Teaching with challenging tasks in the early and middle years of primary school can support the development of student reasoning and unleash critical and creative mathematical thinking; however, teaching with challenging tasks can be challenging. Some issues that might arise for teachers when considering teaching with such tasks are: How do you develop (and use) appropriate enabling and extending prompts to support and extend all learners? How should you structure lessons involving challenging tasks? How do you introduce challenging tasks without creating classroom management issues? Although all of these questions are important and warrant examination, the focus of the current paper is on unpacking enabling and extending prompts. The author draws on his firsthand experience of teaching challenging tasks to students in Foundation to Year 4 to explore this issue.

WHAT ARE CHALLENGING TASKS?

Challenging tasks are complex and absorbing problems with multiple solution pathways, which include enabling and extending prompts to support differentiated learning (Sullivan & Mornane, 2014).

Challenging tasks should:
- engage students;
- be solvable through multiple means (i.e., have multiple solution pathways) and may have multiple solutions;
- involve multiple mathematical steps;
- have at least one enabling prompt and one extending prompt developed prior to delivery of the lesson;
- be initially perceived as challenging by the majority of students and involve students spending considerable time working on the task (e.g., at least 10 minutes),

Generally, lessons with challenging tasks are structured such that work on a challenging task (Explore phase) precedes a whole-group mathematical discussion (Discuss/Summary phase) (Stein, Engle, Smith, & Hughes, 2008). How can the teacher ensure that all (or almost all) students are in a position to potentially contribute to this mathematical discussion? Facilitating an inclusive discussion is dependent on all students engaging meaningfully with the primary learning focus, which is in turn contingent on the teacher employing carefully developed enabling and extending prompts.

DEVELOPING APPROPRIATE ENABLING AND EXTENDING PROMPTS TO SUPPORT ALL LEARNERS

Enabling prompts are designed to reduce the level of challenge through: (a) simplifying the problem, (b) changing how the problem is represented, (c) helping the student connect the problem to prior learning and/or (d) removing a step in the problem (Sullivan, Mousley, & Zevenbergen, 2006). Extending prompts are designed for students who finish the main challenge and expose students to an additional task that is more challenging; however this requires them to use similar mathematical reasoning, conceptualisations, and representations to the main task (Sullivan et al., 2006).

There are a number of things to keep in mind when developing (and using) enabling and extending prompts, some of which are particularly relevant when working with early primary students (Foundation, Year 1, Year 2). These considerations can be separated into how prompts should be used during the lesson, and how prompts should be developed prior to the lesson.
HOW SHOULD PROMPTS BE USED IN THE CLASSROOM?

When teaching with challenging tasks, it may be helpful to refer to the enabling prompts using the more student friendly term “hint sheets.” Children should be encouraged to access the enabling prompt of their own volition, after spending at least some time grappling with the problem in what Sullivan and colleagues have termed the “zone of confusion” (Sullivan et al., 2014, p. 11). Initially, there may be a tendency for enabling prompts to be underutilised by students even when they are unproductively stuck on a task for long periods, either because they are not used to taking it on themselves to decide when they need help, or because there is some perceived stigma around using the “hint sheet.” If this seems to be the case in your classroom, it might be worthwhile to praise students for being proactive in accessing the enabling prompt, in part to develop the norm that taking initiative to help oneself with one’s own learning is a sign of maturity and independence, rather than implying “failure” with the task. The goal is to build a culture where students take responsibility for their own learning, and to foster the belief amongst students that they can become better mathematicians through effort, calculated risk-taking and resourcefulness.

To support this culture, enabling prompts should be in the same place for every session where challenging tasks are being used (e.g., on the teacher’s chair at the front). As a more general point when teaching with challenging tasks, developing well established, predictable routines seems particularly important, both for communicating clear (and high) expectations and for building student autonomy (Russo & Hopkins, 2018).

By contrast, you may wish to consider referring to the extending prompt as “the super-challenge,” and including it on the flip-side of the challenging task handed out to students. It is suggested that the teacher might have a role to play in subtly “eyeballing” a student’s work to make sure that they have made genuine progress with the main task before moving on to the extending prompt. Although the intention is to encourage students to take responsibility for determining whether they are ready to be extended, initially this may require some monitoring as students are often keen to “keep up” with their peers. This is obviously likely to be less of an issue if a culture of personal responsibility is well established within the classroom.

HOW SHOULD PROMPTS BE DEVELOPED?

Enabling prompts can be presented in many different forms. However, as much as possible, enabling prompts should use visual cues that support the relevant mathematical thinking (e.g., images, tables, diagrams, concept cartoons), rather than relying on lots of text. This increases the likelihood that students will be able to successfully use such prompts independently of teacher support.

When developing prompts to support work on a challenging task, there might be a tendency to treat anything that makes the task easier as an appropriate enabling prompt, and anything that makes the task harder as an appropriate extending prompt. Given that the goal is to engage all students in meaningful mathematical work, this general rule of thumb might be good enough to achieve this ends. However, ideally, decisions around what are the most appropriate enabling and extending prompts for a given challenging task should be influenced by the primary learning objective of a given lesson. The advantage of this more considered approach to designing prompts is that getting all students to focus on the same primary learning objective lays the foundation for a meaningful and inclusive discussion around the relevant mathematics at the end of the lesson. Even when using the same challenging task, changing the focus of the learning may well lead to a change in one or both of the prompts. Therefore, the ideal role of the prompts is not just to make the task easier or harder, but to deepen engagement with the primary learning focus.

LEARNING OBJECTIVES SHOULD SHAPE PROMPTS

The idea that learning objectives should shape the nature of the associated prompts is best illustrated through examples. The remainder of this article elaborates on three challenging tasks, and explores how modifying the learning objectives influences the best choice of prompt to include.
HOW MANY FINGERS TASK

Consider the challenging task, targeted at Year 1 and 2 students (How Many Fingers task): *Without leaving your seat, or talking to anyone, can you work out how many fingers are in the room right now? Show how you worked it out* (see Russo, 2015). This task appears to have at least two learning objectives embedded within it:

- Problem representation: “To find a quasi-abstract or abstract means of representing a concrete counting-based mathematical problem” (Russo, 2015, p. 10).

- Skip-counting patterns: “Counting by 5’s or 10’s can be a more efficient way of working out how many things there are in a collection” (Russo, 2015, p. 10).

Although both problem representation and skip-counting patterns might be viewed as important learning objectives, prioritising these objectives supports the development of prompts. This would seem to be particularly important when developing the enabling prompt, because focusing on one specific learning objective generally means de-emphasising (or even removing) the other objective(s). The suggestion is that this should be an active and pre-mediated choice by the teacher, rather than something left to chance.

For instance, with the current example task, if the teacher determined that problem representation was the primary learning objective, an appropriate enabling prompt may be: “Without leaving your seat, or talking to anyone, can you work out how many people are in the room right now? Show how you worked it out” (Russo, 2015, p. 11). This maintains the emphasis on finding a means of appropriately representing the worded problem, whilst removing the focus on skip-counting. We might expect the child to model all the people in the room at their tables using Unifix, or perhaps draw a picture conveying this information.

Conversely, if exploring skip-counting patterns was the primary learning objective, a more appropriate enabling prompt may be to show students an image and ask them to determine the number of fingers in the image (see Figure 1). This removes the emphasis on problem representation so that students can engage with skip-counting patterns. Notice that the image chosen in Figure 1 does not allow students to accurately count all the fingers by 1s, as several fingers are obscured. Therefore, to accurately ascertain how many fingers are in the image, students would likely need to skip-count (or use multiplication), or at the very least conceptualise the problem using this structure (even if they resorted to attempting to count by 1s).

![Figure 1. Enabling prompt: How many fingers are in this picture? How did you work it out?](image)

Similarly, if the primary emphasis was on problem representation, an appropriate extending prompt may be something like: “How many fingers are there in all of the Year 1 and Year 2 classes combined?” Assuming there are multiple Year 1 and 2 classes, this problem is considerably more challenging to represent than the original task. Specifically, it is more abstract, likely requiring a “top-down” conceptualization (e.g., knowledge of approximately how many students are in
each class, and skip-counting “this many times”), rather than a “bottom-up” conceptualization (e.g., drawing pictures of students sitting at tables, and using this pictorial representation to count the fingers).

By contrast, an appropriate extending prompt for the Fingers task if the emphasis was on skip-counting patterns might be: “I forgot to tell you; thumbs don’t count as fingers!” This invites students to skip-count by more challenging patterns (e.g., counting by 4s or 8s, rather than 5s or 10s) to solve this extension and/or engage with multiplicative ideas, in particular a preliminary version of the distributive property (e.g., students may use their existing problem representation to count back by 2s, leveraging off the idea that a group of 8 is 2 less than a group of 10). However, it is worth noting that ensuring that the extending prompt builds on the primary learning objective is probably less important than is the case for the enabling prompt, as these students will still be able to contribute meaningfully to the whole-group mathematical discussion.

**BLOCK OF CHOCOLATE TASK**

The next challenging task was sourced from the Australian Curriculum work sample portfolio available through the ACARA website. It is targeted at students in Year 2 and can be referred to as the Block of Chocolate task. It is presented as follows: *I have a 30 piece block of chocolate (in the shape of a rectangle). What might my chocolate look like? Record as many possibilities as you can* (ACARA, 2014).

Two learning objectives inherent in the Block of Chocolate task might be:

- **Drawing an array:** For students to be able to visualise a discrete set of objects, and represent and record the set of objects as an array.
- **Many factors:** For students to realise that some numbers can be represented by multiple arrays; that is, they have many factors (e.g., 24 can be represented as $8 \times 3$ or $6 \times 4$ or $12 \times 2$).

An appropriate enabling prompt if the primary learning focus was on drawing an array might be to reduce the number of pieces of chocolate being considered; for example, 10 pieces, rather than 30 pieces. Using a smaller set of objects will likely support students’ capacity to appropriately visualise the problem, and allow them to use their pre-existing computational knowledge to mentally organise the pieces into an array (e.g., 10 is the same as 2 rows of 5).

Alternatively, if the primary focus was on students discovering that some numbers have many factors and can be represented by multiple arrays, it might be more appropriate to provide students with concrete materials to manipulate; in this case, square counters to represent the pieces of chocolate (see Figure 2). Again, although both learning objectives seem important, prioritising your objective helps to determine which prompt might be more suitable in a given learning context.

![Figure 2. Enabling prompt: Can you organise these 30 pieces of chocolate into a rectangular block? How many different rectangular blocks of chocolate can you create using all 30 of these pieces?](image)
FOUR SEASONS TASK

The last challenging task is most appropriate for students in Years 3 and 4 (although it has been used with younger students), and is called the Four Seasons task. Without any preliminary discussion, students are asked: *In Australia, what is the longest season?* (see Russo, 2016). There are likely to be several learning objectives embedded within this task, including:

- **Digging deeper**: For students to appreciate that mathematical problems can involve counter-intuitive findings that will only be revealed after a student works through a task methodically.
- **Applying knowledge**: For students to use their knowledge of how the seasons and months are constructed to solve a mathematical problem.
- **Computation with addition**: For students to use appropriate computational strategies for adding a sequence of two-digit numbers.

Any one of these learning objectives might serve as the primary focus for the lesson. Let us take perhaps the most obvious scenario first, and imagine that the objective of digging deeper is the primary focus. Although ideally we would still like students to bring to mind and apply their knowledge of the seasons and months to solve the problem, and to employ appropriate computational strategies, we would be willing to sacrifice these aims in order for students to engage with the idea that mathematical tasks can involve counter-intuitive findings that only reveal themselves through methodical application. Consequently, we might give students access to tools that allow them to hone in on the primary learning focus through removing the emphasis on knowledge application and computation. To this end, our enabling prompt might in fact be a calendar and a calculator!

If, instead, our primary focus was on computation with addition, we might provide a table for students which removes the applying knowledge and the digging deeper objectives and turns the task into one which emphasises multi-digit addition. Such a prompt is presented in Figure 3.

![Figure 3. Enabling prompt: Can you work out exactly how many days there are in each season through completing the table?](image-url)

Although most teachers would likely concur that the calendar and the calculator intuitively seems a more appropriate enabling prompt than the table included in Figure 3, prioritising the various learning objectives embedded in the task emphasises why this is in fact the case. The task seems more in the realm of a rich problem solving inquiry than an elaborate context for addition practice. Hopefully this contrast provides further evidence for the contention that not all prompts are created equal, and that identifying and focusing on the primary learning objective is a fruitful means through which to develop and refine prompts.

CONCLUDING THOUGHTS

Teaching with challenging tasks is inherently challenging for teachers for many reasons, one of which is the expectation that they will create and apply appropriate enabling and extending prompts to support student learning. The purpose of this paper has been to provide some initial guidance to teachers both around how to develop prompts prior to the lesson, and how to use prompts in the lesson. In particular, there has been emphasis on how the process of identifying...
and clarifying the primary learning objective can help direct the development of prompts. Carefully developed prompts can do much more than simply make a task easier or harder; they have the potential to deepen engagement with the primary learning focus and enrich the subsequent mathematical discussion. Teachers may wish to consider adapting existing problem-solving tasks that are available through professional journals (e.g., *Australian Primary Mathematics Classroom, Prime Number*) and websites (e.g., *Nrich, reSolve*) by developing specific enabling and extending prompts that suit their specific learning focus.

**REFERENCES**


