Using Push and Support Cards for Differentiation

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Abstract: *The authors share their use of push and support cards to differentiate whole class instruction and to support the use of high cognitive demand tasks. Strategies for generating and implementing the cards in school classrooms are shared.*
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1 Introduction

Recently, we posed the following rich task focusing on arrays to a group of second grade students.

The Desk Task

Ms. Tily needs to help her friend Julie rearrange the desks in her first grade classroom. Julie has 20 desks and they must be in an array. What are possible arrangements for the desks? For each array, draw the array and write a number model to tell Julie what you did.

A few groups seemed to breeze through *The Desk Task*. For these groups, we posed a follow-up.

The Desk Task Extension

Two new students came. How can Julie arrange the desks?

The follow-up problem not only kept groups working on the context and mathematics of the original task but also provided us with insight into their mathematical thinking. For instance, we were surprised when one group wrote one row of 22 cubes along with the number model 1×1. In this article, we share our learnings about the use of follow-up questions — what we refer to as push and support cards — to promote student problem solving of rich tasks in whole group settings. Through examples, we illustrate how push and support cards enable us to differentiate instruction while engaging students in "productive struggle" as described in *Principles to Actions* (NCTM, 2014).

2 Push and Support Cards

We use push and support cards to differentiate instruction involving a single rich task. The cards support and extend problem solving as small groups of two or three work on a task. For us, differentiation means supporting the mathematical and social growth of each student. This means selecting tasks that challenge students while "plan(ning) ways to support students productively without removing the opportunities for students to develop deeper understanding of the mathematics" (NCTM, 2014, p. 49). As we planned, we considered the potential of a single task to engage the whole class in problem solving and discussion. We designed our push and support cards to be provided to groups after they had begun working on tasks together. The cards have questions or situations printed on them that support student problem solving. The figure below illustrates a push card we used with students after posing *The Desk Task*.

The Desk Task Push Card

Rachael created this array for Julie. What number model could Rachael write? Do you think Julie's principal will like this array? Why or why not?
xxxx
xxxxx
xxxx
xxxxx
xx

These cards allowed us to keep the whole class engaged in heterogeneous groups of two or three on a single main task. In designing our tasks, we explored Smith and Stein's (2011) definition of cognitive demands of tasks (also in NCTM, 2014). Specifically, a higher cognitive demand task includes multiple starting points, no clear direction on getting the "right" answer, and possibly more than one correct solution. Lower cognitive demand tasks are the more typical math practice problems we see in textbooks, such as memorizing number facts or solving a straightforward, real-world math problem. Although we recognize the use of lower cognitive demand tasks for some learning goals, we focused on high cognitive tasks for two reasons: first, we were curious to explore what made a "good" high cognitive demand task and second, we felt there wasn't any room for differentiation in a lower cognitive demand task. The tasks shared in this article are taken from our work with a second grade classroom in a public school with 21 students, three of whom were special education students.

3 How We Differentiated Tasks with Push and Support Cards

Inspired by the *Five Practices* (Smith & Stein, 2011) and Gavin and Moylan's "7 steps to High End Learning" (2012), we decided to generate push and support cards to differentiate instruction. Both types of cards offer students a question or hint about the task. Support cards help students who were "stuck" and push cards would provide an extension of the task.

For example, one of the *Five Practices* is to anticipate how students might start the task, generating possible solution paths, and considering where they might get stuck or go off course. We used this idea to generate support cards to give to student groups as they worked if they needed help. The idea was for us to avoid "rescuing" students (NCTM, 2014) or having students rely on us as experts as we monitored student work (another of the five practices). Thus, when we saw a group get stuck in any part of a task (the beginning or middle), we had a support card ready and could literally drop off the card to the group and keep moving. This idea is similar to "the parting shot" described in the *Five Practices for Science* (Cartier, Smith, Stein & Ross, 2013).

Similarly, if a group finished a task, meaning each group member could describe their solution path, we had a push card ready to encourage further mathematical thinking. Our hope was to be prepared for the many ways students may engage with a task and support their "productive struggle" (NCTM, 2014).

3.1 Support Cards

Support cards were used for groups who either did not know where to begin, got stuck, or were making a common error when working on a high cognitive demand task. For example, in second grade, students gain fluency in addition and subtraction through the 100s, as well as build a stronger understanding of place value through the 1000s (CCSSM, 2.NBT). To support these concepts, we posed the *Market Task* (based on a task in Bell et al. (2016)) shown below.

The Market Task (based on Bell et al. (2016))

Given a price sheet from a market, what can you buy for $100? You do not have a calculator to help you find the total cost of the items you want to buy. Choose at least three items. Spend as much of the $100 as you can. Explain your thinking two different ways to show how you know you found your answer.

Because our task required fluency through 100, we prepared support cards for any group that started the task but then either didn't know what to do or asked for help. During one implementation, a few groups experienced difficulties getting started. We made support cards that had additional problems or questions to help students generate ideas for approaching the problem. One card gave two items and asked the group to find a third item that would add to 100. Another card suggested the group look for precisely two items they could purchase with $100. These cards helped the groups get started and narrow their focus on the task, enabling more students to contribute productively in subsequent whole group discussions of various solution strategies.

3.2 Creation of Support Cards

We use a variety of structures to create support cards, regardless of the task. We list several below.

- Use simpler numbers
- Break the task into smaller pieces and ask a group to consider just one piece
- Use scaffolding steps in existing problems
- Build on past successes by referencing a similar previously worked task
- Suggest the use of an organizational tool like a table or a number line

The intent of support cards is to provide the group with scaffolding to help them struggle productively with a task that is difficult for them. Once groups have made sense of the question or situation on a support card, they return to the original task with an idea of how to approach it. If the group doesn't have time to return to the original task, the group can still offer a solution since the support card maintains the context and mathematics of the original task.

Another common strategy for creating support cards includes referring to existing problems in teacher guides. We found tasks in teacher guides and student versions that had extra scaffolding that could be removed to make higher cognitive demand tasks. For example, *Everyday Mathematics 4, Grade 2* (Bell et al., 2016) includes an activity around patterns with even and odd numbers. Students are told to order numbers, put them in a table, and circle the ones place. This scaffolding may not be necessary. To elevate the cognitive demand of the task, we simply gave our students number cards and asked them to look for patterns with even and odd numbers. Instead of discarding those extra scaffolds, we repurposed them as support cards. Specifically, we suggested the following ideas for our students on three separate support cards: (1) separating evens and odds, (2) placing the cards in order, and (3) looking at the ones place. The extra steps in textbooks often anticipate various mathematical challenges and provide help to students to get started if they can't figure out an entry point themselves.

As we began to use tasks in class, another support card strategy was to build on past successes to support perseverance. For example, cards could reference a student's way of solving an addition problem discussed in a previous lesson. For the *Desk Task*, if the class had experience with arrays and counters, students could be asked to grab 20 counters in order to model the problem.

Finally, from time to time, our students need help organizing their work. For these students, we create support cards that suggest using a table or another mathematical representation to help groups see a pattern they might not otherwise notice. A table, for example, is useful when solving the *Market Task* with a guess and check approach.

3.3 Push Cards

Push cards are intended for students who find a solution and can explain their solution path. In our implementation of *The Desk Task*, one group finished very quickly. The group made a single array and wrote the number model accurately. They explained that their solution was an array because it had equal rows. So, we gave them a push card that said "Find as many arrays as possible for Julie to try." The group was then able to find multiple arrays and write number models to match. While some of the class was still working on finding an array and correctly writing a number model, this group was able to continue work within the same context and mathematical concept, because the push card reminded them to continue finding more options for Julie's desks. When we had a whole class discussion of *The Desk Task*, this group could offer their peers additional solutions.

3.4 Creation of Push Cards

As is the case with support cards, a number of structures exist for creating push cards. We list several below.

- Ask that they use another representation, like a graph or chart
- Create a student solution for the group to consider
- Work the problem in reverse

For instance, we often asked second graders to find another solution using a different method or representation (NCTM, 2014). For *The Market Task*, a card could ask a group to consider the use of a number line to find a solution and anticipate if the solution would be the same or different from the answer they had found using a different method. Representation cards can help students make connections to previous math lessons or can be used to preview what students already know about a representation.

Another strategy we implemented when creating push cards was to create a student solution to the same task for the group to consider. The student solution could have a mistake in it or could present a novel solution strategy. Consider, for instance, the following push card for *The Market Task*

Market Task Push Card

Jorge said he would purchase a clock for $26, a remote control car for $58 and a game controller for $24. Do you think Jorge's solution is correct? Why or why not?

The Desk Task is designed to support CCSM standard 2.OA, helping students use equal groups of objects to begin supporting multiplication. Using the student solution strategy, a push card for this task could provide an array and ask students some questions about the given array (as illustrated in Section 2). Another push question could be added for students to compare their solution to Rachael's.

Finally, we noticed many of the tasks we used had a "direction" to them, meaning there was a paring of numbers with a start and end point; therefore, another strategy for creating a push card was to ask the students to work the problem in reverse. Having a start and end point was common in pattern tasks but also in problems like *The Desk Task*. In *The Desk Task*, students start with the number 20 and are expected to generate arrays. Thus, another useful push card was generated by reversing the direction of the task by providing an array and asking for the number.

4 Pros and Cons of Differentiating Tasks

4.1 Learnings on Tasks

Finding, creating, or modifying tasks is not easy, but we found it less time consuming than planning multiple lessons for the same day. Particularly, once we found common strategies to develop push and support cards, we realized the prompts were easier to develop. We also gained confidence as the year went on — we not only tried more tasks ourselves, we also helped other teachers consider how their high cognitive demand tasks worked with their students. Thus, as with many components of teaching, practice made us better.

4.2 Learnings about Push and Support Cards

Reflecting on all the ways we generated push and support cards, we noticed these ideas are aligned to CCSSM Standards for Mathematical Practice (SMP). The purpose of all support cards is to help a student persevere through a problem (Practice 1). Creating another solution for a group to consider helps students critique the reasoning of others (Practice 3). The use of organizational tools has connections to modeling (Practice 4). Our intent in selecting a task for a specific mathematical learning goal was to also engage students in the mathematical practices. Depending on the particular task, we could elevate one practice over another. It is interesting, however, to see the connection to providing support and push cards with the mathematical practices.

Interestingly, some support cards worked as push cards even though we anticipated them as support cards. Anticipating what students will do with a task is not always easy. Not only were the tasks new to us, but we were also getting to know our students' mathematical understanding. By using the categories of push and support, we were able to generate 5-7 cards that we could use as we enacted the lesson. Whether we had thought they were push or support in planning didn't really matter because as we monitored the students' conversations we were able to provide an appropriate card.

The cards also allowed us to see student thinking without giving too much support to start. None of us want our students to feel uncomfortable or so frustrated they refuse to engage. But we were pleasantly surprised by what students could do without much support. The cards allowed us to shift our mindset from anticipating who would need support (and potentially limiting those students' growth) to supporting mathematical ways of thinking if a group didn't know where to start, was stuck, or thought they were done. This aligns with the mathematics teaching practice of "support[ing] productive struggle in learning mathematics" (NCTM, 2014). Instead of focusing on individual students, we focused on the mathematics and ways to support learning mathematics.

Another unanticipated benefit of our work on tasks and cards was that we could use this same strategy in other content areas. For example, in science, if students were working on an experiment, we could anticipate ways we might support and push scientific ideas and have cards ready to go. The cards could also be used to help students in a writing task. Basically, by practicing how to generate cards we were improving our lesson planning for multiple areas.

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