Instructional Practices: Differentiation

Elements and options to consider in order to differentiate a lesson

Overview

Differentiation in the mathematics classroom is about allowing for multiple access points for students to engage in and to discuss the mathematical ideas under consideration. Elements within differentiation range from supporting student autonomy, to pacing, allowance for editing, and allowance for multiple solution strategies. It includes the ways in which students are allowed to work and where to work within the learning space.

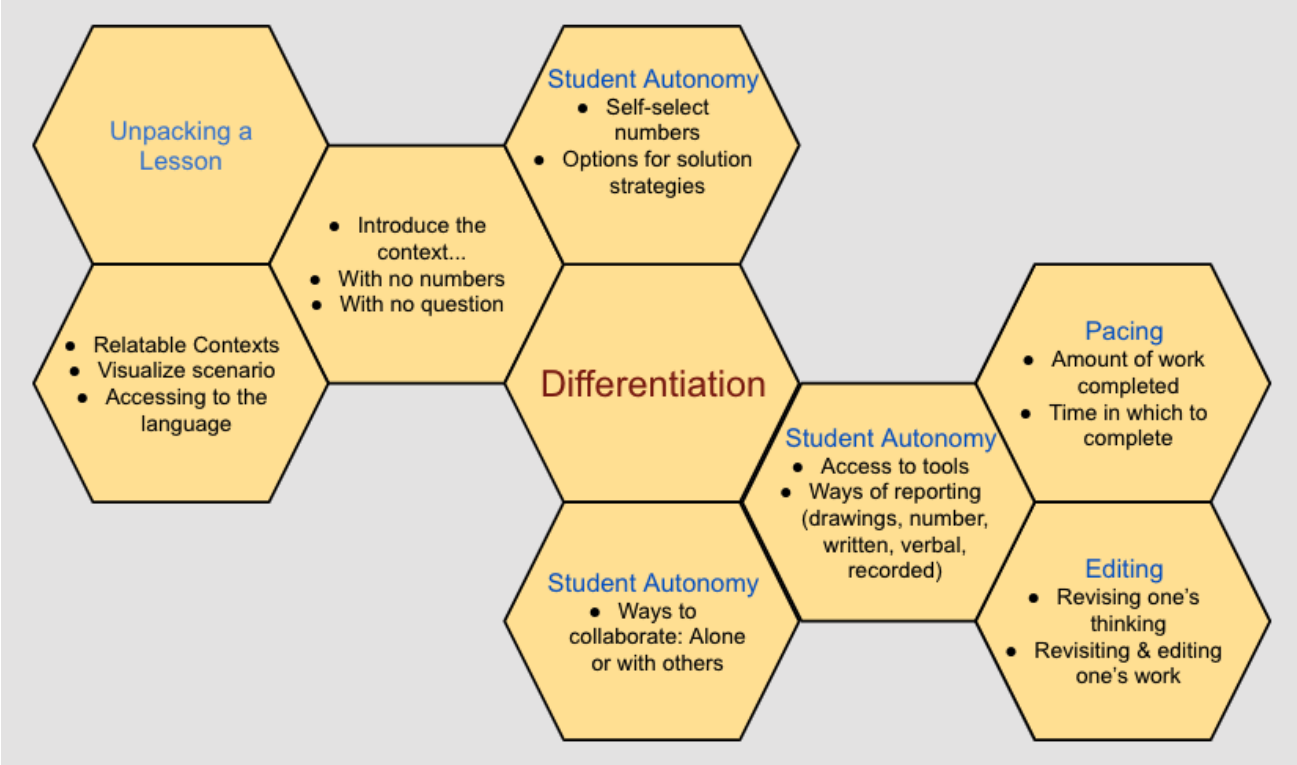
A standard on multiplication may underpin a lesson. A range of understanding pre-exists among students in the classroom at that given point in time. All students may be successful with solving the multiplication task, but not everyone may be able to do so at the same number level or use the same strategy. Consider the following task.

> *Sophia read ___ books over the month of March. The class as a whole read ____ times as many. How many books were read by everyone in the class?*
>
> (10, 5) (7, 12) (18, 14)

I could have everyone in the class solve this problem with the exact same numbers. That choice may be too easy for some, too hard for others, and just right for the middle. If I differentiate the numbers that students can self-select (an example of student autonomy), then everyone can engage in finding a solution to the question. Come time for public sharing, the conversation focuses on commonality and differences of strategies, efficiencies in effort, and progression of thinking. Everyone has a voice. Everyone contributes. Students observe what next steps are available in their development. Some students comprehend the perspective of another strategy approach they themselves had not considered.

Consider the points of access for the range of students within the learning community. Students determine their own strategy. Correct solutions are found but some students physically model the question, use repeated addition, use complex doubling, or use the distributive property of multiplication over addition. This is what it means to differentiate. Everyone solves the same problem, but not everyone chooses the same numbers, uses the same strategy, or same level of strategy.

The sections below have you think about differentiating a task, allowing a full range of developmental strategies to be used, options regarding the formation of small groups, and developing student voice. All of these are aspects of differentiation.



Differentiating Tasks

Teacher professional decision-making – Permission to change things

There is no such thing as a perfect curriculum resource. Each and every teacher must make adaptations to the material in front of them to fit the students with whom they are working; *including these materials.* While this material is based upon how children learn mathematics, there is no way that one can write curriculum materials that take into account all students' needs. One student asking a reasonable question can change the course of a lesson. *Making in-the-moment decisions is part of teaching.* Responding to students' questions is very much a part of this material. The main question is: *what is the basis for your changes? Are you keeping to the standards? Are you keeping to the mathematical intent? Or are the decisions random?* Changes should be made to enhance student engagement and to make the mathematics accessible to each and every learner.

The following gives you some insight as to how you might make some of those planned and spontaneous decisions.

Standards and Lesson Intent

In many instances where warm-ups and instructional tasks are presented in this document[1], the *standards* being addressed in the lesson are listed. Also listed is the author's *intent* of the lesson. If the intent of the lesson is to *decompose a single digit number in order to move into a new decade* and the numbers given are 17 + 5, but those numbers are too easy for where your class is at, *then change the numbers!* Maybe 57 + 5 is more challenging or even 117 + 5. What is being encouraged is to adjust the numbers *while keeping to the intent.* If fluency already exists with this skill, then adjust the numbers to something like, *"You're at 17, go up 15."* Adjusting numbers is one very important means to differentiate a lesson.

[1] The "document" referenced here refers to the online curriculum units on the Project for Elementary Mathematics website. These lessons are the trace of co-teaching experiences with classroom teachers over the years.

Number Size, Number Range

Extending what was just said above, not every student in an instructional task has to use the same numbers as everyone else in the class. There is research evidence that students can be successful with, say, multiplication but only within a certain number range. If a student is struggling, bring the numbers into the student's comfort zone. Have the child figure the task out with smaller numbers, focus on the strategy used successfully using the smaller numbers, then possibly return to the original numbers. *Letting students self-select their own numbers* is another possibility for you to decide. Consider the following problem:

Martha loves making pea soup for her friend George. She has already filled ___ bowls of soup. How many more bowls of soup does she need to fill to have ____ bowls?[2]

(7, 12) (7, 18) (15, 26) (9, 31)

Notice the places where numbers should be in the story are blank. Sets of numbers are listed down below. The first number goes in the first blank, the second number in the next. The numbers listed have different levels of difficulty and potential challenge. Seven and 12 are close together in range. Seven and 18 are just one more than ten apart that the child may or may not notice. The same is true about 15 and 26 but both are double-digit numbers. The same is also true with the last set of numbers but both numbers are one lower and one higher, respectively, than the nearest decade. *Let your students choose* which numbers are *just right or challenging* to them. If done too quickly the numbers were *too easy*. If the student is sitting there not knowing how to start, the numbers may be *frustrating.*

When it comes to *sharing,* everyone is sharing the same *problem structure,* but they are sharing the different numbers that they have selected. Compare and contrast strategies become an essential part of the sharing process: *You used different numbers but is that strategy the same or different than Martha's?*

Change Names, Change Contexts

It has also been noted in research that using familiar contexts that relate to students' lives elevates levels of engagement among students. Bring in classroom student names into problems. Bring brothers and sisters, parents, and aunts and uncles into the contexts. This makes mathematics real to students. Use literature with which students are familiar, like what was used above (The above problem is based upon images from the *George & Martha* series by author James Marshall). Use events around the school or neighborhood. Use what students like to collect. Shape the curriculum around student experiences to enhance levels of engagement and to make the mathematical ideas accessible.

Make More Complex or Simplify Tasks

Let's return to the George and Martha task listed earlier.

Martha loves making pea soup for her friend George. She has already filled ___ bowls of soup. How many more bowls of soup does she need to fill to have ____ bowls?

(7, 12) (7, 18) (15, 26) (9, 31)

When reading the problem to students, read the problem in its entirety. If the problem needs to be repeated, read it in its entirety, not piecemeal. If a child asks you a specific question like, *how many bowls did she need to have when she was finished,* that can be answered specifically with the exact number. *However,* if you know you are working with a child who is an emergent learner, *simplify the language* by dropping out extra words. Take the same problem and re-read it locally with fewer words:

[2] The *George & Martha* series of stories were written by James Marshall and published by Houghton Mifflin, 1972

Martha filled ____ bowls. How many to have ___?

On the other hand, if you have a class that needs more challenge, consider the following rewrites of the same task.

Martha loves making pea soup for her friend George. She wants to have a total of ___ bowls of soup. She already has ___ bowls of soup. How many more bowls of soups does she need to fill?

The problem structure is the same but the order of the information has been altered.

Martha loves making pea soup for her friend George. George hates split pea soup, but he is afraid to tell Martha because it would hurt her feelings. Martha has already filled ___ bowls of soup. George is worried. How many more bowls of soup does she need to fill to have ____ bowls?

The problem is the same but students have to sort through extra information. Know your students. Know their needs. Adjust accordingly.

Flexible Options of Strategies

All students may be successful in finding a solution but not everyone needs to use the same strategy or the same execution of a strategy. Example: In second or third grade, students may be given a subtraction problem. One child may solve it using the Combining Like Units strategy while another uses Incremental. *Allowance for students to select the strategy that makes most sense to them is a form of differentiation and fosters student autonomy.*

Among the students who select to use the Incremental strategy, one student may do so via direct modeling, while another skip counts or repeatedly adds smaller increments, while yet another works at an efficient abstract number level. The problem was correctly interpreted. The solution is correct. The strategy worked. The point of assessment on the teacher's part is to note the level at which the various students worked. In public sharing, the point is to have students compare and contrast the efficiencies of the different strategy levels and see *"Now that you solved the problem, where could you save yourself some time?"*

Work Options

When do students work alone, with a partner, or in small groups is an instructional decision that impacts learning within the classroom. Student accountability for one's own learning is important. However, the historical practice that mathematics is best learned by oneself and quietly is not supported by research. Mathematical ideas are socially negotiated. Justification and proof are the pinnacle of mathematical reasoning. This is a social process. Working with a partner or within a group allows one to listen to and analyze another person's ideas. It allows one to practice thinking aloud to test one's own thoughts. That give and take within a community is where mathematical ideas are strengthened.

When to work alone, when to work with a partner or in a small group is an intentional instructional decision. Is it early in a unit or late in the unit? The formation of working groups should be intentional. There are times where allowing students to self-select a partner is valid. There are other times when it is appropriate to assign members of a group. The instructional decision should be based on how communication links within any particular group is to occur.

In supporting student accountability, it is important that when it comes to sharing you are intentional in preparing students ahead of time who you will be selecting to share out. Giving advance notice allows the

reporter to prepare what to say, ask questions of others in the group to make sure that strategies are understood and decisions are clear. Everyone gets to have a voice. However, be aware of cultural sensitivities. Not all cultures foster individuals but rather teams. Yet with a partnership of sharers, it is important that the most vocal does not always dominate.

Differentiation is not a synonym for ability grouping. Grouping should be flexible and fluid so that students hear the full range of mathematical ideas. There are times when small groups need to be heterogeneous enough so that ideas can be exchanged. This is most beneficial when early or in the middle of a unit. There are times when homogeneous groups are appropriate such as when one wishes to have a group of students to extend their thinking or when practice skills are the focus to become more fluid in one's work. These groups are temporary and membership fluid.

Editing One's Work

In literacy, we frequently have students do a first draft to get their ideas down and then allow for a revision process to tighten up the grammar and spelling. The same should occur in the mathematics classroom. A form of differentiation is allowing students to reflect upon the work that they have started or completed and see where, while the strategy was a correct one, computational errors were made and provide them time to fix the work. This helps students to distinguish what was mathematically sound in their thinking and where further refinement needs to occur. Research shows that student achievement is higher when errors are processed constructively and in full within the classroom. Knowing how to fix something builds student autonomy, builds stamina in developing productive struggle, and focuses for students where further mathematical concepts and skills need attention. The following are instructional decisions to consider.

- **Interim sharing** – Giving students an amount of time to work then stopping to have an interim share to find out about what's working, what's still confusing and in need of clarification. What are the range of strategy approaches being used? Where are the false starts? Then direct students to revise their work based on what was just heard. The idea is not to stress uniformity of strategy usage, but rather to focus student thinking and foster success in their work.
- **Early Finishers Sharing** – "I'm done!"
    - Have early finishers solve the same problem but…
        - "*Now use a different strategy"* (Develops flexible thinking and uses a larger range of mathematical skills.)
        - Do the same problem with a more challenging set of numbers
        - Write a description of how one approached solving the problem. (Writing in mathematics uses a different part of the brain to process one's thinking.)
    - Have early finishers pair up with each other to compare and contrast strategies. If there is a difference in one's answer with the partner, work together to find where the bug is.
- **Revising & Reflection** – The following are prompts to consider using to get students to revisit their work and make refinements. Each encourages students to take ownership of their work and find success at the level at which they were successful.
    - Your strategy is a good one. I want you to double check this part here.
    - Now that you found that error, how does that change your answer?
    - Now that you know what the answer is, if you were to solve this problem again, where could you save yourself some time?

The goal is to to scaffold students along the spectrum of thinking and strategy usage. Not everyone will be using the same strategy or the same numbers. However, everyone can be engaged in mathematical thinking and progressing in one's understanding. You will always have a range of student abilities. Differentiating instruction is about guiding students along their trajectory of understanding and success.