books and web-sites on their own were not sufficient to support a beginning teacher's planning. It seems that at least some beginning teachers need more specialised and longer-term support to establish the wider understanding and

expertise needed to plan, including establishing specific learning goals. This is consistent with the findings of Desimone, Hochberg, Porter, Polikoff, Schwartz and Johnson (2014) who point towards the need for the support of beginning teachers to focus on deeper understandings of the teaching process rather than simply being provided with resources. The framework proposed by Roche et. al. (2014) could be a useful starting point to guide planning, with a particular focus on encouraging beginning teachers to check school, curriculum and web documents and other relevant teacher resources in order to establish specific learning goals, select and sequence tasks and plan for teaching and assessment including suitable differentiation. This is a complex task, particularly for the beginning teacher, unfamiliar with each and every mathematics unit they teach.

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