WHAT MAKES A RICH TASK?

Pete Griffin responds to an editorial request to document an INSET he provided on rich tasks.

“To do the right thing is not enough; to be competent one must also know what one is doing and why it is right”. Von Glaserfeld, 1987.

This quote is about student learning and is often used (well, at least, I have often used it) to convey one of what I consider to be the main principles of assessment for learning – i.e. that learners need to be aware of their own learning.

A common view seems to be emerging in the mathematics education world at the moment that the development and use of ‘rich tasks’ is a good thing; a ‘right thing’ to do. We have many examples of these ‘rich tasks’ and, as teachers, we are encouraged to use them whenever we can.

As learners, professional learners ourselves it is right that we don’t just accept this uncritically, but question what a rich task is and why we should value them. This article is my own reflection on the nature and value of rich tasks and draws on a session which I was asked to run for Somerset heads of department last year.

So what exactly makes a rich task? What are we referring to when we use this phrase? Wherein lies the richness?

Let’s start with a couple of conjectures:

- A task or activity isn’t an activity until someone does it. So the richness exists in the actual doing of it.
- Some activities have more potential for richness than others, but sometimes a relatively ‘ordinary’ task provides the stimulus for an engaging and effective lesson.

The following statement in the ‘Improving in Learning in Mathematics’ resources seems to back this up.

> The resources by themselves, however, do not guarantee effective teaching. This is entirely dependent on how they are used. When using them, therefore, we suggest that you try to implement the following principles that should underlie good teaching”.

- Build on the knowledge learners bring to sessions.
- Expose and discuss common misconceptions.
- Develop effective questioning.
- Use cooperative small group work.
- Emphasise methods rather than answers.
- Use rich collaborative tasks.
- Create connections between mathematical topics.
- Use technology in appropriate ways.

So, there is a suggestion here that it is the combination of the task and the following of some pedagogic principles that makes for richness. I am struck, however, by the rather circular argument that one of these ‘principles’ is the use of ‘rich collaborative tasks’! Maybe it is the collaboration that is really being highlighted here and that provides me with a very helpful question to work on in my own practice – i.e. whether collaboration is always necessary for a rich learning experience.

And then (also in ‘Improving Learning in Mathematics’):

> These types are not there to simply provide variety (though they do); they are devised to develop different ways of thinking.
> - Classifying mathematical objects.
> - Interpreting multiple representations.
> - Evaluating mathematical statements.
> - Creating problems.
> - Analysing reasoning and solutions.

So here the definition of a rich task seems to be building into a helpful set of connected ideas. They are tasks which, when mediated in certain ways (i.e. adhering to the eight ‘good teaching’ principles above) produce certain kinds of actions and mathematical behaviours in our learners.

I have found these teaching principles and ways of thinking very useful both to inform the way I choose or devise activities and also to inform me about useful ways of working with these resources in the classroom. But then I am sometimes brought up short when students do not respond in the way...
I expected and I am left thinking that a rich task, well prepared and appropriately used in the classroom, is not enough. There is something else that is required; some call it ‘the culture of the classroom’; some refer to the need to develop an ‘awareness’ in their students or of the importance of student ‘meta-cognition’ (i.e. students thinking about their own thinking). Something that somehow ‘surrounds’ everything that happens in the mathematics classroom so that:

- tasks are worked on rather than just worked through;
- questions are asked genuinely to find out what students are thinking rather than to illicit responses that we are on the look out for;
- and
- students think their own thoughts and assess their own understanding without trying to guess what is in their teachers’ mind.

What I attempt to describe in this article is the result (or some of the results) of questioning this list and exploring what signifies richness for me. So here is a collection of activities that I have used with students and teachers alike and some reflections on what I have learnt from doing this.

Activity one

[From Improving Learning in Mathematics].

I ask which one might be the odd one out and why.

I have been struck by how often the first connected pair spotted from these shapes is the first and second (making the third the odd one out) even though the mathematical sameness (i.e. same area) might be a more complicated sameness that the sameness of, for example, both having a right angle. What a number of people report is that the quality they ‘spot’ straight away is that of ‘same height’. My experience is that through discussion this develops into some more focused thinking about area.

I have felt for some time that if there is a ‘natural’ reaction to a stimulus that I offer learners; that if in some way I am tapping into something they can perceive readily then I have the chance of being rewarded by a rich lesson.

Activity two

“Sort out these fractions in ways that produce as many whole circles as you can”. Record what you are finding as you go along.

I am struck by how little I have to say to get the pupils to respond, and how; somehow, the activity provokes something natural in the learners, allowing them to make contact with an already existing understanding of fractions which I don’t need to teach them.

In addition it allows me to introduce fraction notation as a way of recording something that students have already noticed (i.e. that \(\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{1}{2}\); \(\frac{1}{4} + \frac{1}{6} = \frac{5}{12}\); \(\frac{3}{4} = \frac{3}{6}\), etc...).
Activity three

I show this picture:

and ask “Can you see the following fractions in this diagram?”. I then read some of the following statements slowly (sometimes with a prompt):

2/5 of something? – (Prompt – what’s the something and where is the 2/5?)
3/5 of something? – (Prompt – what’s the something and where is the 3/5?)
5/2 of something? – etc...
5/3 of something?
2/5 of 5/3 of something?
3/5 of 5/3 of something?
1/3 of 5/3 of something?

I am aware when using this activity of how students are forced to alter their perception of the diagram to accommodate different seeings of the ‘whole’ and that this seems to extend and make richer their understanding of fractions.

Activity four

1 coffee
1 tea
Total: £1.45

1 coffee
2 teas
Total: £2.10

[From ‘Badger Key Stage 3 Maths Starters: Year 9’]

Almost all students I offer this to have an intuitive response which is to find the difference between £2.10 and £1.45 and reason that this must be the price of one tea. The ‘Method of Elimination’ for solving simultaneous equations (i.e. make the coefficients of $x$ or $y$ the same in both equations and then eliminate by adding or subtracting) which is found in all text books is redundant here - the students already know it!

This is another example for me of needing to teach only what students can’t learn for themselves.

As a result of trying these and other activities with various groups I would like to add to some of the ‘tests for richness’ offered earlier in this article with a few others:

- When pupils are able to make choices.
- When pupils are able to gain ‘direct access’ to the topic without too much telling or need for memoralising.

- When pupils are introduced to symbols in such a way that they feel in control of them and use them to express something they know.
- When pupils are genuinely doing their own mathematics rather than following or mimicking somebody else’s.

I am proposing that lists and frameworks like these help us to think about ‘rich activities’ in mathematics classrooms. I offer them as a touchstone for evaluating and creating rich activities in our work with learners as we try things out, question our own assumptions and experiment. It is this questioning and experimentation which is at the heart of deep and lasting professional development, in contrast to the mere knowledge of various lists of criteria or the collection of classroom activities.

There is no doubt that we can train our students’ behaviour very successfully using certain tasks and activities. However, what is far more valuable is to educate learners’ awareness so that they gain the confidence to reflect on what they are doing and make sense of it for themselves.

Similarly, we as teachers of mathematics can be trained (and the language of ‘teacher training’ is still very prevalent) to use certain styles of activity and teach in certain ways. But, we know that this is not enough for us to grow and develop as teachers. What we need is the opportunity to educate our own awareness by questioning and experimenting in our own classrooms in order that we can arrive at our own personal pedagogy.

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Notes

1 ‘Improving Learning in Mathematics’, a resource produced by the Standards Unit in September 2005. Available to order from the ‘Resources’ section of the NCETM web portal (www ncetm org uk).

2 See the NCETM Mathemapedia entry ‘Working on versus working through’ at www ncetm org uk/mathemapedia for an amplification of this idea.

3 See the NCETM Mathemapedia entry ‘Teaching by listening’ at www ncetm org uk/mathemapedia

4 See the NCETM Mathemapedia entry ‘Guess what’s in my mind’ at www ncetm org uk/mathemapedia

5 Dave Hewitt wrote in this journal on ways of attaining ‘direct access’ to mathematical ideas. Hewitt, D. (2007), Canonical images, MT205, pp6–11.

6 The 23 sectors are cut out from the template shown, put in an envelope and given to students in pairs.

Reference

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