This paper reports on one aspect of a study that explored Pasifika students’ ideas about learning mathematics at Year 7. Students were asked to name key practices for learning mathematics (espoused theory) and were then observed working during a regular mathematical class to identify the practices they used (theory-in-use). Further discussion enabled the differences between students’ espoused theory and their theory-in-use to be explored and evaluated. What is these students consider ‘best practice’ in learning mathematics? Do they practice what they preach?

INTRODUCTION

In July 2005 enrolments in Auckland schools (New Zealand) reached 50% non-European. With the changing composition of the New Zealand school population the underachievement of Pasifika students in mathematics has become apparent. Pasifika students make up 21% of those attending primary and intermediate schools in the wider Auckland region. Pasifika people are those who identify themselves with, or were born in, the island nations of the Cook Islands, Fiji, Niue, Samoa, Tokelau and Tonga. Today 58% of the New Zealand Pasifika population is New Zealand born (Statistics New Zealand, 2005). Although the number of Pasifika students in New Zealand schools is growing, research relating to Pasifika educational issues is sparse with a significant gap concerning Pasifika students’ experiences at the Year 7 / 8 level (Coxon, Anae, Mara, Wendt-Samu & Finau, 2002).

The New Zealand Numeracy Project introduced in 2001 is one initiative that attempts to address the imbalance of achievement for Pasifika students in mathematics. While Ministry of Education evaluations have shown that the Project has been effective in raising mathematical achievement for all students (Higgins, 2003; Thomas, Tagg & Ward, 2003), Young-Loveridge (2004) found that not all students involved in the project have achieved at the same rate, with Pasifika students making the smallest gains of all ethnic groups. The underachievement of Pasifika students is a cause for concern. What is it that Pasifika students see as important in helping them learn mathematics? This paper presents the ideas about best practice in learning mathematics of a group of Year 7 Pasifika students (11-12 Year olds).

BACKGROUND

Existing research has focused on either what students say is best practice (espoused theory, identified through interviews with students) or what they actually do (theory-in-use, identified through observations of students involved in normal work
routines). The accuracy with which a students’ espoused theory matches their
type-in-use may vary due to a number of constraints (Argyris & Schon, 1974;
Robinson, 1993). New Zealand research identifying what students consider best
practice has been focused at the secondary school level although overseas studies have
given us some insight into younger students ideas. So what has research shown
students consider best practice in learning mathematics?

Research that has looked at students espoused theory has documented some common
ideas about best practice in learning mathematics, including listening to the teacher and
asking the teacher questions. Listening to the teacher was recognised as a key practice
by students in both primary and secondary schools (Clark, 2001; Jones, 1991;
McCullum, Hargreaves, & Gipps, 2000). The primary school aged students in a British
study (McCullum et al., 2000) recognised that listening to the teacher was not all that
was required if they were to learn, but was seen as important when the teacher was
introducing a new topic, explaining something difficult or giving instructions about a
set task. The Pasifika students attending secondary school in Jones’ study (1991)
identified listening to the teacher as the only appropriate way to learn, as it was the
teacher who held the knowledge they required to pass the exams.

Asking the teacher questions was also an important ‘practice’ in learning noted by the
primary school students in McCullum et al’s (2000) study. These students believed that
through asking questions they were able to find out something new, confirm their own
thinking or clarify an idea, as well as receive feedback on their progress. Secondary
school Pasifika students, however, saw asking the teacher questions as disrespectful
(Clark, 2001; Jones, 1991). As the teacher had already ‘taught’ them it was their fault
they did not understand.

The research that has developed alongside the implementation of the New Zealand
Numeracy Project has provided some insight into primary and intermediate aged
students’ ideas about best practice in learning mathematics. As part of the project
students have been encouraged to share strategies used in solving numerical problems.
Students noted that listening to how peers solved a problem allowed them to learn
other strategies, but even though they saw listening to others as important they placed a
higher level of importance on being able to explain their strategy (Young-Loveridge,
2005).

None of the studies above compared students espoused theory with their theory-in-use.
They focused either on what students said or what they did. To build a complete picture
of what students believe is ‘best practice’ in learning mathematics both their espoused
theory and their theory-in-use needs to be explored (Argyris & Schon, 1974; Robinson,
1993).

**METHOD**
The students involved in this study attended a large co-educational intermediate school
(11 – 13 year olds) located in a low socio-economic area of South Auckland, New
Zealand. The school was located in a low socio-economic area with the school population was representative of twenty-two different ethnic groups with Pasifika students making up 31% of the school roll. The school employed a mathematics specialist teacher who worked with both teachers and students to improve mathematical skills across the school. Students requiring extension (higher achievers) and those needing extra help (lower achievers) were identified at the beginning of the school year through the use of the New Zealand Performance Achievement Test (PAT). Students identified as requiring extension or extra support in learning mathematics attended either a class for higher achievers or lower achievers with the mathematics specialist teacher. These sessions were timetabled during their regular class mathematics periods for two of the four school terms (mathematics was learnt in their home room for the terms they were not timetabled into the specialist class). Eighteen Year 7 Pasifika students participated in the study. The higher achieving group comprised five Samoans, two Tongans, one Fijian and one Cook Island student (four males and five females). The lower achieving group included six Samoans, two Tongans and one Cook Island student (four males and five females). Two students in each group had been born outside New Zealand, but all had completed all their schooling in New Zealand.

Procedure

Individual semi-structured interviews were conducted with each participant. During these interviews students’ espoused theory (about what is ‘best practice’ in learning mathematics) was identified. Students had the experiences of past schooling as well as two class environments from their current schooling on which to base their decisions about ‘best practice’. The two environments in their current school were those of their homeroom (the more formal environment where often lessons were teacher directed and textbook based) and that of the mathematics specialist class (a constructively aligned environment where they were encouraged to work together to solve problems).

Observations of the students participating in mathematics in the mathematics specialist class were then made to note whether or not they engaged in the practices they had recognised as important for learning mathematics (espoused theory). The criteria used for the class observations was developed from data collected during the individual interviews. Two group interviews were then conducted; one interview with students from the higher achieving group and one with students from the lower achieving group. During the group interviews the data collected during both the individual interviews and the observations sessions, in relation to ‘best practice,’ was presented. This provided an opportunity for the researcher to check the students’ interpretations of espoused theory and theory-in-use and explore some aspects further. The differences between students’ espoused theory (what they said they did) and theory-in-use (what they actually did) were acknowledged and discussed. Students then had the opportunity to consider what this study had identified in regard to their learning, and set goals for their future learning.
RESULTS

Espoused Theory

During the individual interviews the students were asked to identify the important classroom practices or actions that enabled them to learn mathematics successfully. Observed practices in the mathematics specialist class, prior to the interview sessions gave ideas for prompts about best practice. Both the higher and lower achieving groups noted the same range of practices. The most commonly identified practice by both groups was that of listening to the teacher explain something. Table 1 shows the number of students identifying each practice.

<table>
<thead>
<tr>
<th>Behaviour / Action</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listening to the teacher explain something</td>
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<td>8</td>
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<tr>
<td>Having time to think about the problem</td>
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<tr>
<td>Working with others to solve problems</td>
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<td>10</td>
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<tr>
<td>Listening to how other children solved the problem</td>
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<td>6</td>
</tr>
<tr>
<td>Asking the teacher for clues</td>
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<td>4</td>
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<tr>
<td>Asking other children about the problem</td>
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<td>5</td>
</tr>
<tr>
<td>Getting the answer yourself or in your group</td>
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<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Using equipment to solve problems</td>
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<td>2</td>
</tr>
<tr>
<td>Explaining how you solved the problem to others</td>
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<td>1</td>
</tr>
</tbody>
</table>

Key:  [ ] Higher achievers  [ ] Lower achievers

Table 1: Most important classroom practices

The practices students listed during the individual interviews were practices valued and promoted by the mathematics specialist teacher during class session. The teacher was observed waiting for all students to listen before she gave the instructions for the days work. She would remind students that the equipment was there for their use and
encouraged them to collect it as they needed it. She would often use the term ‘in your groups’ when setting tasks and ask students to share their ideas or solution paths with others. These teacher practices were observed during both the higher and lower achievers sessions with the mathematics specialist teacher.

**Theory-in-use**

Observation of students during a regular mathematics session allowed for their theory-in-use to be compared with their espoused theory. The criteria for these observations sessions was based on the practices identified by students during the individual interviews. As the students were in two classes (extension class - higher achievers and support class – lower achievers) the tasks chosen for observation were of a similar type although at different levels of difficulty. Practices observed that matched the students espoused theory are noted in Table 2.

<table>
<thead>
<tr>
<th>Problem Solving Task</th>
<th>Higher Achievers</th>
<th>Lower Achievers</th>
</tr>
</thead>
<tbody>
<tr>
<td>The school grounds are to be used for parking at an upcoming event. What is the best parking arrangement that can be used to make the most money?</td>
<td>Containers have arrived at the wharf holding a combination of vans, trucks and cars. Using the information provided, find all the possible combinations of vehicles in each container.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Espoused Theory Observed</th>
<th>Higher Achievers</th>
<th>Lower Achievers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listening to the teacher explain something</td>
<td>Listening to the teacher explain something</td>
<td></td>
</tr>
<tr>
<td>Listening to how other children solved the problem</td>
<td>Listening to how other children solved the problem</td>
<td></td>
</tr>
<tr>
<td>Working with others to solve problems</td>
<td>Getting the answer yourself or in your group</td>
<td></td>
</tr>
<tr>
<td>Getting the answer yourself or in your group</td>
<td>Having time to think about the problem</td>
<td></td>
</tr>
<tr>
<td>Explaining how you solved the problem to others</td>
<td>Explaining how you solved the problem to others</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Observed practices

**Feedback Sessions – Group Interviews**

During the group discussion following the observation sessions the information gathered from both the individual interviews and the observations was shared with the students and discrepancies discussed.
WHAT HAVE WE LEARNT BY LISTENING TO PASIFIKA STUDENTS?

Pasifikal students in this study did not demonstrate the traditional behaviours linked to teacher / student interactions identified by Jones (1991) and Clark (2001). They saw listening to the teacher as important but not because the teacher held the knowledge they needed to learn. The Year 7 Pasifikal students claimed listening to the teacher meant listening to an explanation of a new concept or listening for instructions about the set task: “If you don’t listen to the teacher you won’t know what to do”. They also held the belief that if you only listened to the teacher you would not learn. As in the McCullum et al. (2000) study they recognised the importance of being involved in the learning, so listening to the teacher was only a starting point: “You have to do things as well as listen to the teacher, that’s how you learn”.

Students also saw asking the teacher questions as an appropriate action if you did not understand what you were being taught. In contrast to students in Clark’s (2001) and Jones’ (1991) studies the Year 7 students believed you could ask the teacher for clues, but not answers: “Ask for clues on how to do the question – clues not answers”. The lower achieving group considered this practice to have a higher level of importance than did the higher achieving group. This rating may be linked to students’ identification of sources of support. The lower achieving group identified the teacher as their second choice for support if having difficulty with mathematics, with parents being their first choice. The higher achieving group placed the teacher third, with parents and peers recognised as first choices for help when they required it.

Another behaviour noted as ‘best practice’ was that of listening to others. Students recognised that listening to how other students solved the problem was a way to hear different strategies. The importance of listening to others was justified by linking to the idea of building on one’s own list of strategies or by being able to help others, advantages also noted by the participants in Young-Loveridges’ (2005) study. Although both groups could justify the importance of listening to others, when this idea was explored further two other aspects were identified. The higher achieving group viewed the sharing of ideas (both listening to others and explaining your own strategy) as a way to clarify ones thinking through having to justify your answer, “It’s important to share your ideas and prove your answer”. They saw it as a time to compare ideas, and if ideas differed, a time for sharing their thoughts, thus clarifying their thinking. The lower achieving group also expressed the belief that listening to others allowed you to hear other solutions. They agreed that this might let them hear ‘better’ strategies than the one they were using, but they also claimed that by listening to others they were able to “check your answers” at the end of a session.

Year 7 students not only saw listening to others as ‘best practice’ but also claimed that working with others was important. Both higher and lower achieving students placed the same level of importance on this behaviour, but once these claims were investigated further a differing understanding of the ‘practice’ became evident. The higher achieving students believed that working together was an everyday practice where you bounced ideas off each other to understand and solve problems: “You need
to talk to others cause talking helps you work through understanding”. In contrast the lower achieving group saw this practice as one to use when you were having difficulty: “Like when you get stuck you can like co operate to get the answer”. Although the lower achieving group expressed a belief in the importance of working together, even if only when having difficulty, there was no evidence of them using this strategy when observed working in the mathematics class. When this discrepancy was discussed the lower achievers stated that they could not interrupt another person when they were working because they might stop them trying to remember something they needed to solve the problem.

Both groups had identified having time to think as ‘best practice’ although the higher achievers placed more importance on this behaviour than the lower achievers. Further exploration showed this was a practice also interpreted differently by the two groups. The higher achieving group believed that having time to think was important so that when you worked with other members of your group you had ideas to contribute to the group discussion: “Thinking about the question, like the one the teacher gives you, you need to think about it to be able to talk properly about it in your group”. The lower achievers saw it as a time to remember the mathematics (basic facts) or process (rules) that were needed to solve the problem: “You can’t remember things quickly, so you have to think”. They recognised that the higher achieving group did not have to do this (think of the mathematics) and therefore would be able to ‘talk’ more.

Although the original interviews provided a list of best practices that appeared to mirror that of the teacher, once further clarification was sought different understandings became apparent. Both groups of students believed they were using the practices valued and promoted by their teacher. This was shown to be true for the higher achieving group, but the lower achievers were found to have developed a very different understanding about what these practices entailed.

CONCLUSION

Everyone has beliefs about how learning should take place and what the best practices are to enable this to happen. The students in this study demonstrated that they had an understanding of practices that enabled them to learn mathematics. These practices included listening to the teacher, listening to others, having time to think, working with others and asking the teacher for clues; ‘best practices’ that on the surface mirrored those of the mathematics specialist teacher. Both higher and lower achieving students identified the same practices, but by exploring their beliefs further a different picture of what students in each group perceived as ‘best practice’ emerged. Through comparing espoused theory with theory-in-use and then allowing students to justify the differences, a better understanding of how these students saw learning was able to be built. If we really want to understand our students as learners we need to look at both what they say and what they do, then work with them to identify the reasons for any differences.
References


