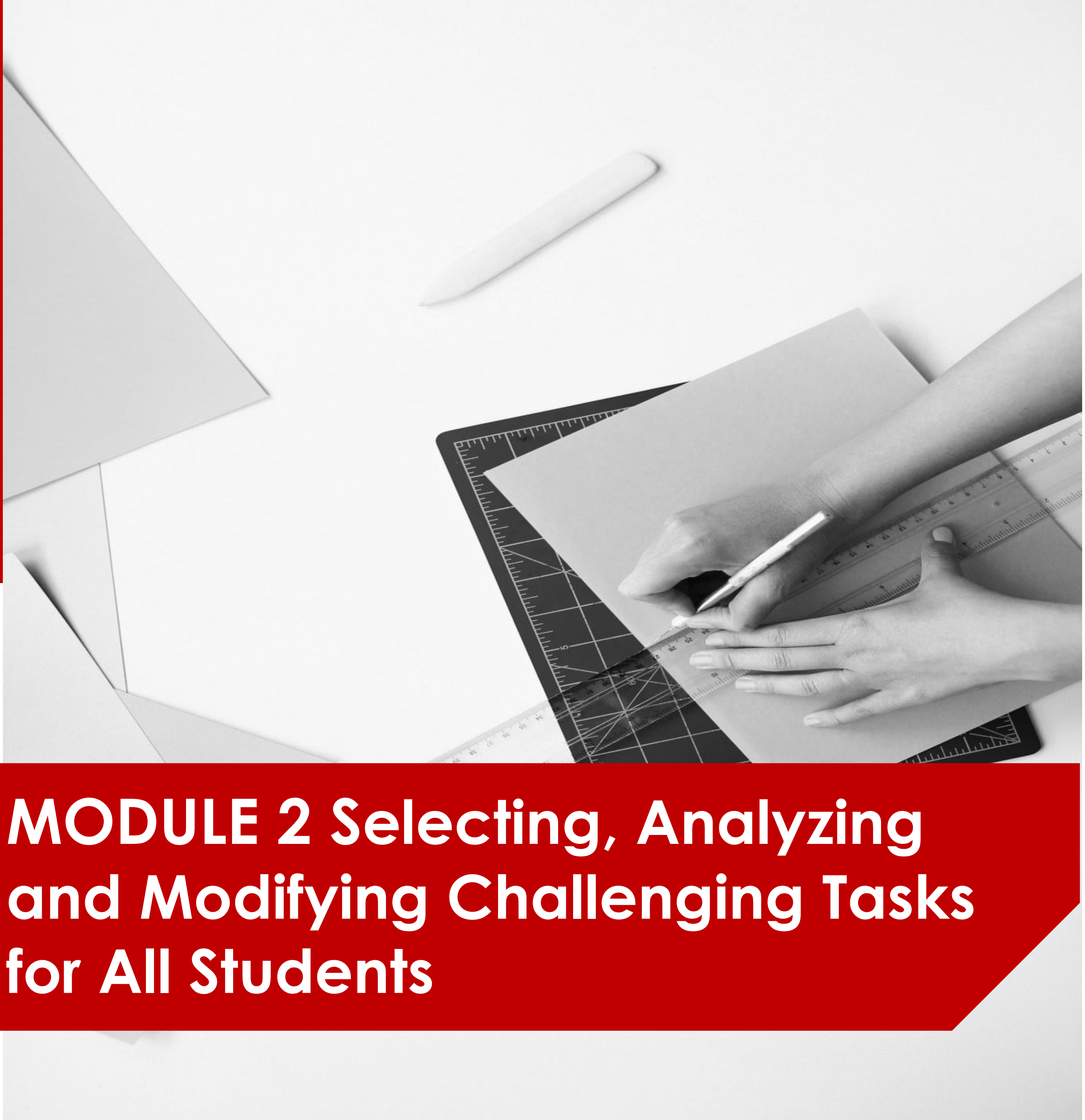

MODULE 2 Selecting, Analyzing and Modifying Challenging Tasks for All Students

EDUCATE Project

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[1] All names are listed in alphabetical order.

SYMBOLS

Next to each activity there is one or more of the following symbols:

👆	Individual work
🖥	Video-club setting
📄	Read
📝	Write or complete
🔗	Link-to-File
▶	Watch
💡	Reflect
💬	Discuss
🎯	Learning Objectives
📅	Plan
☑	Assess

CASE OF PRACTICE 2

Planning for Differentiation: Considering the Task for Different (Groups of) Students

Overview

CONTACT HOURS	2 hours and 30 minutes
TYPE OF RESOURCES	Post-it notes; Videoclips; Interview segments; Tasks; Lesson plan extract
EMPHASES	What makes a task challenging for different groups of students Adjusting/Modifying a task to make it more or less challenging for different groups of students

Activities

Opening Activity

Post-it Parade

You are provided with a few Post-it® notes. Write one idea/ issue/ concern/ question per Post-it® note answering one of the questions below, post the Post-it® notes on the wall and discuss them with your colleagues.

- What have you learned from the previous meeting?
- Are there any questions to clarify, issues you think were left unresolved, or ideas, concerns or positions not yet considered?

Activity 1 - Analyzing Practice

Video club Component

In the previous case of practice, you were asked to (a) **select** two tasks from your own curriculum materials, one mathematically challenging and one less mathematically challenging; (b) **plan** and **videotape** a lesson during which you would implement the mathematically challenging task; and (c) **watch** and **determine** at which level the task was implemented.

Share with your colleagues the episode you selected from your videotaped lesson in which the level of mathematical challenge was either maintained or adjusted. Explain what this episode is about and your rationale for selecting it.

Discuss the shared episodes with your colleagues:

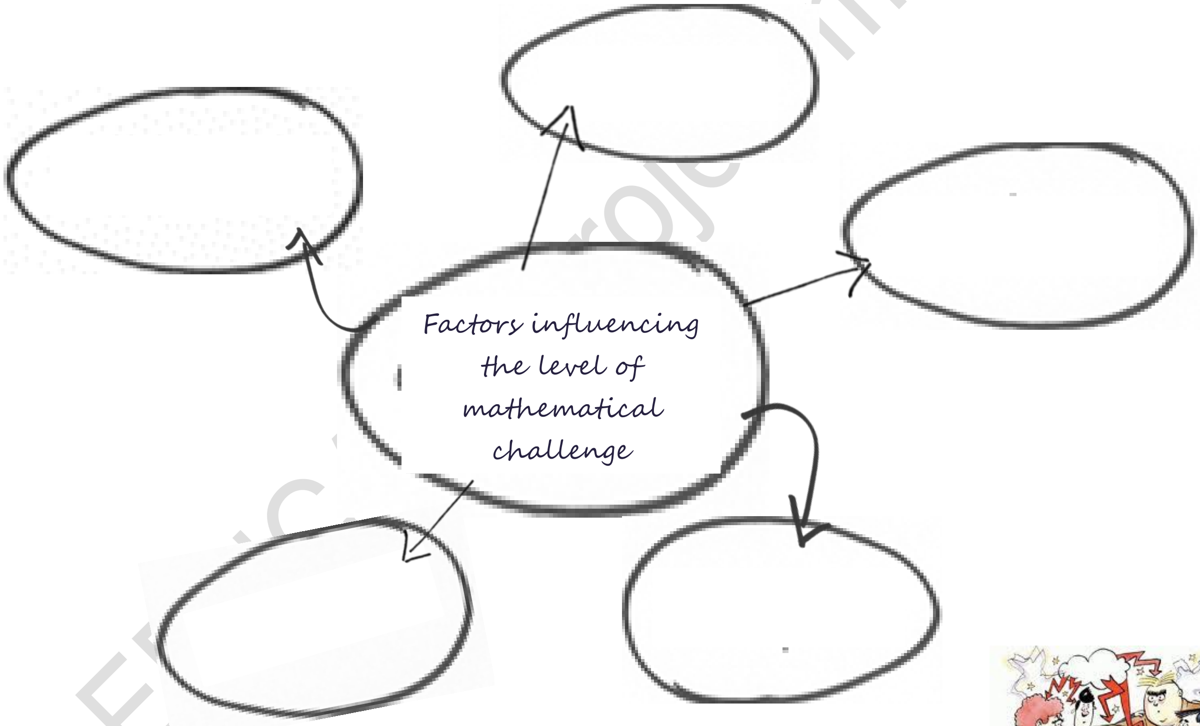
- Describe what the teacher and the students were doing during this episode.
- At any stage(s) did you adapt the level of mathematical challenge? What informed these decisions?
- Do the mathematically challenging tasks work in the same way for all students?
- Did the implementation of the tasks unfold exactly as you planned?
  - If not, what changed during the implementation of the two tasks compared to how they were planned?

The level of demand of mathematical tasks could change during their implementation in mathematics lessons. Hence, the tasks as presented by the teacher or as worked on by the students might differ in terms of their mathematical challenge compared to how mathematically challenging the selected task originally was. As discussed in Module 1, this could greatly impact students' learning opportunities. So, it is important to focus on different reasons/factors that might inform these decisions.

Activity 2 – Considering Factors Influencing Task Implementation

Brainstorming Activity

Based on previous lessons you have taught and considering the excerpts that follow from interviews we conducted with primary classroom teachers when discussing the challenges they faced in implementing mathematically challenging tasks with all their students, identify factors that may affect the level of intended mathematical challenge of the task(s) as planned during the task presentation and implementation.



You know what? I sometimes feel that we are rushing children through lessons rather than focusing on engaging them in procedures of reasoning and understanding. Having to teach an overcrowded curriculum, especially in Grades 5 and 6, which I am teaching these last five years, and trying to follow the guidelines of the Department makes me feel under constant pressure to get students to reach certain benchmarks that don't necessarily match the way they learn.

Margaret

What can I do when half of the students have finished the task, others try it for a couple of minutes but then they give up; two or three students try really hard but they still don't reach a solution and the rest of the students have only just begun? You can tell that the more capable students are getting bored if I spend time explaining more to the less capable ones. What's the point of instruction for those students if they already know the content or if they have already got there and they want to move forward?

Carlos

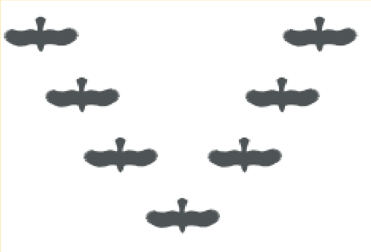
Although we recognize all these student differences, to handle complexity we will suspend issues that relate to the students for the time being. We will assume that when solving a task, at least three different groups of students can be identified: high-achievers, mid-achievers, and low-achievers. In the remaining activities of Case of Practice 2, we will consider how, as teachers, we can plan in ways that can help us scaffold these different student groups without diminishing the mathematical challenge of the tasks.

Activity 3 – Planning for the Use of Enablers and Extenders

Below, you can find "The V-formation" task which comes from a third-grade classroom. The narrative that follows gives an overview of students' autonomous work while working on investigating the V-formation pattern of flocks of birds. Read the task and the narrative and then consider the questions that follow.

Task 1 ("The V-formation" task, Algebra, Grade 3)

Sometimes flocks of birds fly in impressive formations, like the following:



Helen used dots to show the pattern created by the bird formations.

(a) Draw the next two shapes of the pattern.

(b) Fill in the table below.

V-formation number	Number of dots
1	3
2	5
3	7
4	
5	
6	

(c) What pattern can you observe in the table?

(d) How many dots will the 7th and 10th shapes of the pattern consist of?

(e) Draw a shape of the pattern that consists of 19 dots.

(f) Is it possible for a shape [term] of the pattern to consist of 40 dots? Justify your answer.

Source: Cyprus Pedagogical Institute (2013). Student textbooks for Grade 3 (Part 2), Unit 3: Multiplication patterns, pp.53-54

Narrative (The V-formation Episode)

This Grade-3 lesson lasts approximately one hour. The teacher's goal for this lesson was to help students generate the pattern for the V-formation. The lesson begins with the teacher, Ms. Kathrin, asking students to observe V-formations of birds and describe their shape. Then, the class switches to the textbook and students work autonomously, trying to figure out the number of birds for the first six terms in order to complete the textbook table (see above). While figuring out the number of dots/birds for those terms, the teacher circulates and tries to scaffold students' work. We enter the classroom when the teacher is attempting to help some students articulate a generalization either verbally or symbolically.

Marcos: Ms., that's difficult. I just don't get it!

Ms. Kathrin: Look carefully at the pattern that is now written in your maths book [points to the textbook where the class has written the following pattern, which was discussed earlier in the lesson: (1X2)+1, (2X2)+1, (3X2)+1, etc. with the one representing the 'leading bird' and the parentheses the number of pairs]. Do you notice anything?

Marcos: [rather reluctantly]: The number of birds increases by … two each time?

Ms. Kathrin [trying to encourage Marcos to elaborate his thinking]: Nice… and so?

Marcos: I don't know, I think I am confused.

Ms. Kathrin: But you're close! Give it another try and I will come back to you later.

The teacher looks at the clock to confirm that she still has enough time to let the students work on their own before switching to a whole-class discussion. She then decides to go to another group of students who were playing with their pencils.

Ms. Kathrin: Guys, how are we doing here? Have you figured out the pattern?

Mary: We figured out the pattern five minutes ago!

Ms. Kathrin: Very interesting! Can you please explain your thinking to me?

Mary: It is fairly easy. The number of birds [pointing to the dots], emmm there is a pattern. If it is the fourth term, it is nine, if it is the fifth term, it is eleven, if it is the sixth term, it is thirteen. So, every time it goes up by two.

Ms. Kathrin: Nice! Please, let's see what your classmates did; we will shortly share our work in the group—so, Mary, and the rest of the group, get prepared to explain your thinking.

The teacher moves quickly to yet another group of students who seem to be very frustrated.

Peter: We don't know how to start!

Ms. Kathrin: Why? Didn't you notice anything?

Peter: Not really…

Ms. Kathrin: OK, why don't you go to Mary's table to see what they did? We will discuss the problem together as a whole class in a couple of minutes.

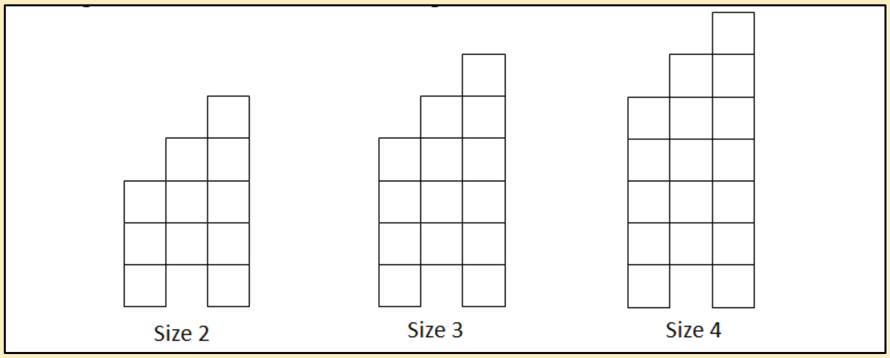
Guiding Questions

- What is the level of mathematical challenge of the ‘The V-formation’ task?
- How did the teacher manage task complexity?
  - Was her management of task complexity effective? Why? Why not?

In a fifth-grade classroom, a similar algebraic task was used. In this case the teacher planned to use *‘Enablers’* and ‘*Extenders’* as a way to manage task complexity. Below you can find the task and an excerpt from his lesson plan, which was edited so as to focus on the differentiation strategies this teacher used. Read the task and the lesson plan excerpt and then consider the questions that follow.

Task 2 (“The Chairs” task, Algebra, Grade 5)

Alex uses identical tiles to make different-sized chair designs for a school art project. The pictures on your sheet show the first three designs created – size 2, size 3 and size 4.



1. a) If Alex wanted to create a ‘size 5’ chair, what would it look like? Can you draw it or use other concrete resources to represent it? How many tiles would be used?

   b) Work out the number of tiles needed for the “size 6” and size 7” chairs? Explain how you did this.

   c) Draw/make the “size 1” chair. How many tiles did you need?

2. Do you notice any pattern between the Chair Size and the number of tiles needed each time? Discuss this pattern with your partner.

3. Alex wanted to create a ‘size 20’ chair. Talk with your partner about a *rule* that would help Alex work out the number of tiles needed for this chair?

   Would this *rule* work for the previous chair sizes? If satisfied, write out this *rule* in words.

   Discuss whether it would work for a chair of any size.

4. Could you re-write this *rule* using symbols/ letters?

5. Use the *rule* to calculate the number of tiles needed for a “size 50” chair?

Lesson plan Extract for ‘The Chairs’ task

<table>
<tr><th>Tasks & Learning Activities</th><th>Expected Duration</th><th>Differentiation</th></tr>
<tr><td>Solving question 2 (Mixed ability pairings will be the default arrangement, but teacher discretion also applies)</td><td>5 mins</td><td>
Introduce Enabler 1 as required to students who do not consider a tabular presentation of the data.
<u>Task Enabler 1</u>
In order to see a pattern between the Chair Size and the number of square tiles needed each time, it may be useful to organize this information in a table……

Complete the following table using the information you have gathered to date.
<table>
<tr><th>Chair Size</th><th>Number of tiles Needed</th></tr>
<tr><td>1</td><td></td></tr>
<tr><td>2</td><td>11</td></tr>
<tr><td>3</td><td></td></tr>
<tr><td>4</td><td></td></tr>
<tr><td>5</td><td></td></tr>
<tr><td>6</td><td></td></tr>
<tr><td>7</td><td></td></tr>
<tr><td>8</td><td></td></tr>
<tr><td>:</td><td></td></tr>
<tr><td>:</td><td></td></tr>
</table>
In your completed table, do you notice any connection between the Chair Size and the number of square tiles needed each time? <i>(if having difficulty here, use Task Enabler 2 for guidance)</i>
Monitor use of Enabler 1 and administer Enabler 2 to students who do not consider the composition of the tile totals (i.e. they do not recognize the significance of size 1 (the constant)
</td></tr>
</table>

and the subsequent increase, and its connection to the specified chair size).

Task Enabler 2

Chair Size (*S*)	**Number of Cards Needed (C)**	**Explainer**
1	**8**	After drawing the 'size 1' chair, I counted the number of square tiles needed. This original count gave me the number **8.**
2	**11**	Original count (8) + 3
3	**14**	Original count (8) + 3 + 3
4	**17**	Original count (8) + 3 + 3 + 3
5	:	:
6	:	:
7	:	:
8	:	:
:	:	:
:	:	:

Return to **Question 3** of the **Main Task**

Extenders 1, 2 & 3 (for those who complete questions 1, 2, 3, 4 & 5

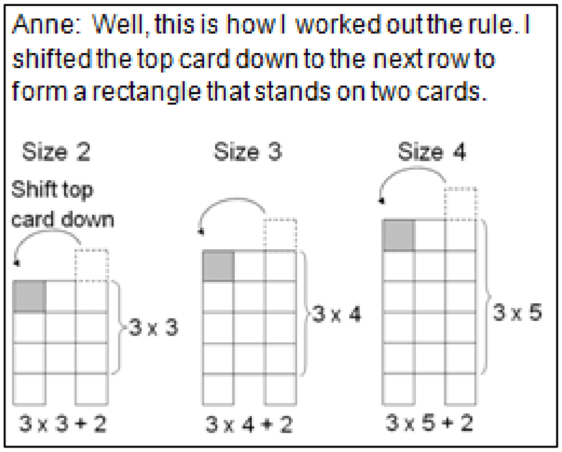
N/A

- During the autonomous work for question 1, students who quickly and accurately complete questions 1 - 5 (likely without need for the **Enablers 1 & 2**) and prove the authenticity of their solution path, can immediately be given **Extenders 1 & 2.**

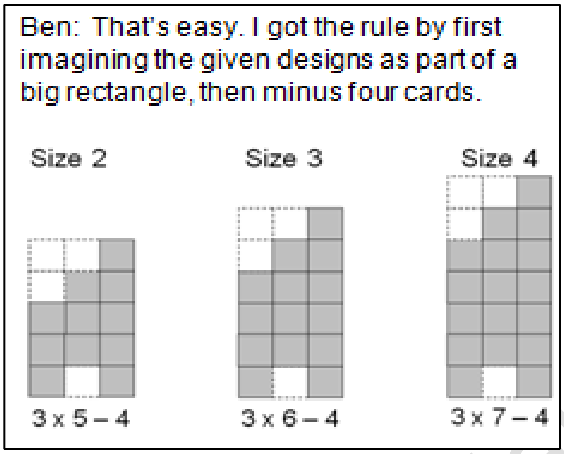
Task Extender 1

There are various ways to find the *rule* that would help work out the number of square tiles needed. Four friends, Anne, Ben, Dawn and Clark all used different methods which are shown below.

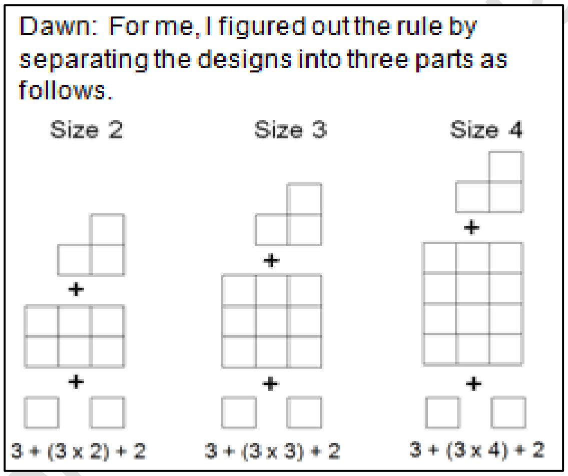
Spend some time exploring each of these methods.



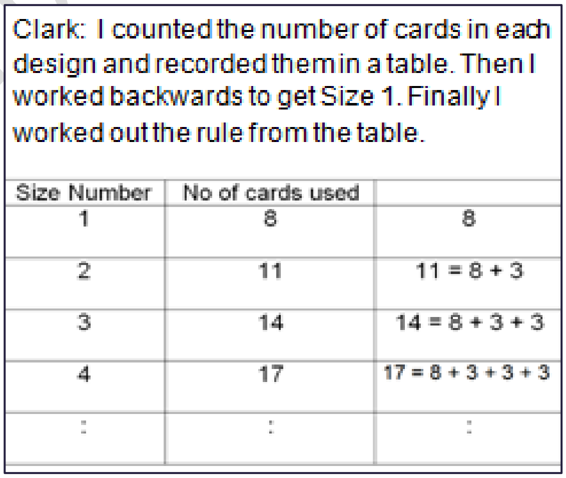
Anne: Well, this is how I worked out the rule. I shifted the top card down to the next row to form a rectangle that stands on two cards.



Ben: That's easy. I got the rule by first imagining the given designs as part of a big rectangle, then minus four cards.



Dawn: For me, I figured out the rule by separating the designs into three parts as follows.



Clark: I counted the number of cards in each design and recorded them in a table. Then I worked backwards to get Size 1. Finally I worked out the rule from the table.

Size Number	No of cards used	
1	8	8
2	11	11 = 8 + 3
3	14	14 = 8 + 3 + 3
4	17	17 = 8 + 3 + 3 + 3
:	:	:

1. For each of these methods, can you consider a *rule* in words that would help you work out the number of square cards needed for a chair of any size?
2. Could you re-write this *rule* using symbols/ letters?
3. Is the *rule* for each of the methods the same?
4. Using any of the methods/ rules, calculate the number of square cards needed for a "size 85" chair?

Task Extender 2:

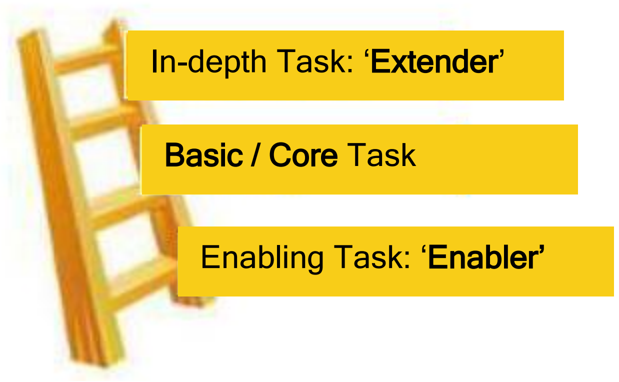
In what 'Chair Size' would 230 square tiles be needed? Explain how you determined this.

Guiding Questions

- Focus on the ‘*Enablers*’ and the ‘*Extenders*’ used by the teacher.
  - How did the teacher plan on using them?
  - Consider their contribution to handling task complexity. How can the fifth-grade teacher’s lesson design help better handle task complexity during task presentation and implementation?

The Ladder of Task Differentiation

Students do not necessarily experience the same level of mathematical challenge when they are engaged with the same mathematically challenging tasks. Some tasks can be too difficult to solve or too easy for different students. At some point, students may need differentiated instruction based on their particular learning needs. One way to deal with this complexity is to develop and use ***tiered tasks***. Tiered tasks are a series of related tasks of varying complexity which *focus on the same content or curriculum objective*. Often times, as teachers, we prepare one task to engage all our students in mathematically challenging work—this task represents what our curriculum is asking us to do, often for the average students—we will call this “***core task***”. However, some students (not necessarily the same ones each time), might need to work on a task that provides more support or scaffolding, we call these tasks ‘***Enablers’***. Other students (again, they could differ from task to task), might finish the core task early and seek an additional mathematical challenge; this challenge can be offered by tasks called ***Extenders***. *Enablers* can ‘enable’ students thinking when they need extra support or guidance with the *Core* task to proceed and *Extenders* can ‘extend’ the thinking of students who need greater mathematical challenge than that presented by the Basic/Core task. “A good way to visualize a tiered task is the image of a **ladder**, where a core task appears on the middle rung, the advanced version of the core task”, the extender, on the top rung and another modified version of the basic/core task, the enabler, “on the bottom rung” (Primary Professional Development Service, n.d., p.13).

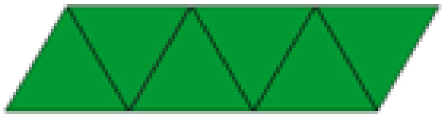


Source: adapted from Primary Professional Development Service (n.d.), Differentiation in Action! http://www.pdst.ie/sites/default/files/Session%202%20-%20Differentiation%20Resource%20_0_0.pdf

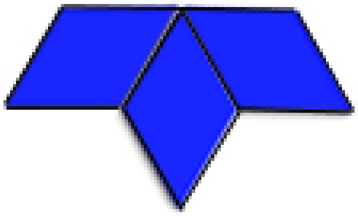
You are planning to use the following mathematical tasks in next week's lessons and you want to think of some ways to differentiate the tasks so that all your students participate and learn. First identify what makes each task mathematically challenging (or less challenging) and then consider different ways of differentiating the tasks at least one level up (extenders) and one level down (enablers) without necessarily presenting your work in written form.

Task 1 ('The Dice' task, Pre-Primary)	Level of Mathematical Challenge:
 1. Roll the 2 dice. Look now. Look away. How many dots did you see? Look again. What is the sum of the numbers? Repeat 3 times. 2. What other sums can you make by rolling the two dice? 3. What is the smallest sum you can make with the dice? 4. What is the largest sum you can make with the dice? 5. What are all the possible sums you can make with the dice? How do you know?	Possible Enablers: Possible Extenders:

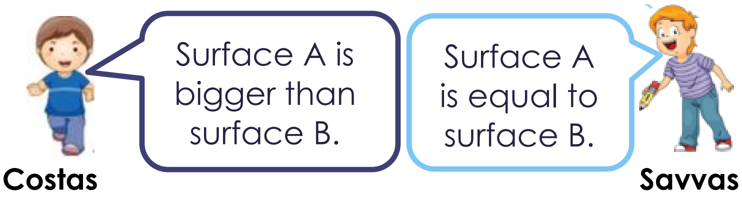
Task 2 ('The Surfaces' task, Grade 2)



Surface A



Surface B



a) With which of the two children do you agree? Explain your thinking.

Level of Mathematical Challenge:

Possible Enablers:

Possible Extenders:

Task 3 ('The Present', Grade 6)

Andreas and Constantinos had some savings in a ratio 3:4 respectively. They decided to buy a birthday present for their mother sharing the cost equally. After they bought the present, Andreas had spent all of his money. Constantinos had 21 euros left over. Find the price of the present as well as how much money each of the two brothers spent to buy it.

Level of Mathematical Challenge:

Possible Enablers:

Possible Extenders:

Differentiated Instruction: Some Principles When Modifying Tasks

When designing tiered tasks, it is important to consider at least three groups of students: those who are at the introductory level; those at the standard level; and those who are capable of more in-depth, higher-order tasks. Bear in mind, though, that these groups are not constant. A student might be clustered in the first group for one task and in the second, for another.

Using the ladder of task differentiation can be effective if the following principles are taken into account:

- Tasks should focus on learning objectives and essential concepts.
- Tasks ought to respond to the specific learning needs of different groups according to ability, readiness, degree of support required and learning preferences.
- All tasks should be engaging, active and interesting
- Extender tasks should not be just "more work" and enablers should not represent "dumbed down" versions of the core task.

Source: adapted from Primary Professional Development Service (n.d.), Differentiation in Action! http://www.pdst.ie/sites/default/files/Session%202%20-%20Differentiation%20Resource%20_0_0.pdf

Connections to (my) Practice

Design a lesson that includes one mathematically challenging task and 2-3 differentiation strategies from those discussed at today's meeting. Then videotape the enactment of these tasks.

Watch the videotaped lesson and determine how effective your differentiation approach was.

- In what ways did planning the lesson as discussed today help your teaching?
- Did your differentiation strategies help all students work productively on the task?
- What problems did you encounter during the task enactment? In hindsight, how could you have dealt with these problems?

Select episodes illustrating differentiation up and down to share with your colleagues during the next meeting.

Closing activity

Working in pairs, name some differentiation strategies you have considered for adjusting the level of mathematical challenge of a given task.