Differentiation:

How to really cater for kids working at very different levels within the one class... without driving yourself nuts in the process.

The reality of classroom teaching nowadays is that no teacher has a class of students who are all working at the one level. Teachers who aim their maths lesson at only one or two groups of learners are choosing to believe in a myth that this type of class still exists, if in fact it ever did. Within every single class, even if students are streamed, we have a diversity of learners to cater for. And for a single teacher with 25 or so different students to teach, this can be very difficult to handle.

This fact first hit home hard for me when I had a grade 5 class to teach. With 31 students in the class I struggled to keep my students with impairments and my extension students all actually learning. I quickly realised that running multiple activities within the one class was not practical unless at least some of the groups were just doing "busy work" and therefore not needing my help. Unfortunately that cut down the amount of "learning time" fairly significantly. There had to be a better way.

I decided to approach teaching maths in a bit of a back-to-front way and see how we went. Instead of getting started on teaching the next concept I asked questions orally to find out what my students already knew. I would often try to lead them down the garden path a little to work out if they really understood concepts, or if they just had the procedures memorised. Once I had worked out where their holes were, I would make up a problem that involved the next step in understanding, and leave them to try to solve it without me first explaining how to do it. For support students, I simply adjusted the content in the problem down until it was a bit beyond their grasp but not too far out of reach. For my extension students I took the same basic question and altered it to involve working backwards, multiple steps, filling a gap or a non-standard representation. Students worked in pairs or threes on their problems, trying multiple approaches and sharing their thoughts so far with the rest of the class. Together we analysed each idea and compared it to what we already knew of mathematical principles to check that the idea was sound.

This new approach led to some rather surprising discoveries. The first was the sheer volume of maths that students could actually work out for themselves when I just encouraged them to give it a go. After six months my traditional explanations virtually vanished from the class as my students learned to generalise their findings and express them as principles, algorithms or formulae. The second surprise was that many fundamental mathematical principles that I believed that the students had worked out years previously turned out to be pretty shaky, and some were missing altogether. The third, and perhaps most important discovery, was that many of my support students who had previously performed so poorly at maths often improved so rapidly that most of them were performing at grade standard within 12 months.

As it turned out, many of my support students had been relying on memorisation without understanding concepts. They had a few fundamental misconceptions about basic principles. Using problem-based teaching allowed these to come out, and challenged students to work out whether or not their ideas were feasible. Once they self-corrected some of these misconceptions and started generalising about mathematical principles they suddenly started "getting it" and didn't have to rely so heavily on memorisation.

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Tips for getting differentiation to work:

A number of very simple strategies can make a big difference to how easy it is to differentiate for your students. My top tips include:

1. Start with one basic question and then adapt the content in the question down without changing the format. This provides support students with the same thinking challenge, but with content that is more appropriate.

2. Start with one basic question and then think of "what if…" scenarios to add complexity for extension students. This increases the difficulty of the thinking skills significantly without necessarily increasing the content load.

3. Group for behaviour rather than for "ability" or "mixed ability". Usually teachers feel incredibly tense about how to choose groups rather than accepting the simple fact that we group according to which students will not try to kill each other. I often allow students to choose their own groups (maximum of 3 in a group), as long as no one is excluded and they are all working. If any group misbehaves then they are split up.

4. Have a *Challenge Table*: Keep one spare table in your room with about four chairs at it. This allows you to have a very flexible space to cater for different students as they need it. I use this set up in a number of different scenarios:

    a. Once I have set a problem: "If you understand what to do, you can go back and work with your partners now. If not, come to the challenge table and we'll have a talk about it"

    b. Once we have come back together and shared ideas, and students have realised that their initial ideas were not ever going to work and they need to try something different: "If you want to change your mind you can go back and work with your partners now. If you think you are right, come to the challenge table." This then leaves me with two distinct groups: the ones who are totally wrong and have no idea, and the ones who are right or pretty close to being right. I usually sent the group who are right/almost right to the challenge table to work out who is right, or to complete a "what if…" question while I work with those who still have misconceptions.

    c. When I cross-reference names with observations it often appears that I seem to consistently miss particular students. When I see this happening, I invite those students to work with me at the challenge table for five minutes so that I can check on where they are up to.

    d. I like to call students with similar communicating styles to work at the challenge table, such as all those who are quiet and just agree with everyone else in their group. When a group is formed with just those students one of them eventually has to try something to solve the problem.

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5. Use *Tip Cards*, numbered and blue-tacked to the board, for a problem. The tips should increase in the amount of help that they offer to groups. A group of students who become stuck while working on a problem can decide to go and get one of the tips to give them a clue. They record the tip number on their books. They can then try to solve the problem again, or decide to get another tip. Usually they want to get as few tips as possible, so they work together pretty well to try and solve the problem without getting more cards.

6. Use *Differentiated Problems* on coloured cards and allow students to work out which problem they want to try and solve. The base level problem goes in the middle, two above and two below are also present. Each student has to solve at least two levels of the problems. This way everyone can start on the base level problem, drop down if it is too hard, and go up if it is too easy. Once they solve one problem they automatically need to go up a level and try the harder question as well.

Problems to adjust up and down:

***Back-to-Front Maths* has suggestions for differentiation for every single journal problem.**
The following problems are taken from this resource, and can be adjusted up or down in order to cater for students in your class. You are to read through the basic problem and write one adjustment down and one "what if…" extension question for each.

A. Draw a line across your floor with chalk. Place a 1 MAB at one end, and a 1000 MAB at the other end. Where do you think the 100 MAB should go?

B. I've been shopping. I now have $20 in my wallet. During the day I bought lunch for $5 and a hat for $10. What did I start with?

C. I'm going on a driving trip. It is 600km long. After I've driven 200km I need a break. How much further do I need to go? What if I didn't quite make it to 200 and instead stopped at 198km? How much further would I have to drive now?

D. How many ways can you make the number 372 using hundreds, tens and ones?

E. How many ways can you make the number 1? Your answers must all involve some kind of fractions.