Using Enabling and Extending Prompts in the Early Primary Years When Teaching with Sequences of Challenging Mathematical Tasks

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The current study explores how teachers report using enabling and extending prompts when teaching with sequences of challenging mathematical tasks. Twenty-nine early years primary school teachers completed a questionnaire following their participation in a professional learning project. Findings suggest that teachers': view prompts as important when teaching with challenging tasks; generally prepare prompts in advance of the lesson; consistently allow students to engage with the core task before making prompts available; and consider prompts equally valuable for augmenting learning across all content areas.

Catering to the diversity of learners in their classroom is one of the most significant issues teachers report facing in their practise (Shernoff et al., 2011). Gervasoni and Peter-Koop (2020) noted that, "teachers at all levels struggle to meet the challenge of providing a high-quality inclusive mathematics education that enables all students to thrive" (p. 1). One approach to meeting this challenge that has been in focus over the past decade in Australia and New Zealand is to teach mathematics through challenging tasks, and use enabling and extending prompts to differentiate instruction (Davidson et al., 2019; Ingram et al., 2020; Sawatzki & Goos, 2018; Sullivan et al., 2016).

Enabling prompts are intended to provide students with an additional learning experience that is carefully connected to the main problem-solving task that has been offered to the class. This additional learning experience involves: reducing the number of steps; simplifying modes of representation; making the task more concrete and/or reducing the complexity of the numbers involved (Sullivan et al., 2006). Extending prompts, on the other hand, are prepared for those students who have completed the main problem-solving task. They expose these students to an additional task that has a higher level of cognitive demand, but involves the use of similar reasoning, conceptualisations and representations as the original task (Sullivan et al., 2006). See Table 1 for an example of a challenging task, with an associated enabling and extending prompt.

Table 1
Example of a Challenging Task, and Associated Prompts (Year 1-3)

Challenging Task	Enabling Prompt	Extending Prompt
I visited a farm and counted 8 heads. How many legs did I see?	Draw a picture of your family. How many heads and legs are in your family altogether?	Imagine you only saw one type of animal on the farm when you counted the 8 heads. What are the different possibilities for how many legs there might have been? Explain how you have found all possible solutions.

There is evidence from studies undertaken in a primary school context that teachers who have taught with challenging tasks across multiple lessons both use prompts consistently and view prompts as useful for differentiating learning. Sullivan et al. (2016) supported 30 Year

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3/4 teachers to implement ten lessons constructed around challenging tasks. An element of the research project involved these teachers completing a proforma that documented their facilitation of the lesson, including how enabling and extending prompts were incorporated. The median number of students who accessed an enabling prompt across the five lessons described by Sullivan et al. (2016) was: 4 (Lesson 1), 4 (Lesson 2), 4 (Lesson 3), 5 (Lesson 4) and 10 (Lesson 5), and almost all teachers provided enabling prompts to at least some students in each lesson. Moreover, the mean time until teachers made prompts available was in the range of 6 to 7 minutes for each of the tasks reported on. By contrast, the median number of students who accessed the extending prompts was: 5 (Lesson 1), 6 (Lesson 2), 6.5 (Lesson 3), 6.5 (Lesson 4) and 1 (Lesson 5). Collating the data from the Sullivan et al. (2016) study, and assuming class sizes of 25 students, it appears that the "typical" (median) teacher in a "typical" (median) lesson involving challenging tasks might administer enabling prompts to around one-fifth of students in the class and extending prompts to around one-quarter of students; although there was substantial variation across both teachers and tasks.

Reporting on a related project, Cheeseman et al. (2017) used grounded theory to analyse 37 Year 3 to 6 primary teachers' responses to an open-ended questionnaire item to ascertain what factors these teachers considered when choosing to use enabling and extending prompts with their students during a lesson involving a challenging task. They found that teachers used enabling prompts for several interrelated reasons, including: to assist the thinking of students who were struggling with the main task, to make the main task more accessible and to support student understanding more generally. They also noted that some teachers reported using prompts to encourage students who lacked confidence, and to facilitate students experiencing success. By contrast, teachers used extending prompts to: maintain the level of mathematical challenge and extend student thinking; to challenge particular students; to match tasks to student thinking; and to invite students to apply their knowledge.

Providing further evidence that prompts are an important aspect of teaching with challenging tasks, Clarke et al. (2014) reported on the responses of 36 Victorian upper primary school teachers involved in a professional learning initiative in terms of strategies that they believed supported student persistence on challenging tasks. It was revealed that attending to differentiation, which included developing and identifying prompts, was the most often-used strategy reported by teachers when planning a lesson to encourage student persistence. By contrast, differentiation was the second most frequently described strategy during the lesson itself for encouraging student persistence, after questioning students and supporting students to reason mathematically. This suggests that preparing enabling and extending prompts for students during planning is likely to be valuable for supporting differentiation, independent of whether students actually use prompts during the lesson.

There is also evidence that students themselves find prompts valuable, at least in the case of enabling prompts. Russo et al. (2020) invited 132 Year 3–6 students to complete a questionnaire describing their attitudes towards enabling prompts in classroom environments where they were expected to access prompts themselves. Students consistently reported that having access to enabling prompts allowed them to be successful with, and take control of, their mathematics learning. Importantly, there was little evidence of any stigma or embarrassment associated with accessing enabling prompts, with the authors concluding that classroom teachers can rapidly establish a culture where students access such supports themselves to support learning mathematics through problem solving.

Much of the existing research into how teachers use and view enabling and extending prompts has focussed on the middle and upper primary years. Consequently, the current study endeavours to examine teacher perspectives on using enabling and extending prompts when teaching with sequences of challenging tasks in the early primary years. In addition to exploring how prompts are used with younger students, we will endeavour to shed some light on several

unresolved issues concerning prompts. First, although often it is assumed that the teacher is responsible for disseminating prompts to students (Cheeseman et al., 2017; Sullivan et al., 2016), more recently it has been demonstrated that students in Years 3–6 can benefit from accessing prompts of their own volition (Russo et al., 2020). In the current project, we have deliberately kept the decision as to whether the enabling prompts should be teacher or student initiated ambiguous, in order to probe how project teachers choose to use enabling prompts in their classrooms. Second, although project teachers are generally encouraged to view enabling and extending prompts as an aspect of the lesson planning process (Sullivan et al., 2016), it might be that teachers also generate enabling and extending prompts "on the spot" as they attempt to find ways to optimally differentiate the lesson for students. We will ask project teachers the extent to which prompts were pre-planned or created in vivo. Third, prior research has not inquired into whether teachers view enabling and extending prompts as being equally useful for supporting all mathematical content areas. In fact, our project team has assumed that prompts are perhaps less useful in areas such as measurement and geometry, where the tasks are often inherently low-floor and high-ceiling. Whether or not this view is held by project teachers will be empirically examined. Finally, other than the Sullivan et al. (2016) study, other research in this area has not considered either the proportion of students who access enabling and extending prompts during work on a challenging mathematical task, nor the typical "wait time" before teachers make such prompts available. This will also be a topic of inquiry for the current study. Our research question is:

> *How do teachers utilise prompts to support student mathematical work in a sequence of learning involving challenging tasks in the early years of primary school?*

Method

Our project has involved supporting two school systems in Australia (Melbourne Archdiocese Catholic Schools and Catholic Education Diocese of Parramatta) integrating an approach into their mathematics instruction that can be described as student-centred structured inquiry (Sullivan et al., 2021). The project has targeted generalist, early years (Foundation-Year 2; 5–8-year-olds) primary school teachers. We have provided participating schools with access to up to 14 sequences of problem-solving tasks intended to be connected, cumulative and challenging which are introduced to teachers on the first project day. In addition, schools received some professional learning support around planning mathematics instruction, and how to use the tasks from the sequences, both from the project team, and in-house, system-level instructional experts. The project began formally in 2019, although has been disrupted considerably over the past two years because of COVID-19.

The final project day for Melbourne Archdiocese Catholic Schools was held remotely during November 2021. Attending teachers were invited to complete a questionnaire describing their experience of implementing the sequences in 2021. Twenty-nine teachers from eight schools completed the questionnaire. Participants taught Foundation (45%), Year 1 (45%), and/or Year 2 students (34%), with several teaching composite grades. On average, participating teachers had 9.8 years teaching experience (Range 1 to 30), and almost all were female (n = 27; male, n = 2). Most participating teachers (62%) who completed the questionnaire had also been involved in the project the previous year.

Several of the items related to participants' experience of using enabling and extending prompts to support students to engage with the sequences of challenging tasks in the classroom (as opposed to during remote learning). Reporting on this data will be the focus of the current paper. Data were organised and analysed using SPSS Version 25. Qualitative data from the two open-ended responses were used to supplement the quantitative analysis through illustrating and fleshing out trends apparent in the quantitative data.

Results and Discussion

Prompt Preparation and Administration

When asked whether they have their enabling prompts prepared ahead of time before the lesson begins, over three-quarters of teachers noted they did so frequently; this is all, or most, of the time (n = 23; 79%). By contrast, less than one-quarter of teachers (n = 6; 21%) indicated that they frequently came up with enabling prompts 'on the spot' during the lesson (see Table 2). One teacher described the process of developing prompts during the lesson planning phase: "During planning, we discuss the task and talk about where students might have misconceptions or get stuck. We then use this to plan enabling prompts." (T16). An even more dramatic difference was evident when comparing the numbers of teachers who reported frequently preparing extending prompts ahead of time (n = 25; 86%), compared with those who frequently came up with them 'on the spot' (n = 3; 10%). A teacher described how they used pre-planned tasks as extending prompts: "If I noticed students finding the task easy or have found all the solutions or solved it systematically, I give them the extension task" (T7). The idea that prompts were generally prepared in advance is consistent with how such prompts were intended to be used in the project (Sullivan et al., 2021).

Table 2
Enabling and Extending Prompt Preparation and Administration (percentage frequency)

Item	All of the time	Most of the time	Some of the time	Never
I have my enabling prompts prepared ahead of time before the lesson begins	41%	38%	21%	0%
I come up with my enabling prompts 'on the spot' during the lesson	3%	17%	72%	7%
I have my extending prompts prepared ahead of time before the lesson begins	38%	48%	14%	0%
I come up with my extending prompts 'on the spot' during the lesson	3%	7%	83%	7%
I give enabling prompts to students who are struggling on the main task	24%	45%	28%	3%
My students access enabling prompts themselves if they are stuck on the main task	0%	24%	59%	17%

As noted in the introduction, we left it deliberately ambiguous in the current project as to whether teachers might encourage students to access enabling prompts themselves, or instead disseminate prompts directly to students when needed, given contrasting recommendations in the literature (Russo et al., 2020; Sullivan et al., 2006). Whilst over two-thirds of teachers frequently gave enabling prompts to students who were struggling (n = 20; 69%), only around one-quarter of teachers (n = 7; 24%) observed that students frequently accessed enabling prompts themselves if they were struggling. This may have reflected the limited cognitive maturity of these young students, as implied by one teacher:

> Some students would be willing to take the enabling prompts on their own, however others would sit there struggling and become overwhelmed and I would need to give the enabling prompt to those students as they wouldn't take the initiative themselves. (T15)

This suggests that encouraging students to access enabling prompts of their own volition was relatively unusual, and that, consistent with Sullivan et al.'s (2016) findings, most teachers in

the current study viewed disseminating prompts as an active pedagogical action they could take when students were exploring challenging tasks and encountered difficulty.

Prompt Utility and Classroom Culture

The data in Table 3 and Table 4 reveal that almost all teachers agreed, or strongly agreed, that both enabling prompts (n = 28; 97%) and extending prompts (n = 29; 100%) are an important component of teaching with challenging tasks. This suggests that project teachers found such prompts valuable for differentiating instruction, a finding that has been noted elsewhere in the literature (Clarke et al., 2014). One teacher highlighted the importance of enabling prompts for providing a pathway into the main task for some students:

> After the suggestion is launched and students are given time to come up with ideas, if students have not begun, and look like they are unable to begin, then an enabling prompt may be suggested; if that is successful then I would encourage them to have a go at the original suggestion. (T17)

Interestingly, more teachers strongly agreed that extending prompts (n = 13; 45%) were important in supporting such lessons than was the case for enabling prompts (n = 8; 28%). As one teacher indicated: "I enjoy using extending prompts for those children that need to be challenged." (T5).

Table 3
Enabling Prompt Utility and Classroom Culture (percentage agreeing/disagreeing)

Item	SA	A	N	D	SD
Enabling prompts are an important component of teaching with sequences of challenging tasks	28%	69%	3%	0%	0%
There is a negative stigma associated with accessing enabling prompts in my classroom	0%	10%	31%	38%	21%
Enabling prompts are useful for supporting students when working on challenging number tasks	24%	72%	3%	0%	0%
Enabling prompts are useful for supporting students when working on challenging measurement tasks	28%	69%	3%	0%	0%
Enabling prompts are useful for supporting students when working on challenging geometry tasks	28%	62%	10%	0%	0%

Table 4
Extending Prompt Utility and Classroom Culture (percentage agreeing/disagreeing)

Item	SA	A	N	D	SD
Extending prompts are an important component of teaching with sequences of challenging tasks	45%	55%	0%	0%	0%
There is pride associated with accessing extending prompts in my classroom	24%	34%	38%	0%	3%
Extending prompts are useful for stretching students on challenging number tasks	38%	59%	3%	0%	0%
Extending prompts are useful for stretching students on challenging measurement tasks	41%	55%	3%	0%	0%
Extending prompts are useful for stretching students on challenging geometry tasks	38%	55%	7%	0%	0%

Only a relatively small number of teachers agreed that there was a negative stigma associated with accessing enabling prompts in their classroom (n = 3; 10%). This resonates with student data presented by Russo et al. (2020), which revealed that very few of the 132 Year 3-6 student respondents agreed that they were embarrassed to access an enabling prompt when working on a challenging task (2%), or that accessing enabling prompts meant that a student was bad at mathematics (3%).

Finally, despite our assumption that project teachers may find enabling and extending prompts more useful for number-related tasks compared with measurements tasks, or geometry tasks, we found no evidence that this was the case. Almost all teachers agreed that enabling prompts were useful for supporting students, and extending prompts useful for stretching students, regardless of the mathematical content area being considered. This may be in part due to the fact that enabling prompts in particular were broadly construed by teachers, and, in addition to an enabling task, might have also included other enablers, such as access to manipulatives or "spotlighting" of other student work. Spotlighting involves the teacher pausing exploration of the task to draw the class's attention to a particular student work sample in order to illustrate something of mathematical importance (e.g., revealing how the student overcame a misconception; sharing a solution strategy; describing a novel insight into the task). For example,

> It [the enabling prompt] varies. Some [students] are asked to come to the floor to work with materials, while others are given a verbal prompt, while others can read from a card. T22.

> After 5 minutes I spotlight or share someone's work- this would be the first enabling prompt I would use. I would then ask the students to try the task again having looked/ listened to other strategies. If I find after another 2 minutes this student is not grasping the concept, I would tap their shoulder and say they are invited to use an enabling prompt/ walk around and look at other people's ideas. T14.

Prompt Wait Time and Propensity to Access

Figure 1 indicates that almost all teachers generally waited at least some length of time before making enabling and extending prompts available to students. In fact, a large majority of teachers typically waited at least five minutes to make an enabling prompt available to students (83%) or an extending prompt available to students (93%). The typical median wait time across participants before providing prompts was 5 or 6 minutes for enabling prompts, and 7 or 8 minutes for extending prompts. One teacher described how they waited several minutes before making an enabling prompt available:

> I would wait for students to have seen a spotlight after the 5-minute mark. If they are still struggling after seeing another student's strategy, I would wait 5 minutes and then give them an enabling prompt. If they can do it successfully, I would ask them to revisit their original task. (T19)

Another teacher indicated the importance of a student exhausting the mathematical possibilities of the original task before making the extending prompt available:

> When students have explored all possibilities and are sure they have found them all and can explain how they can prove that they've found them all, then I would pose the extending prompt. (T17)

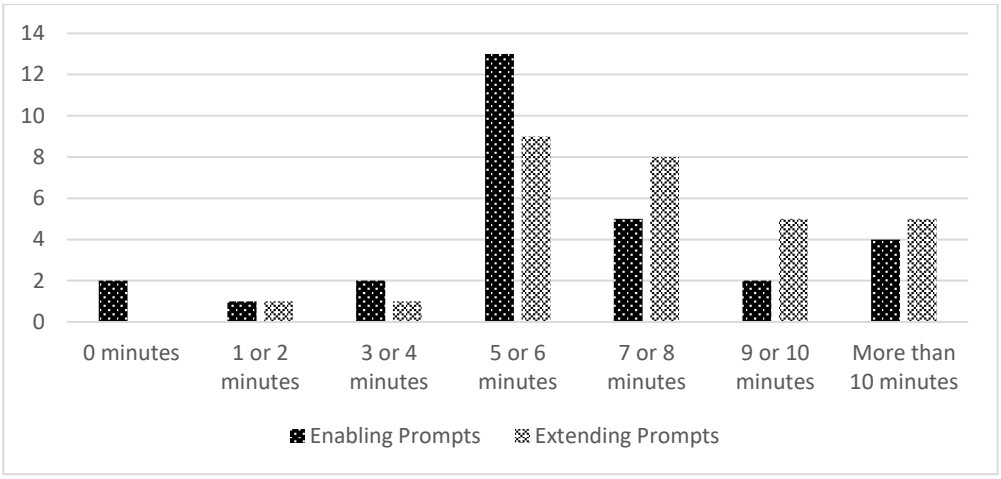

Figure 1. Typical wait time before teachers made prompts available during a typical number task by frequency of response.

The average duration teachers in the current study reported waiting before providing students with enabling prompts was very similar to what teachers described in the Sullivan et al. (2016) study for the typical task (6 to 7 minutes). This is particularly notable because teacher participants in the Sullivan et al. (2016) taught middle years primary school students (Year 3 and Year 4) rather than early years primary school students (Foundation to Year 2), suggesting that the age of the students is a relatively unimportant consideration in terms of when in the lesson teachers choose to make prompts available. In addition, it is interesting to note that for teachers in our study, typical "wait time" for enabling prompts and extending prompts were correlated, suggesting that those teachers who tended to wait longer periods before making the enabling prompt available also waited longer before making the extending prompt available ($r_s = .43$, $p < 0.05$, $N = 29$).

Teachers were also asked to report on the percentage of students that typically accessed an enabling and extending prompt when working on a typical task in the number domain. On average, teachers reported that 17% of students accessed an enabling prompt (range 4% to 80%; median 10%), and 22% of students accessed an extending prompt (range 4% to 55%; median 20%). In comparison to teachers in the Sullivan et al. (2016) study, it appeared that our study teachers reported that their students were slightly less likely to use either type of prompt, although the differences were relatively marginal and not of clear practical significance. Again, it is interesting to note that teacher reports of the percentage of students who accessed enabling and extending prompts were correlated, such that teachers who were more likely to report higher usage of enabling prompts also reported higher usage of extending prompts, and vice versa ($r_s = .51$, $p < 0.01$, $N = 29$).

Conclusions and Future Research Directions

Overall, our results suggest that project teachers perceived enabling and extending prompts to be an important aspect of teaching mathematics through sequences of challenging tasks in the early primary years. In general, teachers prepared prompts ahead of time during lesson planning, and took primary responsibility for administering prompts to students during the lesson. Prompts were perceived as equally valuable for supporting all mathematics content areas, and it was unusual for teachers to report negative stigma associated with students accessing enabling prompts. Furthermore, teachers generally allowed students to grapple with the core task before immediately supporting them with an enabling prompt or offering an extending prompt. Collectively, these findings are consistent with how we intended teachers to

use prompts in our project (Sullivan et al., 2021), and resonate with previous research into teachers' use of prompts with middle and upper primary students (Clarke et al., 2014; Cheeseman et al., 2017; Sullivan et al., 2016).

One notable limitation of the current study is that it relies on retrospective self-report data. We intended to use lesson observations and post lesson interviews with teachers to shed further light on how prompts were used, however our data collection efforts were significantly curtailed due to difficulties accessing schools as a result of COVID-19. Future studies might attempt to further validate and illuminate the current findings through systematic lesson observations of several teachers who report different prompt usage patterns (e.g., "high prompt usage", "moderate prompt usage", "low prompt usage"). This would enable further insight into how enabling and extending prompts are used alongside other pedagogical considerations (e.g., access to mathematical manipulatives, use of teacher questioning, encouraging collaborative student work) to facilitate differentiated instruction.

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