The Perspectives of Two Children who Participated in the Advanced Numeracy Project

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This paper reports on the perspectives of two ten-year-old children selected from a sample of 77 children attending four schools that had participated in the Advanced Numeracy Project in New Zealand. The two girls' ideas about solving a particular multi-digit addition problem that was given to them on paper, their perceptions of the importance of obtaining a "right" answer, and their views about discussing solution strategies with others are reported here. This analysis has raised some interesting questions and issues for us to explore further with the data from the remainder of the sample.

The Numeracy Development projects have been under way in New Zealand schools now for more than three years (see Ministry of Education, 2001, 2003). Each year, comprehensive evaluations have been completed on each of the projects, looking at changes in students' mathematics learning over the course of the project (see Higgins, 2001, 2002; Irwin & Niederer, 2002; Thomas & Ward, 2001, 2002). The perspectives of teachers, principals and facilitators have been researched as part of the evaluation process. To date, the students themselves have not been given the opportunity to give their perspective on how the project has had an impact on their mathematics learning.

Increasingly, academics are writing about the value of listening to and talking with students themselves (Carr, 2000; Davies, 1982; Devereux, 2001; Nieto, 1994; Paley, 1986; Roberts, 2000; Smith, 1995; Smith, Taylor & Gollop, 2001), as well as to their parents and teachers. Recent research has focused on the issue of student "voice" and in particular, on the importance of finding out how students see themselves as learners (Fielding, Fuller & Loose, 1999; Freeman, McPhail & Berndt, 2002; Phelan, Davidson & Cao, 1992; Pollard, Thiessen & Filer, 1997). For example, Duffield, Allan, Turner, and Morris (2000) found that for young secondary students (13- & 14-year-olds) in Scotland, the social aspects of school experience were far more important than curriculum and pedagogy. Moreover, Duffield et al. noted "the absence of a discourse of learning from pupil accounts" (p. 2). The pupils' voice is considered to be an important factor in understanding schools and schooling (McCallum, Hargreaves & Gipps, 2000).

Others such as Rudduck and Flutter (2000) argue that pupils have a right to be heard with respect to their views about aspects of their schooling and these views should be taken seriously. It is not that pupils' voices are more valid or better than any other voices, but that they too need to be considered within the framework of a complex, socially constructed world (Duffield et al, 2000). Furthermore, it is stated explicitly in the UN Declaration on Human Rights that children should be given a voice on matters that have an impact on them (New Zealand Ministry of Foreign Affairs and Trade, 1997).

This research project set out to explore the perspectives of year 5 and 6 students attending schools that had participated in the Advanced Numeracy Project. This particular paper explores the findings from our conversations with two girls who shared their ideas during interviews with us.

Method

Participants

Seventy-nine Year 5 and 6 students who attended four schools in the Waikato region that were involved in the Advanced Numeracy Project served as participants in the main study. Two of the schools had participated in Numeracy Project for two years, and the other two had been involved for just one year. The students ranged in age from 9.1 years to 11.7 years (mean age = 10.7 years, S.D. = .63). There were approximately equal numbers of girls and boys. The majority of students were of European descent (68.4%), approximately one fifth were Maaori (21.5%), and the others consisted of Asian (7.6%), Pacific Islands (1.3%), and other ethnic groups (1.3%). Three of the schools were decile three, and the other was a decile four school.

Transcripts of two students only, Maia and Lucy (pseudonyms), have been selected for in-depth analysis for the purposes of this particular paper. Maia, a girl of Maaori ancestry, was aged 10.1 years at the time of the interview, and Lucy, a girl of European ancestry, was aged 10.4 years. Both girls were in a year 5 class and had been assessed by their teacher as being at the Early Additive Part-Whole stage (stage 5) on the New Zealand Number Framework (see Higgins, 2002).

Procedure

All participants were interviewed individually by either Jenny or Merilyn in a quiet room outside the classroom at a time the teacher thought would cause least disruption to their school work. The purpose of the study was explained to the child, and their consent obtained (Parental/caregiver consent had already been given for the child to participate in the study). Each interview was audio-taped for later transcription and analysis.

Results and Discussion

For this paper we have selected some of Maia's and Lucy's responses to our questions to present here. We have reported on the girls' ideas about solving a particular multi-digit addition problem that was given to them on paper, their perceptions of the importance of obtaining a "right" answer, and their views about discussing solution strategies with others.

The Written Problem

When asked to solve the problem "27 + 54" presented to them on paper in vertical form, and then to describe how they had solved it, both Lucy and Maia were happy to share the mental processes they had used. Maia described how she started by adding the two left-hand digits, then used her knowledge of the combinations which make ten, saying:

> When we're doing something like this with … these are the tens and these are the ones, so that just add five on to … oh, two and five … And that will make seven, and then we take the three from the four and put it onto the seven and that will make ten, and then we put it onto the seven, so I made eight, so we can put eight there and one there…. I'd put the two on the five…. Take away three from the four…. And then I'd add it on to the seven and then there'll be one left from the four and then there'll be one left from the four and then I'd add the tens of the eight … oh the tens to the seven … so they're 81.

Lucy, on the other hand, began by using the traditional written algorithm. She first wrote down her answer as "811", but quickly realized that she had made a mistake. The researcher (R) asked her the explain the strategy she had used initially, and how she had known that her first answer was incorrect. As the excerpt below shows, her understanding of the number system became evident and this helped her to realize that her initial answer did not make sense.

R Right – so you started with the 7 and 4, and..

L …and that's 11, so you put 1 up there 'cause, and oh no, I done it wrong. Yeh.

R Oh OK – just tell – take me through that.

L Oh No – that's wrong. (Laughter)

R That's OK – you can rub it out or put a line through it or whatever. (Pause)

L That is, that is 81.

R Right – how did you realize just, before when you had 811 - what made you realize that it….?

L Because 50 plus 50 is 100 – you'd have to have like 500 and 200.

R Right, so you just knew it didn't make sense the way you had it?

L No.

R Right – so what do you think about this way of working things out with the numbers lined up in columns?

L Well first of all, you just go to the start and you go 7 plus 4 is 11, take away that 1, put it up there. 2 plus 5 is 7 plus 1 - it's 8.

R Right, so you like that way of working things out?

L Normally I just work things out in my head, like 53 plus 26 – that's easy because it will be 79.

After this exchange, Lucy was then asked how she would work out the same problem a different way. Her second approach was similar to Maia's initial strategy, because she worked from left to right, first with the tens and then with the ones.

L Well, I don't really know – oh yes I do. 20 plus 50 equals 70, plus 7 (unclear word) 4 equals…

R Right, Oh, OK. So you got 70…

L …and that's not meant to be there.

R Oh that's (unclear words)

L …plus 7.

R Oh OK, so you would go 7 and 4, and then you'd add the 7 on.

L OK – 'cause the 2 and 5 is 70 – which is equals there, and then put 4 on - that's 74, plus another 7 is 81.

Both girls demonstrated the use of additive part-whole strategies according to the New Zealand Number Framework (see Ministry of Education, 2003). We noted that Maia and Lucy used mental strategies to solve the written (decontextualised) problem. Although Lucy initially endeavoured to use a traditional right to left written algorithmic method, she soon abandoned this process in favour of using her knowledge about number to obtain a solution. Lucy demonstrated that she was able to work mentally with both hundreds and tens, describe the process, and in this instance at least, self correct when she realised she had made an error. Maia worked confidently from left to right, adding the tens first, then combining the three (taken from the four) and the seven to create another ten (the bridging-up-through-ten strategy described by Thompson, 1997) leaving one left which she added at the end. We found it interesting that Maia described the process of working out her solution twice as if to check for herself that she had included all parts of the operation and the numbers she was dealing with at the time. The working memory demands of this procedure were quite high (see Griffin, Case & Sandieson, 1991), yet Maia was able to deal with this complexity.

Their Perceptions of the Importance of the "Right" Answer

It appeared that neither Lucy nor Maia was concerned about getting a "right" answer to any particular problem that was presented to them. When Lucy was asked, "How important is it to get the right answer?" she responded:

Not at all – because just getting the right answer is OK but if you get it wrong, there's always next time – it doesn't really matter if you get it wrong or right.

Maia responded in this way:

Not that important because it's … if you get the wrong answer it's quite good because you can really learn that equation….And sometimes when you don't get the answer … or when you do get the answer you know that you've done that, but some people in our classroom would look back from their last answer that they got and they look for the same equation for today and they'll go back from their book and then they'll look for it.

There was an interesting difference in their responses. Lucy considered that it was always possible to get to the right answer at some point, so in effect getting the correct answer was a goal, but was not of immediate concern to her. This is consistent with the findings of McCallum et al (2000) who reported that older primary age children were less concerned about getting an immediate right answer than they were about their own learning over the long term. In Maia's opinion, getting something wrong was a learning opportunity for others, but she did not see this as necessarily so for herself. We noted that Maia often chose to express her ideas as if she was not directly implicated in the process of learning herself.

Their Views About Discussing Solution Strategies With Others

Lucy and Maia were asked how they felt about talking to other people about how they worked out their answers to mathematics problems. Maia reported that she enjoyed sharing solution strategies with other members of her group. She viewed discussion as a

way of recognising that others solved problems in ways that were different from her own. She said:

> We sit in a circle on the mat and the teacher goes from one person like J and me, then Doug, M, and Lucy … all around the circle and they'll say how they worked this out and how they got this number. [Questioned about whether or not knowing how other people work something out is important.]… No, not really. [Why?] Because there's lots of different ways you can work something out. It's not just one way you can do it. There's lots of other different ways really know what to do, so …

Maia went on to interpret our question in a way that we had not expected. Our data revealed that she thought different strategies were useful as teaching opportunities for her in working with the less capable peers whom she liked to assist. She appeared to view herself as a member of a community of learners (Lester, 1996), and this brought with it roles and responsibilities for her. Maia demonstrated this by saying:

> Well because somebody might not know an answer and you can help them out by just helping them a little bit with that and you can … you don't tell them the answer but you can set an example for them … from the other answer … that's quite ?? the same…. we help them with say Ira [pseudonym] … this is just a person I help with his work. He asks me to help him … And they sit in this semi-circle and then the teacher asks them and the teacher sends me down for ?? since I helped Ira because Ira wouldn't really know what to do, so…

In Lucy's view, any formal discussion about solution strategies occurred in class only when nobody knew how to answer a particular question, and therefore it became necessary for the group or class to share ideas so that an answer could be worked out collectively.

> Well we sit at one table usually and just think it over, and when we get to a certain answer where no-one can answer it, we'll work it out together.

Lucy also provided an interesting perspective on the personal relevance of discussing solution strategies. In her view it was important that others talked to her to help her, and that it was other people's responsibility to explain their mathematical thinking to her and thus help her to understand.

> I found that every time you do maths, you know something more than you did before, and when you get to a point when you don't know what this thing is, and you ask other people and they say "No", you just think well, they must be busy, and then you ask another, and then – the more that people say "No", the more you don't know things because people aren't helping you out with things like that.

Lucy recognised that listening to other pupils' thoughts could help her to develop her own understanding of the mathematical ideas that were being presented. This is consistent with the recommendations of Cai and Kenney (2000), who suggest that it is important to have environments in which children can listen to each other and explore important mathematical ideas freely. It seemed that Lucy recognised that others could contribute to her own learning, and felt at ease about seeking others' ideas when she felt the need to do so.

Maia, on the other hand, saw the process of sharing ideas as a social activity, rather than as a learning opportunity. She was interested in what other pupils had to say because she was interested in them as people, and not so much in their mathematical ideas. This raises questions about whether it is important to help students such as Maia to consider

peers' contributions to discussions as intellectual opportunities or whether this will happen naturally as children get older, as McCallum et al (2000) have suggested.

Conclusion

While this paper has focused on just some of the thoughts of two ten-year-old girls, it has raised some interesting questions for us. We wonder if other children value discussion about mathematics in the ways that these girls did. We also question whether the social roles that Maia and Lucy appeared to adopt (Maia to help others to learn mathematics, and Lucy to have others help her learn mathematics), reflect the perspectives of children more generally. We wonder too, if the ease with which these girls spoke about how they solved a mathematical problem is typical of children who have been involved in one of the New Zealand numeracy projects, or if it was coincidental that these girls were able to verbalise about their thinking so well. Further analyses of their data, as well as that from the other 77 participants in the main study should provide further insights.

The transcripts from these two girls show that they at least, were aware of what was happening in the classroom with respect to their own and to others' learning of the mathematical ideas embedded within the current numeracy initiatives. Their views and those of the other children interviewed should help to inform us further.

Perhaps the final words belong to Lucy. An initial question about her familiarity with the terminology used with respect to the Advanced Numeracy Project yielded a delightful response from her. She said that she had heard the word "numeracy" used by her teacher, but when asked what she knew about it, she responded:

> Nothing yet...Nothing, 'cause the teacher hasn't teached us yet – she just told us the word.

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