Using Mathematics Curriculum Materials When Planning on Practicum: A Case Study of One Primary Year Three Pre-service Teacher

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This paper describes how one third and final year pre-service (PST) used curriculum materials when planning for primary mathematics teaching on practicum. The findings were drawn from a semi-structured focus group interview, where four PSTs recalled how they planned for primary teaching during a previous practicum. This case study shows how one PST used curriculum planning documents from the practicum setting, and a teacher's guide when planning mathematics lessons. Planning processes are also identified, and implications for associate teachers (ATs), PSTs, and mathematics Initial Teacher Educators are discussed.

There is widespread agreement that curriculum materials play a key role in supporting teachers, especially pre-service teachers (PSTs) to plan for teaching (Mutton et al., 2011; Remillard, 2000). In the field of mathematics education there are a range of curriculum materials for teachers to choose from when planning, for example, national, local, and school based curriculum programmes and plans (Sullivan et al., 2012), and textbooks, teacher guides, and commercially produced hard copy or digital materials (Rezat et al., 2021). PSTs as novice teachers are faced with many decisions when planning for mathematics teaching such as the focus of their lessons, what tasks and equipment, examples, and representations to use, and the structure of their plans (John, 2006). Curriculum materials in whatever form, can provide guidance for PSTs when making these decisions, particularly when, as novice teachers they are only just beginning to develop their repertoire of ideas for mathematics planning and teaching (Ensor, 2001). In the field of mathematics education there is some literature about how more experienced teachers plan for mathematics teaching, for example Sullivan et al. (2013), and more recently Chin et al. (2021), but very little is known about how PSTs plan for mathematics teaching in different practicum settings with varying year levels and for varying mathematics curriculum topics (Mutton et al., 2011; Superfine, 2008).

In New Zealand (NZ), teachers and PSTs are required to use *The New Zealand Curriculum* (NZC, Ministry of Education [MOE], 2007), when planning for mathematics teaching. The mathematics and statistics learning area in NZC includes prescribed achievement objectives that must be used when planning. From this information schools design localised curriculum plans, including long-term plans, weekly, and daily plans, to support their teaching. The MOE provides some published mathematics curriculum materials, for example, teacher guides, student booklets, and a website, called *nzmaths*, but none of these are mandated for use. This means that NZ teachers can use any curriculum materials when planning mathematics lessons.

Initial Teacher Education (ITE) programmes provide opportunities both within course work and practicum experiences for PSTs to explore the vast array of curriculum materials available for mathematics teaching, and how to use these when planning. During practicum PSTs are typically expected to follow the existing classroom programme, adhering to the established long-term and shorter-term curriculum plans. Some must use the curriculum materials selected by their Associate Teachers (ATs), while others are able to choose their own. Mathematics educators have a responsibility to prepare PSTs prior to practicum, and therefore need to understand what curriculum materials PSTs might be expected to use, and how they could use these when planning. This is challenging work, because unlike course work,

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practicum experiences occur away from ITE settings, making it difficult for ITE mathematics educators to fully understand how these planning processes are conducted (Remillard, 2000).

This paper aims to shed light on how PSTs plan by examining the planning processes of one third year PST Ben (a pseudonym), with a focus on the curriculum materials he selected, and how he used these when planning for mathematics teaching. The data is drawn from a doctoral study which focuses on how PSTs plan for primary mathematics teaching during their final practicum. Prior to this practicum, a focus group interview was held with four of the study participants, where they each recalled what curriculum materials they used, and how they used these during a previous practicum. Ben was selected for this paper because he recalled using school-based curriculum plans, and a MOE teacher's guide when planning. The research question guiding this case study is "what curriculum materials did a year three PST use, and how did he use these when planning for mathematics teaching on practicum?"

Background Literature

Teacher's Use of Curriculum Materials When Planning

Shulman (1987) contended that planning involves a process of "pedagogical reasoning" (p. 16), and an important part of this process is critically interpreting and analysing curriculum materials, selecting, and analysing these to determine which instructional strategies to use. Also critical is modifying activities for learners. Grossman and Thompson (2008) agreed that curriculum materials play an important role in influencing and guiding planning decisions. In their research they found the beginning teachers relied on curriculum materials to inform planning decisions, including using suggested activities and pedagogical approaches, and adapting these when necessary.

In the field of mathematics education several researchers have investigated how teachers use curriculum materials when planning (Sherin & Drake, 2009; Superfine, 2008). In a study that examined how teachers used a new textbook, Sherin and Drake (2009), found the teachers followed three processes, which were: reading lesson outlines in textbooks; evaluating this content for use with students; and adapting these by creating, replacing, or omitting activities or mathematics materials suggested for use in lessons. Superfine (2008) also found that planning involved processes of reading curriculum materials, considering the mathematics content within these, and modifying tasks for learners. She contended that curriculum materials, such as textbooks, play a key role in providing a base for mathematics lessons.

Similarly, Kauffman (2002) found that new secondary mathematics teachers relied heavily on textbooks, using them as a base for planning lessons. They also read and examined lesson suggestions in textbooks and then selected specific mathematics objectives and activities for lessons. One participant described this as "picking and choosing" (p. 10), information from a textbook. Some participants chose to use activities as described in the text, while others adapted activities to meet learner needs. All the teachers felt using the textbook made planning more efficient and allowed them to focus on learners when teaching.

PSTs Use of Mathematics Curriculum Materials When Planning

Earnest and Amador (2019) examined how PSTs used mathematics curriculum materials when planning, as part of an ITE course assignment. Unlike the study reported in this paper, that research was conducted in the university setting, not a practicum setting. These researchers provided a group of PSTs with a commonly used curriculum resource for developing a lesson. The PSTs read these materials, drew from various aspects of these by choosing some aspects and omitting others, similar to the teachers in Kauffman's study. While there was variation across the group of PSTs, they chose activities that related to the important mathematics ideas,

and examples they evaluated as being enjoyable for learners. The PSTs noticed aspects of the curriculum to determine what they needed to teach, modified the selected activities, included more mathematics language, and introduced mathematics materials to support learners (Amador & Earnest, 2019).

In a NZ context Wilson and McChesney (2013, 2018) investigated how PSTs plan in the school setting of practicum. In their ongoing study investigating how NZ primary PSTs plan for mathematics teaching, they also found that given the choice, PSTs used a range of curriculum materials when planning for mathematics teaching. This included textbooks such as teacher and student guides, online materials from websites such as *Namath's*, and localised school curriculum materials including long and short-term mathematics planning. At the beginning of practicum this localised planning was important for PSTs, helping them determine what they had to teach on practicum, and by indicating the topic from NZC. The long-term planning information prompted them to explore the contents of the NZC to find information about what they had to teach, specifically the objectives for planning. Their next process was to search for curriculum materials in their setting to guide their planning decisions for their lessons. Some were given textbooks, while others had to source, search for, and find their own hard and online copies of materials. They found and selected non mandated MOE teacher and student guides, and activities on *nzmaths* and other internet sites. Similar to the teachers in Kauffman's study, they reported feeling secure using these because they had national status. At the beginning of their study, this planning process was described as an active process of "navigating" through a vast landscape of curriculum materials for mathematics teaching, and "noticing" aspects from these that were relevant for their lessons (Wilson & McChesney, 2013).

Research Design

This paper draws on data from a doctoral study that investigated how PSTs plan for primary mathematics teaching during their final practicum. Adopting an interpretive methodology, the doctoral study aimed to identify and describe in detail the mathematics planning processes of four cases of primary PSTs (Cohen et al., 2011; Yin, 2014). Each participant was a final year PST in a three-year undergraduate degree for primary teaching. The participants were a purposive sample because their practicum settings were in different schools, and at different primary year levels. The author was their mathematics education lecturer but did not teach them during the time of the study. Ethical consent was granted for the study, and data collection included a focus group interview, three self-recorded "think-alouds" at different times during the practicum, and a post-practicum individual interview supported with planning documentation provided by the participant. The first data collection was a semi-structured focus group interview, where participants reflected on how they had previously planned for mathematics teaching, and where one prompt question related to the kinds of curriculum materials used, how were they used, and reasons for their decisions. The interview was audiotaped, and the transcripts returned to each participant for checking. Each checked transcript was analysed using a thematic analysis approach, which involved several iterations of the author listening to and reading the transcripts, identifying themes, coding, and then looking for patterns (Miles et al., 2018). One analysis theme was how the PSTs used a range of curriculum materials when planning for mathematics teaching. The next section reports the analysis of Ben's reflections on and recall of how he planned for mathematics teaching during the previous practicum that occurred three months before the focus group interview. Extracts from the transcript are used to illustrate his recollections.

Results

Finding Out About the Practicum Setting

Ben's practicum setting was a Year 2 class (seven-year-olds) with approximately fifty learners, his AT and one other teacher. Prior to practicum Ben met with his AT and sought information about what he had to teach for mathematics, which curriculum materials he had to use, and how learners were organised for teaching. His motivation for this was "to get my head around" what he had to teach and how he would be expected to do this in this setting. The AT shared with him her mathematics long term plan, and from this he found out he would be teaching addition, e.g., "doing problems like 2 + □ = 8", and place value. The main curriculum material he was expected to use for his lessons, was a teacher's guide from the numeracy project resources called *Book 5: Teaching addition subtraction and place value* (MOE, 2012). He also had the freedom to choose and use other curriculum materials if he wanted to. He also learned that learners were grouped by ability, which meant he would be planning lessons for small group teaching.

Reading and Selecting Information from NZC and the Teacher's Guide.

Once he had information about his class, and before practicum began, Ben recalled searching through the NZC and corresponding information on *nzmaths*, looking for detailed information about what he had to teach. He explained, "I looked through the levels to find the specific thing that I was looking for," looking for key words like addition and subtraction to guide his decisions. He settled on the *Number strategies* section of NZC, read the relevant achievement objectives for this, and "just picked one" that he decided aligned with what his AT wanted him to teach. Next, he browsed through the *suggested learning activities* section on *nzmaths* that aligned with the achievement objective he selected, to "quickly see what they had". This information provided links to relevant activities on *nzmaths* that he could choose for his lessons. At this stage he did not choose activities for his lessons, but was scoping possibilities, to get a feel for the types of activities he could use.

Moving away from *nzmaths* Ben found his copy of the teacher's guide and carried out a similar process of reading and searching for content to align with the selected achievement objectives. He knew he had to use this teacher's guide, so "spent a lot of time looking through it". Like his search through the NZC, and *nzmaths*, the information given to him from his AT guided his search. He said, "it was good because I knew what to look at, and I needed some tips". He easily found the *lesson experiences* for teaching the addition equations and scoped out suggested activities to help him do this. He made a mental note of these and waited to begin practicum to get more information before beginning planning.

Reading and Analysing a Weekly Curriculum Plan

Ben recalled that on the first day of practicum his AT was absent, so he began the week by analysing her weekly curriculum plan, which was left on her desk. He explained this plan included, "short notes that I could sort of understand," and which gave him "enough information" to teach addition equations that day. The notes outlined the focus of her intended lesson, and indicated the activity from the teacher's guide she had selected. His previous scoping of this material helped him to find it easily in his own guide, which enabled him to teach on the first day of practicum. To further his knowledge for mathematics teaching, he recalled observing another teacher teaching a group using the teacher's guide, describing how he "followed and listened" to what she did, and made notes about this so that he could copy her actions when planning and teaching his own lessons. He was confident that what he observed, was also how his AT taught, saying "it was the same stuff." He used this information

to inform the structure of his own lessons, which he began planning early in week one of practicum.

Selecting Objectives and Equation Examples from the Teacher's Guide.

Away from the classroom Ben began planning for one student group (approximately ten learners) by returning to the *lesson experiences* he had earlier identified in the teacher's guide. Each lesson experience contained information about lesson objectives, word problem, equipment that could be used, instructions for teaching, and examples of addition equations. He read these and decided to only use the equations such as, "4 + □ = 6, 7 + □ = 9, 6 + □ = 8" (MOE, 2012, p. 31) in his lessons. He copied these directly onto his lesson plans and used these with learners during teaching. He opted to use these sets of examples because they "saved" him from "making up my own examples". He liked the efficiency of being able to copy someone else's ideas and did not see the need to make up his own. He also trusted them as examples that he "should" be using, because they came from a MOE published resource. He felt confident that the examples he planned aligned with the NZC and were therefore appropriate for his lessons.

Ben also chose to use the readymade examples because within the sets of equations, the range of numbers that students worked with, increased in complexity. The addition sets began by adding numbers in the range zero to ten, increasing in value from ten to twenty, and then twenty to one hundred, e.g., "6 + □ = 8", 12 + □ = 14, and 87 + □ = 89", (MOE, 2012, p. 32). Ben described these as a "a sort of a progression … that can be stepped through." He liked the guidance provided by these examples because they showed him how to extend learning within a lesson, especially when learners needed more complex examples. Having the progressions also gave him options if he had to return to easier examples during teaching. He also used the progressions between lessons, picking up where he left off from a lesson, to develop learning in future lessons. Ben said that this helped him sequence lessons for learners during the week.

During the interview, Ben reflected that he continued to use them because they provided readymade examples which he could refer to during teaching. He described how stopping to create examples distracted him from the lesson, which meant he lost the flow of the lesson, and left opportunities for learners to disengage in the activities. He also admitted that the teacher's guide offered better examples than what he would have made up if he had to do this "on the spot" in lessons. He remarked that when he made up his own examples during lessons, he felt pressured and often "stuck to the numbers 2, 3 and 5" for equations, e.g., "2 + □ = 5". Using the examples from the teacher's guide, meant he could extend this range, and not feel pressured. He commented that near the end of practicum when he "dropped full planning," he continued to use these examples, which shows how he valued these as a key component of his lessons.

Creating Word Problems from Equation Examples

When carrying out his observations early in the practicum, Ben noticed the teacher used word problems for some of the equations, and the teacher's guide also suggested doing this. He initially discarded these but after a few lessons, returned to the examples in the guide for ideas about how to create his own, commenting that they were "so good … really good, to use as a basis for my own." He also described these as being "a good launching platform" for writing his own. He re-read the examples and adapted these choosing a class theme of "pirates" as a "common context", creating pirate names for each learner and using "treasure" as different numeric amounts that could be added. While he was guided to use word problems by the teachers in his setting, and by the teacher's guide, he also acknowledged using them as an important part of his decisions when planning. He believed writing word problems based on contexts learners could relate to, supported them to connect mathematics to "real life." He

remembered saying to learners, "we're not just learning it because we need to learn it, but to use it in our lives." He also wanted to ensure learners enjoyed mathematics and the subject was not "boring."

Discussion and Implications

Scoping Curriculum Materials Prior to Practicum

The results show that Ben's planning process began prior to practicum, and the school based long-term curriculum plan was an important document that helped him begin this process. From this he gained valuable information about what aspects of NZC he had to teach, and this was elaborated on by his AT, who told him to teach the addition equations. This long-term plan, which included key curriculum terms helped him find specific information on NZC and led him to choose the *number strategies* objectives for his planning. This prompted him to focus his searching through *nzmaths* where he investigated possible activities for his lessons. The direction from his AT to use the teacher's guide, meant that he found his own copy of this text, and as he did with *nzmaths* spent time exploring this, looking for possible tasks for his lessons. Again, the direction he had from the long-term plan and his AT, meant he could search through this text with purpose. This process is similar to the PSTs in the study by Wilson and McChesney (2018), who spent time searching and finding activities for teaching. Once he began practicum this initial scoping helped him to interpret the notes written by his AT on her weekly curriculum plan, which meant he had the confidence to teach on the first day in her absence. It also set him up for carrying out the observation of another teacher using the teacher's guide. Unfortunately, he did not recall the specific aspects of this, other than how she used word problems as part of her lesson, but this did reinforce to him that the guide could be used as the base for his lessons.

Using the Teacher's Guide

The results also show that the teacher's guide, was an important curriculum resource that Ben used throughout practicum to support his lesson planning (Amador & Earnest, 2019). Once he had gained information about what to teach from his AT, the long term and weekly curriculum plans, NZC, and *nzmaths*, he was able to begin planning using this document. He began this process early in week one, and his initial scoping of the guide meant that he could easily find appropriate *lesson experiences*. He read these again, this time making decisions about what to use, and what to omit in his lessons, a similar selection process to the teachers in Kauffman's study (2002). He consistently used three aspects, the specific objectives, the sets of equation examples, and the word problems.

Ben used the objectives as specific foci for his lessons, copying these directly onto his planning. He did the same with the equation examples, describing how this saved him time, so that he did not have to make up his own for his lessons. He recognised that the readymade equations provided a wider range of numbers than what he would create when feeling pressured during teaching. He also valued the learning progressions, recognising their use during teaching, particularly when responding to learners who needed extending, or to work with easier examples. The equation examples helped Ben keep the flow and pace of the lessons during the teaching, which was important for keeping his attention on learners.

Ben used the word problems by adapting the examples in the guide, keeping the addition focus, but changing the context to suit his learners. He made the decision to adapt the word problems, because he had observed this pedagogical approach, and there were examples in the guide. This prompted him to adapt the examples in the guide, choosing the pirate theme because it was a context the class were already working with. His justification of the importance of

using contexts suggests that Ben valued this as an effective pedagogical approach for learning mathematics, because it linked mathematics to contexts that learners could relate to while also helping them enjoy and engage with the lessons (Earnest & Amador, 2019).

While Ben was obliged to use the teacher's guide, he spoke positively about using it. He had the freedom to choose from it what he wanted to use, and the parts he did choose were beneficial for his lessons. There was a sense that because the guide was authored by the MOE, he trusted the objectives, the equation examples (particularly the progressions), and the word problems as representing the NZC content that he need to teach, along with ways to do this. This gave him a sense of confidence that he was planning and teaching what was expected of him in the practicum setting, by both the AT and as directed by NZC. On a more pragmatic level, using the guide made planning efficient and less time consuming than if he had to search for, find and use his own materials (Kauffman, 2002).

The results also highlight that hidden underneath the term "planning," Ben carried out several smaller grain processes (Amador & Earnest, 2019; Boerst et al., 2011; Superfine, 2008), that Ben carried out. These included, gathering information from his AT, reading, analysing, and interpreting school-based curriculum documents, and searching for and scoping curriculum materials (e.g., NZC, related websites, and teacher's guides,) before planning lessons or sequences of lessons. Once in the practicum setting, he interpreted weekly curriculum plans, observed teaching, analysed weekly curriculum plans, read the teacher's guide, and from these made selections about what he would use. These selections were then copied onto plans or adapted for the practicum setting. While Ben was constrained by what he had to teach, and the materials he could use, the identification and naming of these smaller grain processes show that he was an active designer of mathematics lessons for his teaching. Curriculum materials played a significant role in helping him do this (Remillard, 2000; Rezat et al., 2021).

Although a single case is limited there are tentative implications in the findings for both ATs, PSTs, and ITE mathematics educators. It was beneficial for Ben, as a PST to meet with his AT to discuss the mathematics programme, determine what he had to teach, and what materials like the teacher's guide he was expected to use. Receiving copies of mathematics long-term planning, weekly planning, and teacher's guides also help with preparation for teaching. Therefore, it is important for ATs and PSTs to make time to meet with each other prior to practicum to share important information about expectations, documentation, and curriculum materials for mathematics teaching for the duration of practicum. It is also important for PSTs to observe mathematics teaching before beginning planning to gain further information about the pedagogical approaches used in lessons, and how materials such as the teacher's guide could be used. For PSTs there is value in spending time before practicum, reading and scoping out curriculum materials they might use in their lessons. This would help them become ready to plan their own lessons once practicum begins. It also seems that using a text such as the teacher's guide can provide a base when designing these lessons, providing direct examples to use, as well as those that can be adapted.

In ITE courses it would be helpful for PSTs to spend time with mathematics educators practising how to plan for mathematics teaching prior to practicum. This could include planning lessons for a range of mathematics concepts, searching and finding curriculum materials both in hard copy and digital form to align with this, critiquing and analysing their selections, and choosing aspects from these that are most useful for lessons. This could also include adapting activities for specific learner needs and working with contexts that help learners connect with mathematics ideas. It would also be useful to include time in course work to explore how mathematics concepts progress both within and between lessons, so that PSTs like Ben do not have to rely on materials, such as teacher's guides, to learn these particularly important concepts. Rehearsals of these practices carried out in an ITE setting with the support

of mathematics educators would positions PSTs as designers of learning, preparing them for future mathematics teaching experiences (Grossman et al., 2009).

Finally, Ben presented as a confident and capable PST who was ready, willing, and able to take on the professional responsibility of planning and teaching mathematics lessons on practicum. He relished the opportunity to work with his AT, and to plan his own mathematics lessons using the curriculum materials available to him. His reflections on his planning processes revealed smaller grain practices related to planning, which will be examined in depth in the larger doctoral study.

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