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From Confusion to Clarity: Two Early Years Teachers' Remote Learning Experience

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Abstract

Just as students experience productive struggle or spend time in the 'zone of confusion' when engaging with challenging tasks, teachers also experience similar difficulties and periods of confusion when engaging with new pedagogical approaches. Prior to a 19-week lockdown due to Coronavirus (COVID-19) during 2020, two Foundation teachers implemented a student-centred pedagogical approach when teaching with challenging tasks. While they had some initial success implementing the pedagogical approach and a three-phase lesson structure, they struggled to do so online during the lockdown. It is the experiences of these teachers, in particular their experience of confusion relating to aspects of the pedagogical approach, and how this confusion was overcome, that is reported in this paper. Central to our findings is the importance of teachers reflecting on their own experiences of struggle and the impact this had on their professional learning, as well as the notion that adversity can be a catalyst for change.

Keywords:
COVID-19, Early Primary Teachers, Mathematics Education, Remote Learning, Productive Struggle, Pedagogical Practice, Organismic Valuing Theory Of Growth

Introduction

The Coronavirus (COVID-19) pandemic impacted on schools across the world requiring teachers and students to shift to remote (online) learning. Within Australia, Victoria had to endure remote learning for a much longer period than other states during 2020: two weeks of Term 1, the majority of Term 2, all of Term 3, and the first week of Term 4, a total of 19 weeks of a 41 week school year. This required a considerable adjustment for teachers, students and parents alike. While several studies have been reported within Australia and internationally (e.g., Flack et al., 2020; Hamilton et al., 2020) about teachers' experiences of having to adapt to teaching remotely, the teachers' experiences in the current study were distinctive in that they were engaged in a professional learning project involving teaching with sequences of challenging tasks at the time. A central focus of the project was to support teachers to make stronger connections between their pedagogical content knowledge and the way it is enacted in their mathematics

classrooms. Embracing and exploring a different pedagogical approach takes time and requires support. However, as indicated in the literature, the resources needed to support teachers to implement a new pedagogical approach were diverted during remote learning because of other issues (e.g., Lepp et al., 2021).

To our knowledge there are no studies within Australia or internationally that have reported on the impact of COVID-19 on the teaching and learning of mathematics in the early primary years of school (Foundation to Year 2- the first three years of school). As such we consider this study makes a unique contribution to the research literature. We offer an account of two early years primary teachers' experiences of pursuing a pedagogical approach to teaching mathematics focussed on teaching with sequences of challenging mathematical tasks during remote learning.

To inform our study, we drew on research literature relating to teachers' experiences during remote learning, parent support and home learning environment, teaching with challenging tasks in classrooms, and online during remote learning.

Review of the Literature

Teachers' experiences during remote learning

While several advantages of online learning for teachers have been highlighted in the literature such as accessibility to learning from regional and remote settings, no commuting, time saving, opportunities to remain in touch with teachers and classmates in an online space (Sadeghi, 2019), there are limitations. These include: a lack of resources, limited physical space for home–based learning, no social interaction with peers, and feeling isolated (Sadeghi, 2019). In essence, these challenges can be categorised according to three key components: 1) technology- access to the infrastructure; 2) pedagogies- teaching materials to engage and maintain students' motivation, lack of student feedback and opportunities for formative assessment; 3) social challenges – suitability of home learning environment, and parent support, as parents are unsure of how to assist their children (Ferri et al., 2020; Yusouf & Ahmad, 2020).

As reported by United Nations Educational Scientific and Cultural Organization (UNESCO, 2020), one of the consequences of school closures, due to COVID-19, was the confusion and stress placed on teachers due to the abruptness of the closures and uncertainty about the duration of remote learning. Moving to remote learning was a steep learning curve for teachers having to develop new skills and expertise in a short period of time (Kim & Asbury, 2020). These authors also noted an additional stress for some teachers was the competing responsibilities, such as having to home school their own children. The shift to remote learning also disrupted a core aspect of teacher identity – that of interpersonal connections, such as relationships with colleagues, students and parents (Goe et al., 2008). Related to this were potential disruptions to teachers' use of reflective practice, whether it concerns their pedagogical approach or how they engaged with parents, students and colleagues (Kim & Asbury).

Kim and Asbury (2020) conducted a study in England to explore twenty-four primary and secondary teachers' experiences during the first six weeks of partial school closure. They conducted semi-structured interviews via Zoom with the teachers relating to a high point, a low point, and a turning point in their practice during remote learning. Six themes were identified from the analysis, one of which was the importance of relationships. Teachers reported that their relationships with students, parents and colleagues had been disrupted, which they described as a low point in their experience of remote learning. For example, some teachers commented on students' lack of engagement or parental complaints. However, other teachers instead commented on innovative ways they had engaged families, such as setting up a Facebook group. Another theme that emerged was teacher identity. Many teachers commented on how their teacher identity had been affected by COVID-19. Teachers in the study did not use any synchronous learning, rather narrated PowerPoints, videos, and educational websites and hard copy work packs. While acknowledging that remote learning presented major challenges, Kim and Asbury noted that when given an opportunity to reflect, several teachers commented that they had the opportunity to be creative and to differentiate students' learning in meaningful ways, and engage with students on a one on one basis. Others commented that the reflection on their teaching during this time enabled them to consider whether some of the changes implemented during remote learning might become part of their practice post COVID- 19 education.

Almost 50% of respondents of a survey conducted in Ireland relating to primary school teachers' remote learning experience indicated that mathematics was the most difficult subject to adapt to online learning (Burke & Dempsey, 2020). Contributing factors were that parents and teachers were not equipped to provide online learning, and parents lacked confidence with the content. Some teachers reported that about a third of the parents expected their children to complete the work by themselves, another third was overwhelmed and a third did not engage with their students' during remote learning. Similarly, results of a survey of 505 teachers in the United States (USA) indicated that 83% of teachers were finding it more difficult to enact their craft during remote learning (USA TODAY & Ipsos, 2020).

An important aspect of mathematics learning is the social interaction, which has been found to have a direct impact on students' engagement with mathematics (e.g., Boaler, 2000; Middleton, 2013; O'Toole & Plummer, 2004). Several studies reported that remote learning negatively impacted on student learning due to the social isolation and social disconnection (Burke & Dempsey, 2020; Flack et al., 2020). Other studies reported that limited social interaction with teachers and peers during remote learning impacted students' social and emotional well-being and the quality of the teacher-student relationships (Kamei & Harriott, 2020; Pecjak et al., 2021). Further, Flack et al. found that many participants in their study believed there was a causal link between social interaction, well-being and student learning outcomes.

Parental support and home learning environment

Several scholars reported on the need for parent support and involvement during remote learning. Parental involvement in their child's regular face-to-face learning varied due to parents' work commitments, family background, and socio-economic status (Di Pietro et al., 2020). In remote learning parental involvement was necessary, particularly with younger children who do not have independent learning skills, or social maturity to apply themselves in a virtual learning environment for long periods of time. However, it is important that learning at home is designed in such a way that maintains students' independence, which is essential for cognitive development (Hwang & Hariyanti, 2020).

The literature indicates many disparities were evident in terms of the parent availability to support their children's learning, including: their inability to work from home. For example, parents did not possess the necessary technological skills or in the case of less advantaged parents did not have the cognitive, social-emotional abilities or sufficient command of the English language to assist their children (Attanasio et al., 2020). A related factor was whether the home environment was conducive to online learning (Di Pietro et al., 2020). The availability of digital resources, including the use of a laptop or computer at home and access to reliable broadband internet were important in remote learning, as these were the main avenues of communication between students and teachers. Data from the Australian Bureau of Statistics (2018) indicates that on average 13.2% of households in disadvantaged areas do not have the Internet (Drane et al., 2020). Related to this are the skills, expertise and confidence of children, parents and teachers to use a digital platform for learning.

Communication with parents about their child's learning is important. During regular face-to-face learning it is a combination of informal discussion, such as before and after school or via face-to-face formal meetings. During remote learning, ongoing communication with parents was essential, some of which occurred via the phone rather than the Internet, others via a daily post on the school's website, email, or ClassDoJo (school-based community platform). However teachers found this challenging and time consuming (Burke & Dempsey, 2020).

The review of literature relating to remote learning highlights some key points. First, moving to remote learning is a steep learning curve for teachers, as they need to develop new skills and expertise and pedagogies to engage and maintain students' motivation, and differentiate the learning. Second, as well as considering their own practice and student engagement, teachers also need to consider parents and how they will support their child's learning in a way that the child's independence is maintained. The third consideration raised relates to the actual technology, the resources required and the technology skills of parents to support their child's learning. These factors were considerations of the teachers reported in the current study, in particular how to transfer new learning to a remote learning environment.

Teaching with challenging tasks and inquiry-based mathematics learning

Current theories for teaching include the use of highly cognitive demanding tasks or challenging tasks, which are designed to promote rich student-centred learning (Sullivan et al., 2011). Challenging tasks are open-ended in nature, engage students in problem solving, and are acknowledged to incorporate high cognitive demand (Middleton, 1995). Teaching with challenging tasks requires a different lesson structure and approach from one that starts with teacher modelling or telling students what to do, which is recognised as reducing the opportunity for productive struggle and the cognitive demand of tasks for students (Roche & Clarke, 2014). Aligned with this is a tendency for teachers to reduce the demand of tasks when planning (Tzur, 2008) and over explain how to respond to tasks during lessons (Stein et al., 1996).

The lesson approach Sullivan et al. (2015a) advocated when teaching with challenging tasks includes a three-phase structure: Launch, Explore, Summarise. The teacher presents the task in the launch phase with no explicit instruction and students are expected to attempt the task by themselves. Initially, students are expected to spend some time in the "zone of confusion" as they grapple with the task (Clarke et al., 2014, p. 9). After students make an initial attempt at the task, they may be provided with an enabling prompt as a sub-task if they are struggling to make progress or an extending prompt once they have completed the task (Sullivan et al., 2006). During the Explore phase the teacher monitors and identifies students to share their working out. In the Summarise phase, the teacher

pauses the lesson and invites students to share their thinking, reasoning and strategies. This phase may occur multiple times during the lesson as it affords students opportunities for peer learning and allows the teacher to support students to make rich connections to the underlying mathematical concepts.

Teaching with challenging tasks and inquiry-based mathematics learning in remote learning settings

Recent studies have considered the shift to remote learning as a consequence of the COVID-19 pandemic, and its impact on teachers pursuing inquiry-based pedagogical approaches, such as teaching mathematics through challenging tasks. In particular, Kalogeropoulos et al. (2021) reported on mathematical experiences of teachers and students from two Australian primary schools that emphasised inquiry-based approaches. These authors explored the extent to which various 'sociomathematical norms' (Yackel & Cobb, 1996) central to effective inquiry-based mathematics classrooms transferred to a remote learning setting. Analysis of teacher interview data and student questionnaire data revealed that providing students with choice over both the tasks they undertook and the level of challenge pursued appeared to effectively translate to remote learning settings. By contrast, opportunities for students to collaborate with peers and discuss the mathematics were more difficult to translate in an online setting. The authors concluded that lack of opportunities for peer support and collaboration had negative implications for student engagement and learning. This is not surprising given that other research suggests that opportunities to explain their thinking and learn from peers are classroom events that students strongly attribute to supporting their mathematics learning, and central to effective mixed-achievement mathematics teaching (Clarke, 2021; Kaur et al., 2013).

Another potential obstacle to implementing challenging, inquiry-based learning approaches in a remote learning setting is the fact that such environments place parents in the role of 'pseudo-teacher'. Parents may have little sense of the value of such approaches to teaching mathematics and be reluctant to allow their children to struggle productively with mathematical tasks, and 'hold back from telling' (Roche & Clarke, 2014). Indeed, as reported previously, the negative attitudes of parents and carers towards allowing their children to struggle when learning mathematics and the absence of a teacher-facilitated, synchronous, learning environment were found to be the two major impediments to productive struggle in remote learning settings in our project (Russo et al., 2021).

Theoretical Framework

It is interesting to consider what our initial assumptions might be about the impact of the COVID-19 pandemic on the experiences of teachers undertaking professional learning involving exposure to a new pedagogical approach; specifically, teaching with challenging tasks. Perhaps most straightforwardly, it might be expected that the dramatic shift to a remote learning environments would undermine teachers' capacities to devote resources to exploring and experimenting with new pedagogical approaches, as resources have been diverted to address issues such as the wellbeing of students, colleagues and parents (Lepp et al., 2021), and teachers educating one's own children remotely (McLennan et al., 2020). This is consistent with the perspective that a lack of time and access to resources more generally is one of the most significant impediments to implementing reform-oriented approaches to mathematics teaching (Day, 2020; Sullivan et al., 2015b). In addition, as it is unlikely that the pedagogical approach being experimented with in this study was developed with remote learning in mind; reimagining this pedagogy in a remote learning environment would most likely require a substantial investment of time and energy. To summarise, this resource-diversion perspective would suggest that teachers will be highly reluctant to explore new pedagogical approaches during remote learning, particularly approaches that do not seamlessly translate to a remote environment, such as inquiry-based mathematics approaches (see Kalogeropoulos et al., 2021).

Conversely, it could be argued that an adverse event such as the COVID lockdown and the shift to remote learning could be a potential catalyst for teacher professional growth because it prompts introspection and encourages teachers to re-examine previous assumptions and modes of operating. This position has some support within the psychology literature, where several theories of growth through adversity have been proposed (Joseph & Linley, 2005; Nerken, 1993; Tedeschi & Calhoun, 2004). In particular, Joseph and Linley's (2005) organismic valuing theory of growth through adversity posits that, "people are intrinsically motivated toward rebuilding their assumptive world in a direction consistent with their innate tendency toward actualization" (p. 276). The theory suggests that individuals who are able to restructure their existing knowledge base to accommodate new information revealed through the adverse event (accommodation) are more likely to grow personally through this event than individuals who try and modify this new information to fit within their existing knowledge base (assimilation). The corollary is that those individuals who can positively accommodate this new information are in a position to achieve

a higher level of personal functioning, than if they had never encountered the adverse event in the first instance (Linley, 2004). The extent to which an individual is able to achieve positive accommodation and grow through the adverse event is influenced by several factors, including whether their social environment is "facilitative of their fundamental psychological needs of autonomy, competence, and relatedness" (Joseph & Linley, p. 274).

The organismic valuing theory of growth has been used to explore changes in teacher knowledge and skills following remote learning brought about by the COVID-19 pandemic. Specifically, Dewi-Izzwi et al. (2020) found some support for the theory when analysing the responses of Malaysian educators (primary teachers, secondary teachers, university lecturers) to a questionnaire that asked them to reflect on changes to their practice following the shift to remote learning. Of the 148 respondents, over 90% indicated that they had learnt new skills and gained new knowledge, whilst more than 80% indicated enhanced creativity as an educator. Overall, almost two-thirds of respondents indicated that they felt they were now a better educator than before having experienced remote teaching.

The current study

The aim of the current study was to investigate whether teachers of Foundation students (5-6 years of age), engaged in a professional learning project involving teaching with sequences of challenging mathematical tasks, would embrace the approach during remote learning, or would modify the new learning to fit with their existing practice. Underpinning this study is Joseph and Linley's (2005) organismic valuing theory of growth, and the notion of growth through adversity and adverse events. The specific research question being investigated was:

> *How did remote learning impact Foundation teachers' implementation of a new pedagogical approach to teaching mathematics?*

Method

The research design was a case study of two Foundation teachers' experiences during remote learning. Yin (2009) states that case study research is suitable for explaining a specific circumstance through providing an in-depth description. The case study is both teachers' accounts of their experience as captured via two online Zoom meetings by the researchers. Note that Foundation is the first year of formal school in Australia, and most students commence Foundation at five years of age. The two teachers were selected as they were endeavouring to use a new pedagogical approach in a remote learning setting.

Background to the study and participants

Schools within Victoria moved into remote learning (learning from home) in March (Week 9 of Term 1, a 10 week term) and continued to do so for the first six weeks of Term 2 (an 11 week term). Remote learning took different forms, as there was no mandated directive from either state or federal education departments. This allowed schools and teachers the flexibility to meet their student learning needs in whatever way they saw fit. Teaching advice and technical support was provided at the school level. Some year levels focused on asynchronous learning where students were provided with the day's content via the school's online communication platform (e.g., Seesaw). Students might start the morning by attending an online briefing session with the teacher, then work independently with support of a parent or carer. Other students watched a series of videos prepared by the teacher before or after engaging with the learning. Some teachers had 30-minute synchronous sessions with their students for literacy and numeracy learning each day or on alternate days, where they provided feedback to students on their learning.

The two Foundation teachers reported in this study were part of the Exploring Mathematical Sequences of Connected, Cumulative, and Challenging Tasks (EMC3) project which adopts a student-centred, structured inquiry approach to the teaching of mathematics (Sullivan et al., 2020b). There were 102 early primary years teachers (Foundation to Year 2) participating in the project that consisted of two professional learning days, one at the beginning of the year and one at the end. The first professional learning day was in February and was face-to-face, prior to COVID-19 restrictions; the purpose of which was to share the underlying philosophy, introduce the enactment of challenging tasks, model the lesson structure approach, and engage teachers in examples of tasks for selected sequences of challenging tasks. Teachers were given a resource booklet that included the sequences of challenging tasks and related pedagogical advice. The purpose of the end of year professional learning day was to celebrate the learning and the insights gained from the experience of teaching with sequences of challenging tasks. This second day occurred online, in November.

Following the first professional learning day, members of the research team supported the teachers with facilitated planning sessions in their schools. During the facilitated or co-planning stage, teachers first engaged with the tasks independently. This was followed by collective discussion of key mathematical ideas, anticipated student responses including potential misconceptions, generation of questions to stimulate student thinking, and ways to differentiate student learning. The intention was for the teachers

to experience a modelled lesson and/or co-teaching of lessons subsequent to experimenting with the co-planned lessons in their classrooms. Unfortunately, due to the onset of COVID-19 this aspect of the professional learning support did not eventuate.

The two Foundation teachers, Susan and Jessie (pseudonyms), reported in this paper were employed in a small Catholic primary school in an affluent suburb of Melbourne. Susan had more than 10 years of teaching experience, whereas Jessie was a graduate teacher. The total population of the school was 144 students and each of the Foundation classes had 11 students in 2020. The school's Index of Community Socio-Educational Advantage (ICSEA) percentile was 93 with 60% of student families belonging to the top quarter Distribution of Socio-Educational Advantage (SEA), and 33% of the students had a language background other than English.

Data collection

Two researchers (authors 1 & 3) provided support to the project school in which Susan and Jessie taught. Due to the COVID-19 restrictions (late term 1), planning and support relating the implementation of the sequences occurred online during terms two to four (periods of the school year). For the study reported in this paper, data were collected via two Zoom online meetings related to the teachers' 'lived experiences' of implementing the sequences during remote learning. Both sessions were audio recorded and the data transcribed. Examples of questions that guided the discussion included:

- What were the challenges with transitioning your teaching of a sequence to remote learning?
- Did any students surprise you through doing the tasks independently prior to the lesson?
- Was there a particular task that was initially unsuccessful when taught online in terms of intended student learning and what happened as a result?
- Describe a task that was highly successful (online). What were the reasons for this? Did you teach the subsequent consolidating task (similar task)?
- From your online experience what did you bring back to the classroom in relation to pedagogy? In what ways have you adapted your planning as a consequence of engaging in online teaching?
- If you were teaching the sequences with Foundation students next year what aspects of your practice would you like to focus on improving or embedding more deeply?
- Do you believe that exploring the sequences in remote learning contributed to any changes in your teaching practice more generally?

Our online meetings primarily inform the current narrative account with participants, as did the researchers' (authors 1 & 3) reflections on the teachers' account and the importance of providing professional learning support to the teachers.

Data analysis

We adopted a narrative approach when collecting and analysing data to inform our study (Connelly & Clandinin, 1990). A narrative approach has several advantages as a method within educational research, including providing thick descriptions of events that support in-depth data analysis and the fact that human beings are naturally inclined towards both communicating and digesting stories (Butina, 2015). As noted in the research literature, validity, in the context of narrative-based research, is concerned more with the research being well grounded and supported by the data collected, than providing results that produce generalisable truths (Webster & Mertova, 2007). Given the purpose of our study was to examine how the rather dramatic shift to remote learning because of COVID-19 impacted on the professional learning journey of Susan and Jessie, a narrative approach that captured their experiences over time in relation to this significant event seemed appropriate.

Authors 1 and 3 undertook the coding process independently initially, by reading and re-reading each of the transcripts and highlighting key words or phrases that provided a sense of the teachers' experiences in each stage of their journey. The second step was to use the phrases and words identified to create broad themes. The third step involved the two authors sharing their independent coding and how they arrived at the themes, and then together reached agreement about the overarching themes. Coding the data independently initially, then discussing and deciding on the themes collaboratively, served to enhance the validity of the inferences being drawn (Creswell, 2013).

The overarching themes included: student access to resources during remote learning; organisational issues related to synchronous teaching; enthusiasm of the teachers; parents (communication, intervention, understanding of task and approach); adapting pedagogical approach for remote learning; student interaction and discussion.

Contexts and Events of Remote Learning

A week after the professional learning day Sally (third author) conducted a planning session with Susan and Jessie focusing on the Counting Principles sequence. Doing so included identifying the key mathematical

ideas, anticipating what students might do and planning enabling and extending prompts. Sally highlighted the important pedagogical actions, in particular the launch without telling and allowing students time to struggle. The teachers responded enthusiastically as Sally recounted:

> *I had a really good planning session with the Foundation teachers today; they loved the resource book and are keen to get started. I hope to model some lessons before the end of term.*

The School Mathematics Leader (Karen) said that the students engaged really well and the teachers enjoyed the experience (email correspondence). Sally was scheduled to model three lessons during the next school visit in March and help the teachers to plan for the rest of the school term. However, due to the unexpected chain of events as a result of the COVID-19 pandemic, this did not happen. Consequently, the teachers were required to do subsequent planning without external support.

Remote Learning 1 – Term 2 (April 15- May 23), Weeks 1 – 6 inclusive

Following their success, Susan and Jessie were keen to explore initial tasks in the Making Things Equal sequence, during the first remote learning period. The mathematical focus of this sequence is equivalence and a key recommendation for developing the idea of equivalence is to use kinaesthetic approaches, tactile objects and visualisations. The first suggestion in the sequence is the 'Cakes 1' task (Figure 1). It is intended that the students find multiple possibilities for making the plates equal and in so doing explore informal concepts of addition and subtraction, as well as equivalence.

A key aspect of the learning is for students to recognise that collections can be compared without necessarily counting by ones and made the same by adding or subtracting items. A task such as this (Figure 1) is fundamentally about developing young children's understanding of the meaning of equivalence using a real life context. Because some of the ideas underpinning the tasks are complex, it is intended that teachers consolidate the learning by engaging students in subsequent tasks which are essentially the same task but use different numbers (Sullivan et al., 2020b).

Both teachers considered the task seemingly self-explanatory and uploaded the task sheet to Seesaw (an online digital platform the school used to communicate with students and parents). The only instruction provided to the parents was to read the task to their child. The students were required to complete the task at home without any synchronous interaction, as the teachers wanted to implement the launch, explore, summarise lesson structure and considered that requiring students to 'have a go' on their own was similar to the launch phase in face-to-face lessons. Students were required to upload their completed work onto Seesaw for the teachers to assess.

A key aspect of the EMC3 approach is the summarise phase of a lesson; however there was not an opportunity for Susan and Jessie to enact this with the students in the online space, as there were no dedicated synchronous learning sessions. Critical to students' developing understanding, which in this scenario was equivalence, is discussion with peers and teachers. Another key to supporting students' learning of equivalence is to use a kinaesthetic approach, however neither Susan nor Jessie had considered this when conveying the task to the parents and students.

Rather than giving the students a consolidating task from this first suggestion, which was a variation of the Cakes 1 task, the teachers chose to progress to the second suggestion in the sequence. The task involved making collections equal by adding or subtracting items, in this case, moving marbles to one side of a

Figure 1.
Cakes 1 task

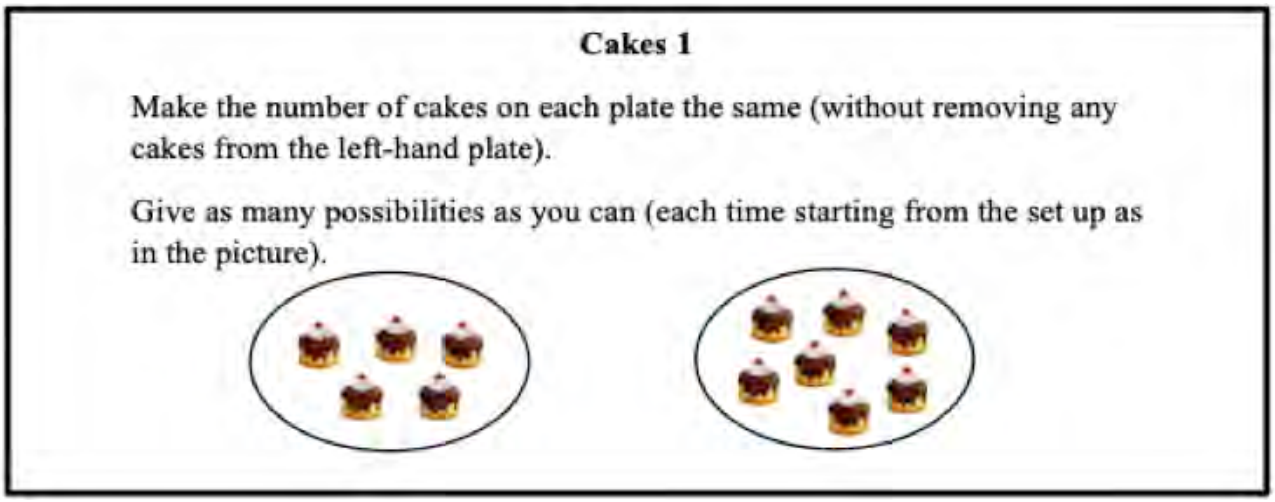
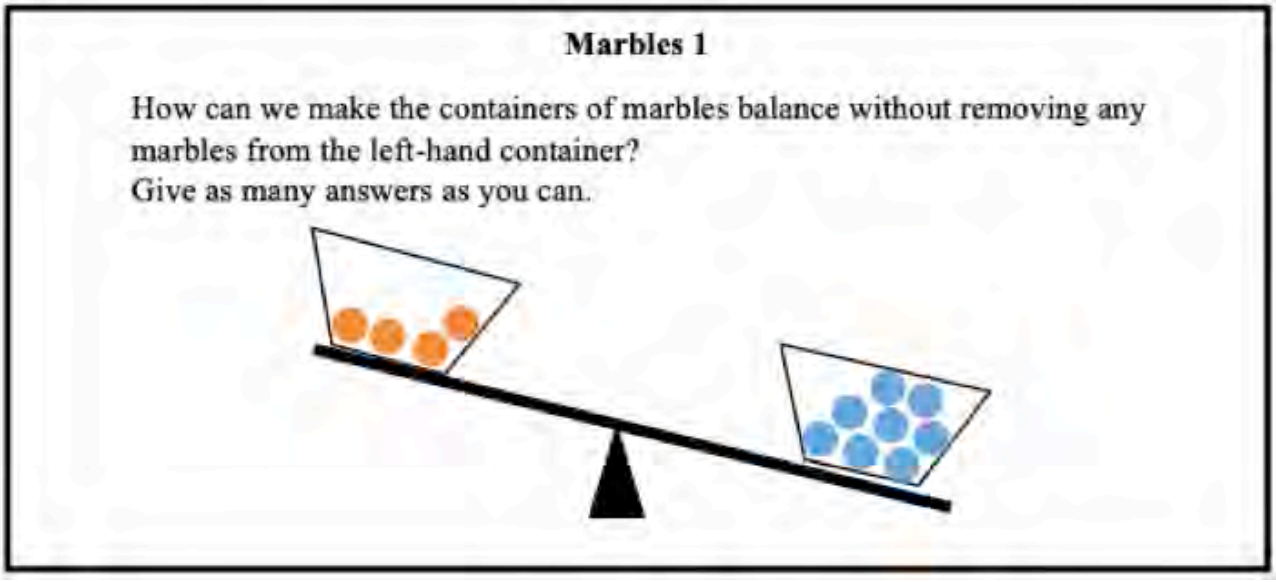


Figure 2.
Marbles 1 task



balance beam, from the other side. The intention of the second sequence was to provide an opportunity for students to consolidate their learning by exploring the same concept in a different context using a somewhat different representation (see Figure 2).

Students were encouraged to draw pictures to represent their thinking or to use the template provided. Susan and Jessie used the same approach as they did with the Cakes task. However, it was only when some parents raised concerns that their child was struggling, and required assistance in how to solve the problem that the teachers realised there was an issue. In supporting their child, parents drew upon their own experiences of learning mathematics and were not familiar with open tasks and the prospect of multiple answers.

The teachers had not anticipated the need to put structures in place for parents to support their children's learning, in particular some suggestions of materials they could use such as coat hangers and pegs to simulate a pan balance. Following this experience, the teachers decided to abandon teaching with challenging tasks for the remainder of Remote learning 1 and instead used a more traditional approach to teaching addition and subtraction, rather than focus on equivalence.

Unfortunately, Sally did not have the opportunity to meet with Susan and Jessie prior to Remote Learning 1 to advise them on the choice of sequence to explore during the remote learning nor to discuss ways to approach online learning. Consequently both teachers were in the 'zone of confusion' as they had not realised how they could transfer their learning of the lesson structure and the project's underlying philosophical approach to an online remote learning setting. In addition, they had not anticipated the need to inform the parents about the pedagogical approach they were exploring.

Students in Foundation – Year 2 returned to face-to-face learning for the last three weeks of Term 2. During this time the focus was on re-establishing classroom routines, assessment and ways of learning, which was particularly important for the Foundation students who had only experienced face-to-face learning for the first eight weeks of the school year.

Post Remote Learning 1 reflection and return to remote learning

Term 3 commenced with teachers preparing to return to remote learning (Remote Learning 2); the school holidays were extended for students, and teachers were given a week for planning future lessons. In the first four weeks of Term 3 during the second lockdown Susan and Jessie returned to a more traditional approach to teaching mathematics that they used in the latter weeks of Remote Learning 1. However, in Week 5 they met with us (authors 1 & 3) to discuss planning for the remainder of the term. This provided Susan and Jessie with an opportunity to reflect on their remote learning experiences and to consider how they might explore a sequence during the extended remote learning period in Term 3. The following account relates to Zoom video meeting with the teachers during remote learning when we provided suggestions as to how they might proceed during the second phase of remote learning,

The teachers recognised the benefits of teaching with challenging tasks in a classroom setting from their initial experiences prior to remote learning. They originally thought the tasks could be transferred to a remote setting, without consideration of the significance of the lesson structure and pedagogical approach. It was only after they attempted to implement some of these tasks remotely that they became aware that these elements are critical to supporting student learning. An opportunity to reflect on their online

teaching experience with us allowed both teachers to identify key components critical for successful implementation of the tasks, which included:

- informing parents about the pedagogical approach, including the need to hold back and allow students to struggle;
- informing the parents about the nature of challenging tasks and the importance of generating multiple solutions and/or different strategies;
- providing suggestions for alternative concrete materials to use, as well as enabling and extending prompts; and
- orchestrating student discussion about the mathematics including the careful selection of student work samples to stimulate thinking.

Teachers' comments related to these components included:

> *I was wondering how you would do these lessons at home when parents are probably going to be supporting [learning] and you know even pushing their child to a particular answer and way of doing something. (Jessie)*

> *Parents intervened too much when they were learning from home and needed explicit instructions [including telling them to struggle] so that the students could learn. (Jessie)*

> *Parents had a big impact in the role during remote learning. We had to teach the parents about what EMC3 maths looks like compared to how they might have been taught. It was a big learning curve for them that there were multiple answers and many different ways to get to the same conclusion. (Susan)*

> *We learnt that our instructions for teaching the lesson had to be for the parents. (Susan)*

> *Towards the end we were sending huge emails that almost outlined our planner for parents to follow and communicated our expected learning for each task. (Susan)*

> *Students didn't have peers around them to learn with/from. (Jessie)*

Through reflecting on their experiences, the teachers realised the impact of the absence of real-time, synchronous interactions to allow students to discuss the mathematics and interact with their peers. Importantly, they recognised the need to restructure their approach to online teaching to accommodate these aspects. We supported Susan and Jessie with planning the Structure of Number sequence (see Russo et al., 2019 for a summary of the sequence); the intention of which was to revisit addition and subtraction as well as the opportunity for the teachers to put their learning from the Remote Learning 1 experience into action. Some of the discussion during this planning session related to trying out different approaches as evident from the following exchange between Susan and Jessie:

> *Susan: Do they [the students] need to do the task in a focus group first and then let them do it independently because we have both focus groups and online site where we post lots of videos?*

> *Jessie: I think that if we did the video and then the summarising part as part of the focus group I think we'd get a lot more rich language out of them, after they'd attempted it.*

> *Susan: We've had a few goes at getting them to record what they're thinking but we get less of a response when we do that than when we get them to take a picture of something that they've done, so the focus group would be a good opportunity for them to tell us what they're thinking.*

The teachers decided to divide the class into smaller groups, and launch the same task three times with different groups of students online. Following initial independent thinking time after the launch, students had the opportunity to share their initial thinking with the group. Students then worked offline independently on the task and recorded a range of solution strategies, which they uploaded through Seesaw. Susan and Jessie had an opportunity to review student work overnight, before engaging with their students online the following day to enact the Summarise phase of the lesson and launch a follow up consolidating task. Sometimes they used a video recording to launch the consolidating task.

Figure 3 shows how the teachers adapted the three-phase lesson structure during Remote Learning 2. There were two significant changes the teachers made to their pedagogical practice during the second remote learning period. The first was to extend the exploration of a challenging task across two days rather than one, and the second was to adapt the three-phase lesson structure to accommodate the different modes of delivery -synchronous and asynchronous, across two days.

Figure 3.

Adaptation of three-phase lesson structure for remote learning

Learning Mode	Day 1	Day 2
Online, synchronous learning (approximately 25-30 minutes)	Check 1 Game / Tuning in (approx. 10 min)	Discussion / Summarise from previous day (approx. 15-20 min)
	Launch challenging task, Independent thinking and initial share (approx. 15-20 min)	Launch consolidating task (approx. 10 min)
Offline, asynchronous learning	Explore	Explore
	Sample uploaded	Sample uploaded

In conjunction with the initial exploration that students had with their teacher, detailed information was sent to parents explaining the project approach and the type of guidance that parents could give their children. It was particularly important that parents realised that struggle was part of the learning process and to allow their child time to experience some initial confusion or uncertainty about how to proceed with the task; to encourage their child to look for more than one possible answer; and to record their thinking predominantly in drawings and words rather than using formal mathematical equations.

Another part of the online meeting with Susan and Jessie related to assessment. We suggested that when the students returned from remote learning the teachers re-engage the students with tasks from the Structure of Number sequence taught during Remote Learning 2.

Post Remote Learning 2 reflection and returning to face-to-face teaching

Students returned to face-to-face teaching in Term 4, and during the first four weeks Susan and Jessie revisited some Structure of Number tasks explored in remote learning, as well as additional tasks within the sequences that had not been taught during remote learning. The reasons for doing so included: to initially compare the students' responses for assessment; to ascertain how much parental influence was evident; and to provide students an opportunity to re-engage with each task in different ways (Sullivan et al., 2020a). The teachers were aware that some parents were possibly overzealous in their support.

> Some questioning of who was doing the work; it was a bit of a mishmash of what was authentic work and what was not. (Jessie)

In Week 5 of Term 4 we met with Susan and Jessie to reflect on student learning, and the teaching of the sequence during Remote Learning 2. We asked them to describe a task that was highly successful during remote learning.

> *Summer time is fly time! The students were drawing the wall, showing they were visualising the question. They explored the task across the week. We know some of the parents were quite involved in the tasks but overall it was a successful start to the subitising [task]. Once they progressed to the donuts task they had quite a good idea about how to approach it. (Jessie)*

> *Repeated the task and compared the work samples from remote learning to in school and it was evident the work samples represented the student thinking. There were only a couple of children who struggled to complete the task and these were ones we anticipated. (Susan)*

Some key points from these reflections included the need to slow down and explore a task across multiple days in a remote learning context; for parents to have an understanding of the task; and the teacher's pedagogical approach. The teachers also indicated that they did some consolidating tasks in the synchronous sessions (e.g., Playtime, and Fish) and some were completed remotely (e.g., Flies and Donuts). They were aware of the need for a blended approach, and being flexible with both delivery and structuring of the content (Burke & Dempsey, 2020).

> *We did some during the live lessons – Playtime was first as a live activity, flies were remote. (Jessie)*

> *The fish task was live [online] and donuts task was remote [independent task]. (Susan).*

We asked the teachers to consider the challenges and successes from the remote learning experience, particularly related to teaching with sequences of challenging tasks.

Challenges

When asked to reflect on the challenges with transitioning the teaching of a sequence to remote learning the teachers indicated that they had been adaptive in their teaching and planning. Adapting their practice was evidence of teacher noticing, an important aspect of teacher reflection (Eden, 2020), in that they noticed, interpreted what was happening and responded. They described the difficulties and constraints of the technology and having to adjust activities that ordinarily would involve concrete materials to learning through digital devices and everyday resources in the students' homes.

> *How to do hands-on activities through digital devices; this meant adjusting plans particularly for students who need concrete materials and thinking about alternative resources students would have at home to use. (Susan)*

Engaging with a new pedagogical approach was also a challenge for both the teachers and the students, as explained by Susan:

> *Making things equal, [they] were the big focuses and introducing the concepts and the big idea that they have to struggle and that was a big struggle and then we've got back to the addition and subtraction in a more traditional way during term 2 when we went into lockdown.*

They also recognised the importance of students being surrounded by their peers for opportunities for peer learning (Burke & Dempsey, 2020: Kalogeropoulos et al., 2021). Even when students were organised into small groups for online synchronous learning it was difficult for students to share their recording of thinking online:

> *Even when in small groups for online it was very difficult for students to see what others were recording and sorting their ideas on paper. (Jessie)*

An initial challenge they identified was how they would explore these lessons remotely in partnership with the parents, as indicated by Jessie:

> *I was wondering how you would do these lessons at home when parents are probably going to be supporting and you know even pushing their child to a particular answer and way of doing something.*

As previously described, as a consequence of these aforementioned challenges, the teachers decided to revert to a more traditional approach to teaching mathematics during the first lockdown.

Successes

Following an initially challenging experience with teaching online during lockdown, a facilitated planning session with the research team (authors 1 & 3) in Week 5 of Term 4 re-invigorated and stimulated both teachers' enthusiasm and perseverance to persist with challenging tasks during remote learning:

> *My brain is going a hundred miles an hour now. Just filling out that template and seeing how they get engaged with all the different tasks. I loved the first time that we explored this and teaching it and hearing all their different ideas come out, seeing the quieter students just come alive because they actually contribute more to a discussion. I'm looking forward to seeing this in action, especially online. (Susan)*

During remote learning, after the facilitated planning session, a task was explored across multiple days to allow the students to share their learning in each small group synchronous session. This effectively slowed down the learning and allowed for greater depth of student thinking. There was evidence of both teachers embedding new pedagogies into their practice, as they identified the importance of questioning and student discussion for each lesson:

> *During remote learning students really missed this opportunity (for discussion) and it really did make an impact not having that there. (Jessie)*

> *We have really kept that pedagogy of really thinking about the questions and how to extend the students or enable them. (Jessie)*

Trialling of a unit planner that contains key aspects of the three-phase lesson structure was considered significant, as articulated by Susan, "I think it's the breakdown of the pre-task, explore and summarise." The planner also identified elements of the pedagogy such as questioning and enabling and extending prompts, which were considered critical in supporting teachers to internalise the new pedagogical approach.

> *The summarise [when sharing students' work samples] is the key component that pushes everything together and starts their brains buzzing and we've found a lot of success out of those key mathematical ideas and questions. (Susan)*

A significant change was indicated in the teachers' dispositions towards teaching and learning mathematics:

> *"It's fun! I think because I have been teaching it in a specific way for so long I just got into that routine. It's that whole shift of their ownership and the way we think about tasks and how to make each individual task fun for both them and me. (Susan)*

This clearly indicates a shift in Susan's pedagogy towards student-centred learning. The teachers also identified a shift in student disposition to learning:

> *They are willing to give something a go or to show their work and be wrong. Their ability to try has really shifted. (Susan)*

> *I've noticed that between literacy and maths, they are more willing to share what they are doing in maths. I know we highlight and build them up as we're going but especially some of the students we perceive as being lower are happy to share their answers – it brings them a lot of confidence. (Susan)*

A quote by Susan suggests that her disposition, in particular her perception of the teaching and learning of mathematics, shifted:

> *I think I would like to embed the idea of not always getting it... one idea as a focus for me and for the parents as well so that when their child comes home and says they didn't get the maths that they have got the language to use with them as well.*

An initial challenge, which later became a success, was communication with parents in relation to the pedagogical approaches of the project and the open-ended nature of the tasks. Through this experience these Foundation teachers formed a partnership with parents. The following quotes reflect these realisations.

> *At the beginning of remote learning we did not have the structure in place for the parents to support the children. We learnt that our instructions for teaching the lesson had to be for the parents. We sent an email to parents explaining the EMC3 project and the approaches to teaching... and communicated our expected learning for each task. (Susan)*

> *We realise that it is important to communicate regularly to parents and involve them in their children's mathematics learning. (Jessie)*

Discussion and Concluding Thoughts

Our study sought to capture two Foundation teachers' efforts to implement an innovative pedagogical approach during remote learning. The findings show that these teachers were enthusiastic about exploring a new approach, but their lack of anticipation of the complexity associated with doing so in a remote

learning context provided some initial confusion. Providing time for the teachers to reflect on aspects of the initial remote learning experiences that were problematic assisted them to explore other approaches. These setbacks were the catalyst for exploring synchronous learning with small groups of students, and adapting the proposed lesson structure in the second block of remote learning. These teachers' experiences align with those reported by others, in particular, the difficulty of adapting instructional practice to online learning, and maintaining the relationships with the students (Burke & Dempsey, 2020; Ferri et al., 2020; Kim & Asbury, 2020; Yusouf & Ahmad, 2020).

Three issues apparent from these teachers' initial online experiences resonate with other studies. First, that the student voice within the learning was missing, they lacked the opportunity to engage with their peers and share their thinking (e.g., Kalogeropoulos et al., 2021). Other research reported that providing students with opportunities to explain their thinking and learn from others are critical aspects of the learning environment that supports students' mathematics learning (e. g., Kaur et al. 2013; Pecjak et al. 2021; Yackel & Cobb, 1996). Second, the parents were expected to support their child's learning without any knowledge about the approach, in particular allowing children to engage in productive struggle (Russo et al., 2021) and holding back from telling (Roche & Clarke, 2014). Underpinning these two factors is a need for students to maintain their independence – an essential component of their cognitive development (Hwang & Hariyanti, 2020). Third, the lack of material resources for students to use to support their learning rather than online resources (Ferri et al., 2020).

Unlike the findings of earlier studies that reported Foundation teachers' perception challenging tasks were not for all students (e.g., Russo et al., 2019), Susan and Jessie embraced the opportunity to adapt the tasks for all learners and maintain the challenge. They also saw the need to do this in a remote learning context as well. A key learning for these two teachers from this remote learning experience was the need to go slower and deeper with the tasks and allow time for students to share their thinking. Another learning was the realisation that parent communication was essential, particularly about the innovative approach and the nature of the tasks. This realisation became a driver for these teachers to strengthen their partnership with parents and involve them in their child's mathematics learning during remote learning two.

In addition, remote teaching experiences highlighted key aspects of both teachers' pedagogical approaches that were not as obvious prior to COVID-19, specifically the importance of discussion, student interaction with peers, planning questioning and use of student work samples to stimulate thinking. However, making these adjustments to the way they approached their mathematics planning and teaching did not happen without dedication and focused effort. The teachers' willingness to embrace the challenge, recognise themselves as learners and immerse themselves in the "zone of confusion" (Clarke et al., 2014, p. 9) was pivotal to transforming their pedagogy. Moreover, there was evidence that the disposition of teachers filtered through to student learning, with students embracing the challenging nature of the sequences.

The reflections and accounts of Susan and Jessie's experiences during COVID-19 suggest that having to teach remotely was a catalyst for change in their practice. We suggest that through experiencing confusion and struggle these Foundation teachers restructured their existing knowledge base to accommodate new information revealed through the adverse event of the first remote learning experience. As Lindley (2004) argued, those who do so are in a position to achieve a higher level of personal functioning than if they had never encountered the adverse event in the first instance. Consequently, our study lends further support for the organismic valuing theory of growth (Joseph & Linley, 2005).

In summary, there is little research relating to Foundation teachers' experiences during the pandemic. The findings of this study relating to the experiences and struggles of these two teachers adds to the research literature and highlights two implications for the designers of professional learning and future research. First, to convey to teachers that just as we expect students to struggle when engaging with challenging tasks, teachers may also experience times of confusion, uncertainly or 'not knowing' as they explore new pedagogical approaches. It was only through experiencing the struggle that these teachers realised the importance of the whole class discussions in the Summarise phase of the lesson, and the need to slow down and go deeper. Second, the support of a 'knowledgeable other' is critical, particularly in the early stages of implementation of new learning, as is collaboration, professional dialogue and reassurance that you will not perfect all aspects on your first attempt. Providing such support and collaboration reflects the third recommendation of the Gonski et al. (2018) report stating that Australian education should, "Create the conditions and culture to enable and encourage more professional collaboration, observation, feedback and mentoring amongst teachers" (p. 3). It is through immersion in an encouraging, cooperative, yet ambitious learning community that teachers, like students, will experience the transition from 'confusion to clarity' as they engage with new pedagogies.

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