There are many ways to make assessment more authentic

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In recent times portfolios or 'work folios' have provided students with the opportunity to demonstrate their learning. Portfolios often come under the rubric of 'authentic' and/or 'alternative` assessment. Portfolios have the advantage of involving students with the collection and even the evaluation of the samples (Eggen and Kauchak, 2001).

This article describes a way of getting students' work, but using an open-ended approach. Although here the curriculum subject is math, this type of activity could be used in most curriculum areas.

Introduction

Assessment will continue to feature on the education and schooling landscape. We can say that with authority and safety as assessment has long been recognised as one of the most basic and difficult tasks that teachers face (Eggen & Kauchak, 2001).

What should guide us as we assess our students? The following are sometimes cited as principles.

- First, that assessment is fundamentally concerned with the exchange of information, and assessment methods should make sure that quality information is (in fact) exchanged.
- Second, that worthwhile assessment should be identical to worthwhile instruction in the sense that teachers should be able to justify the use of an assessment strategy on instructional grounds.
- Third, that assessment should help inform and promote the consequent actions taken by teachers, students and the wider school community.
- And fourthly, that the tasks we set should maximize the chance for students to show what they have learned (Clarke, 1992).

In recent times portfolios or 'work folios' have provided students with the opportunity to demonstrate their learning. Portfolios often come under the rubric of 'authentic' and/or 'alternative` assessment. Portfolios have the advantage of involving students with the collection and even the evaluation of the samples (Eggen and Kauchak, 2001). Normally, with this strategy, samples of student work are collected and dated. The aim is to collect a number of samples over the course of the school year, and to look carefully at these in order to detect the students' change over time. Several suggestions have been made for what to include and how to collect these work samples (Stenmark, 1989: Carr, 2000).

This article describes a way of getting students' work, but using an open-ended approach. Although here the curriculum subject is math, this type of activity could be used in most curriculum areas.

In 2000, Carr & Gray conducted a small pilot study with a group of 12 ten and eleven year olds. The students were asked to write math activities that would help students their age learn important math content. The authors were surprised at the intense interest and the range of topics generated.

The research questions for the study that forms the basis for this paper were:

- What content do students tap into when writing mathematical activities they think are important for their peers?
- Can teachers make use of the student writing for inclusion in portfolios for assessment purposes in mathematics learning?

Method

The first phase of the study took place in three schools during the latter part of 2000 and March 2001. Four classes of pupils (n=99) who were in years five to eight at school (chronological ages 10 to 13) were sampled. These classes are referred to as *A, B, C* and *D*. Classes *A* and *B* were mostly ten year olds. Classes *C* and *D* were aged eleven to thirteen. All were mixed ability except for Class *D* which the school described as a 'top stream' group in a school of three hundred pupils. The participating teachers volunteered their classes for the task, and had the purposes of the project explained fully to them. The work samples were produced during morning sessions at about the normal time in the school day when mathematics would have been taught.

The second and third samples (n=85) were obtained in June and November 2001 respectively, this time from students in classes *B, C* and *D* (but not class *A*). On each of the three occasions the writer introduced the task by emphasising to the students that they were not being asked to complete a 'test' but a task that required their ideas. They were asked to write one page of math activities that would be suitable and important for students their age. Care was taken not to use the terms 'textbook' and 'sums' as it was thought that this might provide strong clues and direction to the students. As well, no recommendations for content were given.

When students asked for guidance the writer and the teacher reiterated that the content was up to each individual, and that the students should write something that they thought was important for students their age to know about (in math). The writing of something 'important' (in their views) was one of the main ideas conveyed to writers who requested more detailed guidance.

During the student writing the author and the teacher stayed in the classroom and responded to questions of clarification when necessary.

Results

The initial observation made by the writer and the respective teachers was that all students appeared to be most interested in the activity. The years five and six (grades 4 and 5) students took (on average) sixty minutes to complete their page. The years seven and eight students (grades 6 and 7) required about fifty minutes. All students in all four classes handed in something.

In general, the older the students, the greater the variety and number of activities that they included on their pages. Table 1 shows an example of the types of mathematical content (most students included more than one type of activity on their page) that the students used when constructing their pages, and the percentages in each class of students who used that particular content area. The results are from Class C.

Mathematics Content Area Categories			% students
Class C (n=26)	March 2001	June 2001	Nov. 2001
1. Operations-whole numbers	80	98	44
2. Statistics	38	64	16
3. Timetables	31	24	69
4. Geometry	31	11	65
5. Measurement	19	14	20
6. Problem solving	19	0	20
7. Fractional numbers	15	53	44
8. Algebra	10	64	44
9. Numeration		18	0

Table 1: Class C's mathematical activities

Next, a closer look was taken at the type of activity that the students wrote. The appendix contains a selection of student responses that are illustrative of pages that the students created for their peers.

Discussion

It is apparent that these intermediate school students saw what we might label as 'basic mathematics' as important for their peers to know about and to learn. The percentages from Table 1 show that over half the activities that they created were of this type. If we look more closely at the proportion of each page devoted to such activities, then again it is easy to detect that this is a dominant feature.

Students from Class *D* wrote a number of suggestions on the pages they created. For example:

- I think children my age should learn their timetables like the back of their hand (Murray, 12).
- I think people my age (year 7 and 8) will definitely need to know there [sic] timetables as they are needed in basically all areas of maths. How to divide. I also think it is important to know how to do basic facts e.g. Division, Multiplication, Addision [sic], Subtraction.
- To clearly present their work e.g., neatly, readable (Esther, 12).
- I think it is important to know most of your timetables reasonably well and to be fairly good at division. I think that algebra is a waste of time unless you are planing [sic] on being a builder. Or something that uses algebra in it. And addition and subtraction are vital that you know them well (Grant, 12).
- I think children my age should be learning in maths how to solve problems. This is because maths has got so many different areas in it. Problem solving is a good way to expand the brain. It gets you thinking on a whole lot of different levels - kids should do this (Mary, 12).

The students did produce a variety of responses that reflected the main elements of the mathematics curriculum. Two of the teachers thought their class' dominant response (in the March sampling) might be to reproduce exercises and activities associated with the topic currently being studied in class (which was statistics). This did not prove to be the case. Class *D* (the 'top-stream' track/grouping) tended to write more sophisticated activities and exercises, and to offer advice for students coming to their class next year (some of their comments are above).

How might we use these work samples for assessment purposes? What can such an exercise tell us about students' thinking/learning?

First, the student work will reflect (on the whole) the content the students considered to be important in mathematics – what they valued in mathematics, as it were. Second, the pages showed, to some extent, the conceptualisation that each student had about mathematics, at least in the school setting. From the responses it was clear that these students had conventional and traditional views of the subject mathematics. Third, the pages reflected the understanding of mathematics that the student possessed at the time, including errors and misconceptions.

What do the pages from this study mean for assessment purposes? On the one hand the teacher may consider that she/he has done a good job in 'grounding' the students in the basics. On the other hand the teacher might also note that the students did write a range of responses including aspects of the math curriculum such as calculator use, math games, problem solving and algebra.

Looking at individual students' work samples these (in the appendix) show a basic knowledge of some math content. The bar graphs of Alison and Ronald suggest that these students are just starting to apply this form of recording to data, and are still grappling with where to place the zero and numbers above zero on the '*y*' axis. Sarah has written 'textbook-type exercises' that have no realistic contexts, but she tried to introduce some variation. It would useful to discuss with her some values for '*E*' and '*F*', to assess her understanding in this area. Alison has a selection of word problems, and seems to think that addition with numbers in the thousands is important. Again, it would be interesting to get her rationale for this view.

The response changes (June compared with November) show that Ronald continues with his creative approach. Some of his work is difficult to decipher, but we can see that fractional numbers and the names for shapes are major features of his November page. Alison too has changed her focus for the final page, tending this time more towards game-type activities that are related to algebra. But she has retained the times table and addition components, while moving away from word problems. In November Sarah has moved strongly towards fractional numbers and geometry content, and now sees BEDMAS as an important 'rule' when working with numbers. Her teacher might say that she has taken a great deal of care with her work. Her math examples continue to be well set-out. It would be interesting to talk to these students about why they included the content that they did.

With a rich mathematical activity such as this, a careful qualitative analysis of the students' responses is possible. This qualitative analysis will tell the teacher far more about the knowledge content and processes of their students than merely counting how many responses are in each category (as in the figure in this study). Certainly the two hundred and fifty-five student pages that this study elicited provided many varied writings that an article like this cannot do justice to.

Probably these pages also revealed the type of exercises and content the students recalled most easily. As well the samples also reflected the teacher's own conceptions and beliefs about mathematics to some extent as it has been documented that students mimic their teachers beliefs about mathematics as these are often unconsciously passed on by teachers to their students. However, one should be cautious in claiming that when students are asked to write a page of mathematics activities (or activities in any curriculum area), they will simply mimic and reflect their teachers' ideas about the content, practices of and beliefs about mathematics. To do so would be contrary to much of what we know about the nature of learning. Much evidence shows that learners construct and develop their own ideas from the experiences they encounter. While certainly reflecting what they have been taught, students' ideas are rarely a direct copy of what they see and hear. It is also important, too, to remember that student work will reflect what the students are able to reproduce, and what they think other students are able to handle. There will be other aspects of math content that they recalled, but they may not have understood these sufficiently well to be able to write about them.

Samples of the students' work from this study were presented to students at Zayed University, Dubai, United Arab Emirates for comment. The tertiary students found it most difficult to comment on the pages. This is entirely understandable when one considers they did not know the students, the rationale for collecting the samples was perhaps unclear, and consequently the assessment was being made out-of-context. This is an important point to remember. An 'academic' look at samples of students' responses may be an interesting activity for the professor who has collected the responses, but may be a meaningless activity for tertiary students who are asked to analyse them. As with good teaching and learning, the assessment needs to be grounded in a realistic context.

Conclusions

How might pages of students' activities be useful for assessment purposes? Certainly a teacher may look at individual responses and note:

- the type and variety of activities that the student wrote, and then make some judgments in terms of what the pupil sees as important in mathematics;
- the level of activities that the student considers suitable for their peers, and any possible confusions and errors;
- that the group data provides an overview on how the class perceives mathematics, and may reveal the depth of the students' mathematical thinking;
- that this, in turn, may lead to a modification of their approaches and the messages that they are conveying to their students about the nature and purposes of mathematics.

There are many ways we can make assessment more authentic for students. This article has described one.

Acknowledgements

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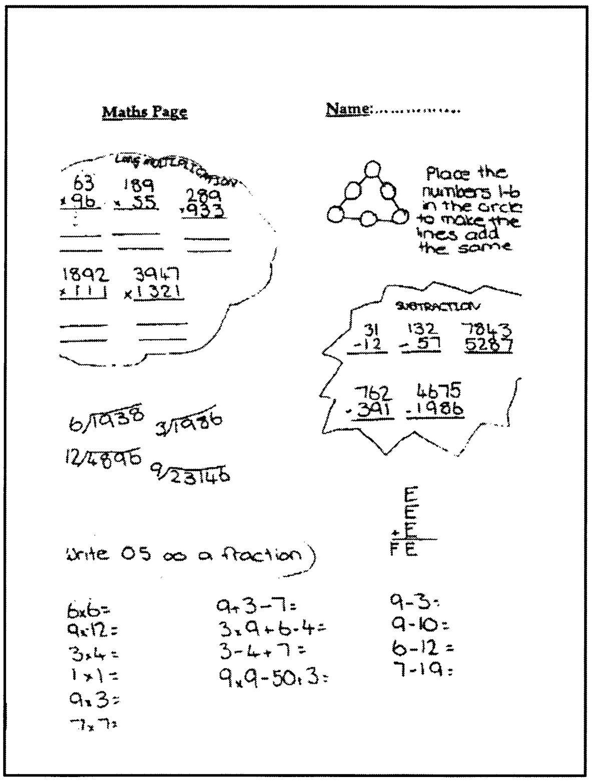
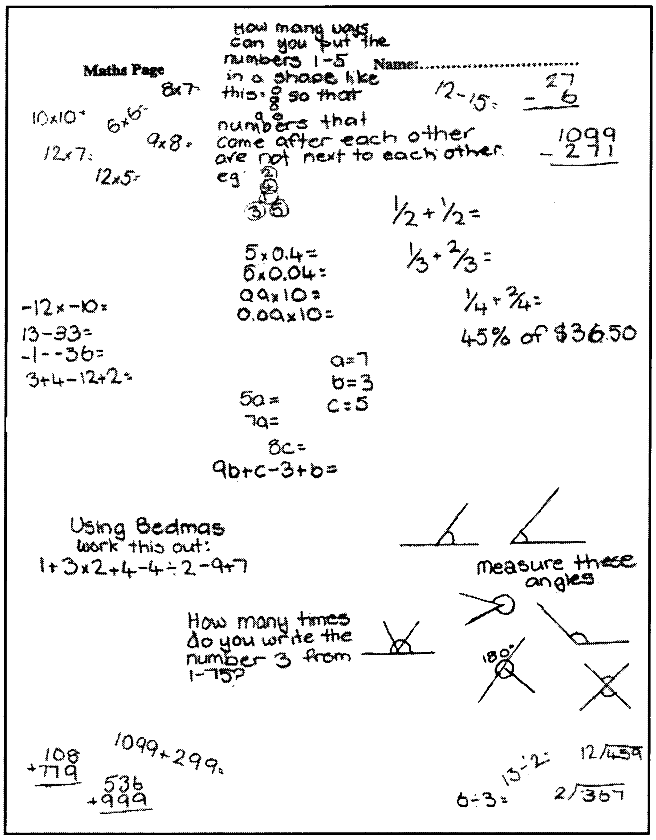
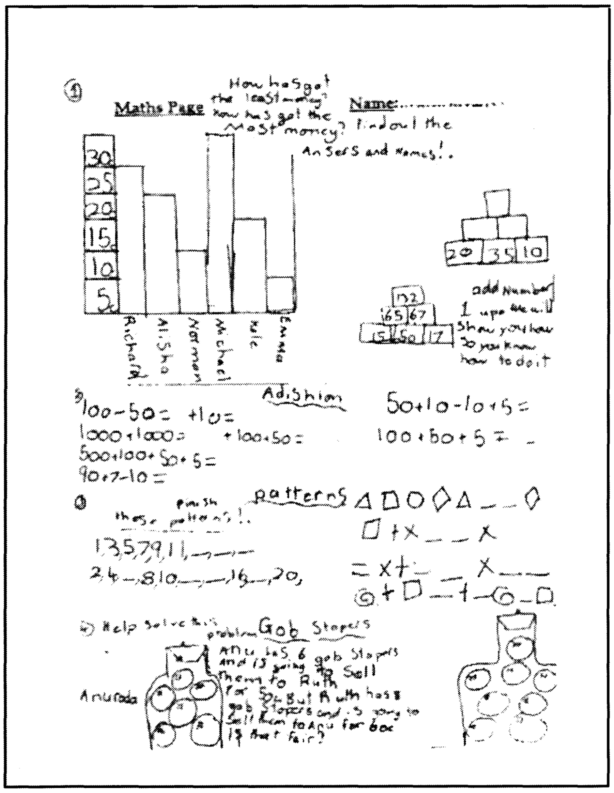
Sarah **June** **November**



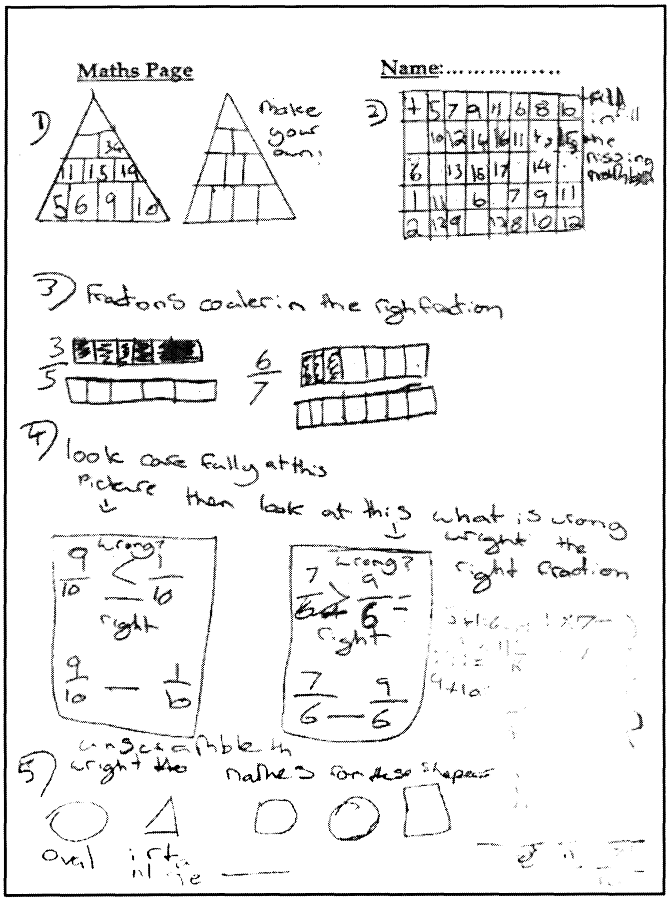


Appendix

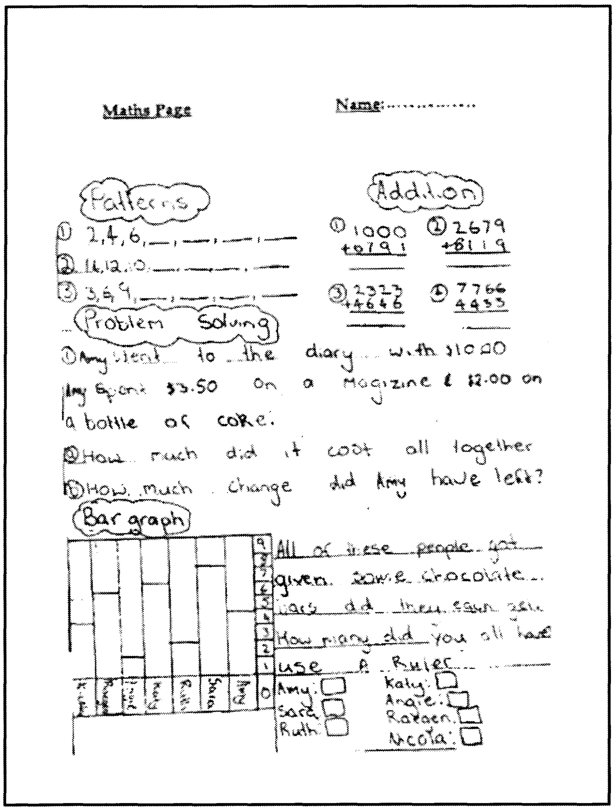
Ronald **June**



November



Alison **June**



November