## CATERING FOR A WIDE RANGE OF LEVELS IN THE MATHS CLASSROOM: A PRIMARY TEACHING PERSPECTIVE

## SEÁN DELANEY

## INTRODUCTION

- My background
- What is similar about your situation?
- What is different about your situation?
- What idea(s), principle(s), strategy(ies) could you use?
- What idea(s), principle(s), strategy(ies) could you adapt?



## Kettlebell Goblet Squat



Kettlebell Military Press


Kettlebell Deadlift Sumo High Pull


Kettlebell Deadlift Sumo High Pull

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## TEACHING MATHEMATICS IN PRIMARY SCHOOL

## Today

- Increasingly diverse student body
- Students with special needs
- Streaming/tracking/'ability' grouping ineffective or impractical
- Students at different stages of readiness


## BROAD MODELS OF DIFFERENTIATION

| US Approach | Japanese Approach |
| :--- | :--- |
| Individual | Whole-class approach |
| Assess children, tailor instruction for individual <br> children or for small groups of children | View intrinsic differences among children as a <br> resource for approaching tasks |
| Different strategies used for teaching different <br> children | Explain ideas in multiple ways to all children and <br> help all children clarify and reconcile ideas and <br> approaches |
| Individual differences are an obstacle to <br> effective teaching | All students benefit from the variety of ideas <br> generated by their peers |
| Meeting each student's needs means providing <br> different instruction for children's different <br> levels of achievement to date | Tailoring instruction to specific students is <br> unfairly limiting and prejudges what children are <br> able to learn |

## SPECIFIC EXAMPLE <br> Teaching fractions to children in $5^{\text {th }} / 6^{\text {th }}$ class

If I eat $1 \frac{1}{2}$ bars of the $34 / 5$ bars of chocolate I bought earlier, how many bars of chocolate have I left?

## POSSIBLE WAYS OF DIFFERENTIATING

If I eat $1 \frac{1}{2}$ bars of the $3^{4} / 5$ bars of chocolate I bought earlier, how many bars of chocolate have I left?

- Change the order in which the numbers are written
- Include a picture alongside the problem
- Change from a word problem to a problem with symbols only
- 3-1 (Remove the fractions)
- 34/5-1 (Remove the fraction from the subtrahend)
- $34 / 5-11 / 5$ (Change the fraction in the subtrahend so that it has the same denominator as the fraction in the minuend)
- 19/5-3/2 (Write both fractions as improper fractions)
- $4 / 5-1 / 2$ (Remove both whole numbers so that only the fraction parts need to be subtracted)
- $4 / 5-1 / 5$ (Remove both whole numbers and use the same denominator in both fractions)
- Other ideas?


## WHOLE CLASS DIFFERENTIATION THROUGH DISCUSSION



Relate ideas to your situation

# SELECT TASKS THAT CAN BE ACCESSED BY STUDENTS AT DIFFERENT LEVELS OF ACHIEVEMENT 

## Solve this problem with a partner

Dublin Zoo has just received two new sheep for the Family Farm part of the zoo. The zoo keeper wants to build an enclosure for the sheep. She decides that the enclosure must be square or rectangular with an area of exactly 100 square metres
(i) Which different enclosures could she build?
(ii) How many metres of fencing will she need for each possible enclosure?
(iii) Use your copy or some graph paper to draw all the possible rectangular or square enclosures.
(iv) Include a key to tell how much each unit on your copy or graph paper equals.
(v) Which enclosure would you recommend that the zoo keeper builds? Why?


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## SMinn caine calcuiations

- What is the length of our local swimming pool?
- If I swam the following number of lengths, how far would I have swum?

1 length
2 lengths
Multiplying lgths
su iengths
50 lengths
$1 / 2$ length
Say how you figured out each one.
-If the pool is 25 metres long, how many lengths would I have to swim in order to swim
50 metres
Dividing 100 metres?
250 metres?
500 metres?
a kilometre?
5 metres?
Say how you figured out each one.

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## DISCUSS A TASK IN GREAT DETAIL

- What do we know?
- What information is most/least important do you think?
- What do we need to find out?
- How can we find that out?
- Where could we start?
- Are there other ways to do it?

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## ENCOURAGE PAIRS OF STUDENTS TO HELP EACH OTHER

- Both have to be able to explain how they got the answer

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## TARGET QUESTIONS TO STRETCH ALL STUDENTS

- Plan the questions you'll ask
- Which ones are more/less difficult?
- To whom will you direct the different questions?
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## DISCUSS TOPICS THAT ARE ADVANCED FOR A PARTICULAR CLASS LEVEL

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## DISCUSS TOPICS THAT INVOLVE REVISION OF WORK DONE PREVIOUSLY

- Some fundamental topics in mathematics
- Place value
- Equivalence
- Mathematical operations
- Common misconceptions (multiplying always implies getting bigger/dividing always implies getting smaller etc.)

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## SEEK A WRONG ANSWER TO SURFACE POTENTIAL CONFUSION

- Errors are an important resource
- Thank students for raising the mistake
- Why is it a mistake?
- How can members of this class avoid making such a mistake in the future?


## REVOICING (AND RELATED STRATEGIES) <br> Discuss conjectures \& solutions in great detail - correct and incorrect

- Are you saying that....
- I think you're saying that..... Am I right?
- Can you repeat what ... said?
- You said X but someone else said Y. How would you respond to the other person?
- Can you put what ... said into your own words?
- Do you agree or disagree with what ... did?

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## RECORD QUESTIONS, IDEAS AND CONFUSIONS IN STUDENTS' NOTEBOOKS

- Record one thing you learned today
- Note one thing you're confused about
- Write down a question you have
- What you think about the discussion we had about ....?
- How would you explain ..... to someone who is learning it for the first time?
- What would you like to work on next?


# SELECT TASKS THAT CAN BE ACCESSED BY STUDENTS AT DIFFERENT LEVELS OF ACHIEVEMENT 

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## VIDEO

- Mathematics Laboratory class
- 20 children in $5^{\text {th }}$ class (age 11 )
- Recruited from 11 different schools (4 serving areas of disadvantage)
- Goal of lesson: Children apply their knowledge of area and perimeter to solve a multi-step problem
- After school on a Friday afternoon/Saturday in May
- Goal of professional development model is not to offer model teaching but public teaching
- Observed by 20 educators
- Amplified and video recorded
- 2 girls have just shared their solutions $-25 m \times 4 m$ and $50 m \times 2 m$ www.mie.ie $13^{\prime} 0$ +
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# WORKING ON THE SAME PROBLEM, EACH AT 

 THEIR OWN LEVEL

## YOUR SITUATION V PRIMARY TEACHING

- Mathematics problems you use will be different
- Adults may be reluctant to criticise peers/share answers
- Need to create a safe space
- Need to deliberately work to create classroom norms so that everyone present sees themselves as a resource for everyone else's learning - and that includes being willing to make mistakes in public

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## UNIVERSAL DESIGN FOR LEARNING

Universal Design for Learning

- Multiple means of engagement
- Multiple means of representation
- Multiple means of action and expression


## Universal Design for Learning Guidelines

| I. Provide Multiple Means of |
| :--- |
| Representation |

1: Provide options for perception
1.1 Offer ways of customizing the display of information
1.2 Offer alternatives for auditory information
1.3 Offer alternatives for visual information
2: Provide options for language, mathematical
expressions, and symbols
2.1 Clarify vocabulary and symbols
2.2 Clarify syntax and structure
2.3 Support decoding of text, mathematical notation,
and symbols
2.4 Promote understanding across languages
2.5 וllustrate through multiple media
R

3: Provide options for comprehension
3.1 Activate or supply background knowledge
3.2. Highlight patterns, critical features, big ideas, and relationships
3.3 Guide information processing, visualization, and manipulation
3.4 Maximize transfer and generalization

## Resourceful, knowledgeable learners

II. Provide Multiple Means of Action and Expression

4: Provide options for physical action
4.1 Vary the methods for response and navigation
4.2 Optimize access to tools and assistive technologies

5: Provide options for expression and communication
5.1 Use multiple media for communication
5.2 Use multiple tools for construction and composition
5.3 Build fluencies with graduated levels of support for practice and performance
III. Provide Multiple Means of Engagement

7: Provide options for recruiting interest
7.1 Optimize individual choice and autonomy
7.2 Optimize relevance, value, and authenticity
7.3 Minimize threats and distractions

8: Provide options for sustaining effort and persistence
8.1 Heighten salience of goals and objectives
8.2 Vary demands and resources to optimize challenge 8.3 Foster collaboration and community
8.4 Increase mastery-oriented feedback

6: Provide options for executive functions
6.1 Guide appropriate goal-setting
6.2 Support planning and strategy development
6.3 Facilitate managing information and resources
6.4 Enhance capacity for monitoring progress

## 9: Provide options for self-regulation

9.1 Promote expectations and beliefs that optimize motivation
9.2 Facilitate personal coping skills and strategies
9.3 Develop self-assessment and reflection

Purposeful, motivated learners
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## PICTURE CREDITS

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