

Andy Giles

The Difference Between Procedural and Proceptual Learners

In three hundred metres, turn left and continue to the roundabout. At the roundabout, take the third exit and park the car, go and open the gate and drive carefully across the field....

Are you a blind follower of the sat nav? Even when you actually know a quicker or more direct route? I have to admit I am totally reliant upon mine as it gives me a level of comfort. I will even follow it to a destination and allow it to take me back by a completely different route as it often directs me to do, even though I know I didn't come that way!

The Procedural Learner:

"Follows a set of procedures or instructions to achieve a stated goal. If he or she deviates from these directions, the chance of returning to the correct path is severely hampered and success is unlikely"

For you sat nav followers, have you ever finished up on a dead-end road, got horribly lost, arrived late at the destination or even found yourself at that gate to the field with a determined whinny voice instructing that you continue straight ahead, despite your instinct telling you there is a better way and traversing a field really is not the best option?!

Many children learn in this manner. They can be taught a set of procedures to achieve and many will do so by following the list of instructions in the correct order. When learning something new, we would probably all confess to occasionally writing ourselves an 'idiot's guide' of steps. But what happens when we miss one out or go wrong?

Mathematically, children might be taught to solve the calculation $4 + 5 = 9$ by counting out 4, then 5, and finally counting the total to make 9. Alternatively, they might count up an additional 5 starting from 4 or they may see that 5 is the biggest and they count up from there. These methods can be described as counting up or counting on.

The Proceptual Learner:

Is able to solve our problem of $4 + 5$ in a number of different and quicker ways. Such learners might recognise that two 5s are 10 and so we want one less. They may double the 4 and add 1, because they know these facts.

They are using derived facts from their knowledge (known facts) to solve the problem. What differentiates them from the process follower (procedural learner) is that they not only solve this faster and in a more 'flexible' way but, in doing so, they also instinctively understand any other link between the number triple 4, 5 and 9 and know the answer to $9 - 4$ despite having never been taught a method to solve it. Children able to adapt one piece of knowledge ($4 + 5 = 9$) to solve a different, but related, calculation, $9 - 4 = 5$, without being taught this, are clearly going to progress more quickly and they are said to be thinking mathematically.

From this simple example, it is clear that a proceptual thinker is likely to achieve faster and further in mathematics. This may well apply to other subjects and life challenges. As part of my Master's research, I worked with a group of nine year olds which confirmed to me that the more able mathematicians were employing a very different method of solving such tasks than their less able peers who, on the other hand, were not only using the simple count-on methods, but were actually working harder than their classmates because, for our example above, they had to count out 5, then count out 4 and then count the entire 9. As suggested by Gray & Tall (1994) "Less able children are doing a different kind of mathematics that is often intolerably hard." This only gets further exacerbated as the years progress.

The proceptual divide:

The children I worked with were just nine years of age; yet there were already fundamental differences in their approach to simple calculations. Moreover, as they progress through school, and the mathematics becomes more challenging, those relying upon procedures will fall further behind their proceptual classmates. This 'proceptual divide' quickly widens.

The plateau:

It may be that the proceptual 'flexible' thinkers, our mathematicians, eventually reach a point where the challenges become too difficult and they revert to the comfort and reliance upon a set of instructions.

If this happens, they have reached a plateau. I consider myself to be a regular plateau-reacher, particularly when it comes to the sat nav scenario! Like many of us, I resort to a set of instructions rather than use the riskier strategy of experimentation. I have then plateaued in that particular task. We know that children hit plateaus in their learning and the evidence for this may be a change in their approach to problem solving and/or a loss of confidence.

So, what does this mean to us as teachers?

Can we prevent the procedural learners from plateauing early in their school careers?

Can we teach children to be proceptual learners?

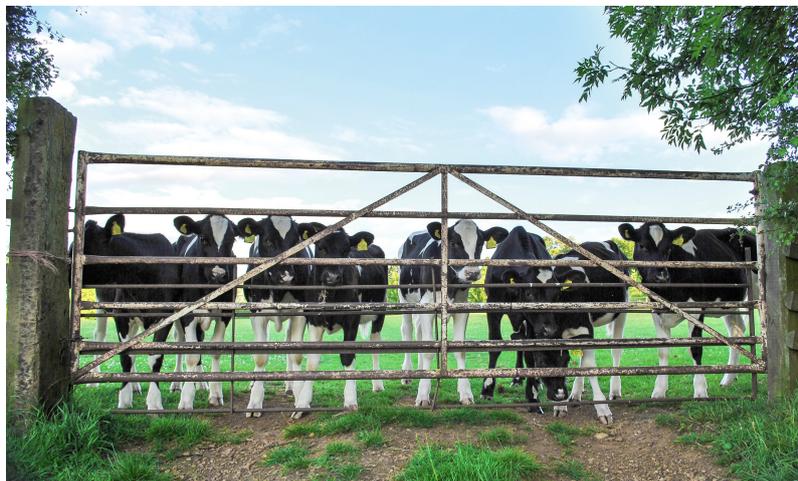
Can we diagnose those learning procedurally and encourage a more proceptual approach?

Should we be recognising when children hit their plateau and encourage them to progress proceptually?

Perhaps we can teach proceptually..

I am not sure that there are any correct answers but, if we recognise the way that children are approaching certain calculations, it will help us as teachers to offer them alternative methods of arriving at the answer and may encourage mathematical thinking.

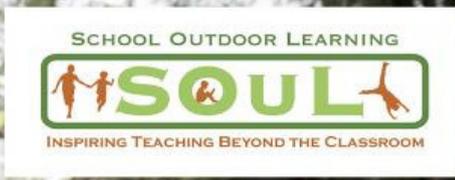
In the next edition of InnovatED, I will describe in more detail the types of methods children employ to solve simple mathematical problems and how this might inform our teaching •



Andy Giles is a former Headmaster and now a Director with The Independent Schools Portal. For further information or to request his full research around Procedural and Proceptual learners, please make direct contact: andy@independentschoolsportal.org

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