Respectful and Responsive Pedagogies for Mathematics and Statistics

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Teacher respect, important within culturally responsive practice, has seldom been explored in relation to mathematical pedagogy. Our study involving interviews, surveys, and lesson videos with Year 12 and 13 New Zealand mathematics students and teachers indicated specific pedagogical behaviours are important for demonstrating respect for students and their learning. Respectful teachers provide opportunities for mathematical decision-making, follow chains of reasoning with individuals, and sensitively guide next learning steps. Implications for practice include knowing individuals' learning needs and prioritising one-to-one interactions.

Teachers showing respect for their students as people and as learners helps nurture students' academic and personal confidence and develops culturally responsive and caring classroom communities (e.g., Bishop, Berryman, Tiakiwai & Richardson, 2003; Gay, 2010). Teachers' respect for their students was a recurring theme in our earlier work that explored teacher-student relationships in secondary mathematics classrooms (see Averill, 2009, 2012; Averill & Clark, 2006). Respect has an important place as an integral part of the curriculum and school education in many countries (e.g., Australian Association of Mathematics Teachers, 2006; Australian Curriculum, Assessment and Reporting Authority, 2012, 2013; National Council of Teachers of Mathematics, 2008; Ontario Ministry of Education, 2004, 2009). Respect is also strongly emphasised in New Zealand's curriculum (Ministry of Education, 2007) and education policy. *Ka Hikitia*, the Ministry of Education's (2008) Māori education strategy, *Tātaiako*: *Cultural competencies for teachers of Māori learners* (Ministry of Education, 2011), and the *Pasifika Education Plan* (Ministry of Education, 2009) all emphasise respect for students, indicating that teacher respect is vital for improving our teaching of those often underserved, Māori and Pacific students.

Developing respect for others and students feeling respected are key themes in literature focussed on effective teaching and educational equity (e.g., Alton-Lee, 2003; Cornelius-White, 2007; Gardner, 2009; Gay, 2010). Teachers show students respect through the professionalism and dispositions they display, such as holding and conveying high expectations of students' learning (e.g., Hattie, 2009) and acknowledging students' individuality and cultural knowledge (e.g., Bishop & Berryman, 2006; Meaney and Evans 2012). Given that values, beliefs, priorities, and perceptions vary across ethnic and cultural groups (Banks, 2006) and that classrooms in New Zealand, Australia, and internationally are increasingly multi-ethnic, students' and teachers' perceptions of respectful pedagogy are also important to understand. How respect is shown and developed through pedagogies used in specific curriculum areas is vital for informing classroom practice, policy, and curriculum implementation, and for ensuring students experience respectful teaching.

Here we report on on e aspect of our wider study into teachers' and students' perceptions of how teachers demonstrate respect within senior secondary mathematics and statistics classrooms (Averill & Clark, 2012). We found that a combination of professional

and interpersonal behaviours and pedagogical practices are important for conveying respect. Here we present results from our re-examination of the data, this time focussing directly on how respect is demonstrated and experienced in relation to mathematics teaching pedagogies.

The Study

The study participants were 127 students and six teachers from four Year 13 and two Year 12 mathematics and statistics classes across three large multicultural middle to high socio-economic urban schools. Full ethical approval was gained for the study. Schools perceived by the researchers to emphasise respect for others were invited to participate. The mathematics heads of department were each asked to identify two teachers of Year 12 or 13 mathematics who they believed nurtured respectful relationships with students, and all invited teachers agreed to be involved. The teachers were New Zealand European (4), Pacific Nations/New Zealand European (1), and Asian (1). Student participants were New Zealand European (72), Asian (36), Pacific Nations (10), and Māori (9). A socio-cultural stance was taken for the study. The study data included surveys (all participants), semi-structured interviews (36 students and four teachers) and video recordings of two lessons with each class (12 lesson videos). To examine participants' views on the relative importance of a range of ways of teachers showing students respect, the surveys included closed, open, and 5-point Likert-scale questions. Semi-structured interviews were used to probe participants' views. Students were interviewed in self-selected pairs or individually according to student preference, and teachers were interviewed individually. The videos were made to capture respectful acts as they happened during mathematics instruction. We analysed the survey, interview, and video data independently to determine initial themes regarding the respectfulness of specific teacher behaviours and then determined common themes using the results of the separate analyses. Validity of the analysis was enhanced using member-checking through gathering teacher participants' feedback on the collated survey data, a draft of the final results, and draft publications.

Findings

The results indicate that a range of pedagogical practices impact on students' feelings of being respected by their teachers when learning mathematics. Discussion of our findings in relation to how mathematics and statistics teaching pedagogy can portray respect follow. All names are pseudonyms. Percentages indicate the proportion of students indicating a pedagogy or behaviour as 'very respectful' or 'respectful' on Likert scale questions.

Preparing for mathematical challenge and listening

'Being well prepared for teaching' was seen as respectful by 95% of students and by all teachers, showing the teacher "cares about" and is "serious about" students' learning. The following vignette shows how one teacher was preparing her students for challenges they were likely to face in solving a problem. The teacher explains and checks for understanding. She avoids 'cold-calling' by asking for answers from students who have shown they want to respond (seen as respectful by 92% of students) and uses revoicing to affirm and extend students' thinking:

Teacher: I have deliberately left question c) somewhat ambiguous. "When was the water 10m up the cliff?" What is ambiguous about question c)? (Miriama indicates she has an answer) Miriama?

Miriama: Because there could be more than one answer.

Teacher:	There could be more than one answer. Why could there be more than one answer?
James:	Because the tide goes up and down.
Teacher:	Because it goes up and down and the cycle repeats itself. So if you are answering an assessment task and it was ambiguous, what would you do? (Sally indicates she has an answer) Sally?
Sally:	Define how you are interpreting the period.
Teacher:	Good thinking.

The vignette above provides other examples of how teachers can show respect to students that are valued by students – commenting positively on students' answers (seen as respectful by 92% of students in questionnaire data) and teacher questioning (drawn from interview data), which will be discussed further in the next section.

Enabling mathematical decision-making

Students' responses indicated that teachers can show students respect by enabling their mathematical decision-making ("some people like to figure it out for themselves, you kind of want to think it about yourself"). This result illustrates that teachers providing problem solving methods and solutions too soon (i.e., before students have had their own opportunities to think through the mathematics for themselves) can be disrespectful. In contrast, teacher questioning (as in the next vignette) can show teacher respect for students as mathematics learners by enabling shared or guided mathematical decision making and shared responsibility for lesson content and pace. Discussions such as the example in the vignette show the teacher's respect for her/his students as novice mathematicians through the teacher eliciting their responses and enabling their explanations to be heard. Following a sequence of related questions and responses with one student at a time shows respectful teaching by enabling students to elaborate on their earlier responses:

Teacher:	OK, from this point (gestures at a graph on the board), what do we need for the equation? What is the basic equation that we start with?
Alana:	y = a cos b(x + c) + d.
Teacher:	OK, you've chosen cosine there. Why did you choose cosine?
Alana:	It's easier to start with the maximum.
Teacher:	It's easier to start with the maximum and the maximum is pretty handy on this graph. Could you have chosen sine though?
Alana:	Yes.
Teacher:	OK, so we need each of these features, a, b, c, d. Where do we find a? Chris?
Chris:	The amplitude?
Teacher:	The amplitude; how do we find it?
Chris:	Uh, it's half the distance between the max and min.
Teacher:	So we want the distance between the maximum and the minimum, so we go 12.5… (teacher pauses to elicit the next part of the response from the student)
Chris:	minus 8.7, divided by two.

Questioning can show students that the teacher believes in students' ability to answer and explain their thinking. Students feel respected when the teacher listens to them. It "gets me motivated" and gives "[me] a chance to explain myself"; "if a teacher listens to you, you feel respected":

[Teachers should] listen to the students' point of view because some people may see a question one way where other students may see it another. (Student)

Students stated that their teachers show respect for students' mathematical ideas by "asking what we think", "encouraging [us] to think for themselves", "giving [us] time to explain", "considering", "expanding, discussing, and using [students' ideas]",

"encouraging group discussions", "having students present work on t he board", and "giving useful feedback".

These results indicate that pedagogical practices that can convey teacher respect for students include encouraging students to problem solve (as opposed to providing, and having students work through, given methods), questioning, allowing time for mathematical thinking and decision-making, probing individuals' thinking, and listening to and building on students' thoughts and answers. They afford opportunities for students to actively engage in mathematical sense-making and for their mathematical skills and understandings to be acknowledged.

Providing mathematical assistance

Students felt that teacher respect was shown through teachers 'providing feedback on answers and errors' (indicated as 'very respectful' by 92% of students), and commenting positively on their answers ("showing what you're saying is important"). Teachers can also show respect for students' mathematics learning by providing one-to-one help and feed-forward, one student saying "things that help respect are checking with each student how they are going". Similar to the student's comment above regarding wanting to think the mathematics through for themselves, some students stated they appreciated assistance that encouraged and helped them to work out problem solving strategies:

> One way [of teachers showing respect] is if I have a question the teacher will help me answer it but not give me the answer straightaway. They'll help me to know how to answer the question and not just give me the answer. (Student)

The next vignette, of a teacher working with a small group, provides an example of a teacher demonstrating respect for students through the teacher eliciting student thinking rather than providing a direct answer. The students were working on a sampling problem in the context of an apple orchard which had a range of different growing conditions. They were asked to determine and justify a sampling method, then to use their sampling method to find specified statistics. The vignette also shows the teacher using open questions to check for progress and explaining her practice, other ways of showing respect for students' mathematics learning:

Teacher:	OK, now, do you know what you are doing now?
Jamie:	Yes, we've been discussing it, but we haven't totally decided. Should we use systematic sampling?
Teacher:	Well, I don't necessarily agree with that actually being the best method for this. I just decided we'd do systematic sampling in the example with the whole class for the previous question because it is random and I thought I'd get a nice even spread. And we can do it with this example too, but what's wrong with that? What is less than ideal? How representative is it? What do you notice?
Stacey:	Well, if we use a small number like every third tree, we'd end up with a much bigger sample than using every ninth.
Teacher:	And that's why you consider that interval sort of idea, to help work out which number to use for the counting for the systematic sampling. But… also… there's the river (pointing to diagram), and there's the road (pointing to diagram), and we're talking about the number of apples on the trees, so, is getting every 9th tree using a systematic sample representative of the population? What's wrong with that sampling method that might not be so ideal for this context?
Marama:	There could be like more apples on the trees in different places, like by the river? And there could be fewer apples on some of the trees in different places.
Teacher:	Yes, so what's here? (T points to river on the diagram) What's around a river? So, we can say it is representative because it is random, but maybe there are important

differences in groupings and strata that we should consider as well though to ensure the sample is truly representative?

The following quote shows a teacher providing students with an opportunity for individual support, showing that he shares responsibility for their learning and that he cares that they are making progress. In addition, he provides flexibility over a d ue date, respecting that his students' other commitments also take time:

> This [worksheet] I want completed and handed in hopefully on Monday. Obviously those people who want a bit longer working on this stuff will need more time, so if I don't end up getting it until Wednesday, that's fine, but I want to know that you guys have got this stuff sussed, so I need something handed in. You should be able to get half of it done today in class. (Teacher)

In describing respectful classroom behaviours, students put more emphasis than their teachers on such constructive treatment of student errors. Students appreciate their teachers treating them respectfully when they make mathematical mistakes, indicating that they feel support and targeted guidance are suitable teacher responses:

> If you say an answer that is wrong, [it's not respectful] to tell you it's wrong and be rude about it; they could tell you are on the right track, then help you out with your answer a bit more. (Student)

The next vignette from a Year 13 t rigonometry lesson illustrates a respectful and supportive teacher response to a public student error. The teacher paused for the student to identify their mistake, and then provided prompts to assist their thinking so that they could self-correct:

> Teacher: OK, what is the easiest way to find the time taken?
> Henare: Well, I don't know if it is the easiest way, but the way I found it was by… (long quiet pause) oh, I think I got it wrong…
> Teacher: That's all right, correct yourself if you can see it… (long quiet pause).. It should be reasonably straightforward. We've done all the hard work by finding the solutions for 10 metres, so what time is between here and here? (teacher gestures to the graph on the board).
> Henare: That's 10.23 and 5.37. I could make that into 24 hour time.
> Teacher: We've got 10.23 to 5.37. It is hard to count time over 12 o'clock isn't it, but yes, we could take it through to 17.37 if that would help.
> Henare: 7 hours and 14 minutes.
> Teacher: Does that complete the answer to the question? What do we still need? (pause) That bit and that bit is going to add up to?
> Henare: We need to double the 7 hours and 14 minutes… 14 hours and 28 minutes.
> Teacher: Yes, Are we there?

Verbal one-to-one interactions (such as those within class teaching as above) as well as those in written form (e.g., individual feedback and feedforward on students' work) provided opportunities to treat student errors sensitively, foster learning-focussed relationships, and maximise the relevance of learning-focussed interactions to individuals, all helping to show teachers' respect for their students.

Students held differing and mixed opinions regarding whether or not it was respectful for teachers to offer them mathematics help outside of class time ("it shows they are willing to go out of their way to help you" / "makes you feel dumb"). Similarly, a range of views were held regarding teachers asking for input when students had not shown they had something to say ("it gets you involved" / "I hate that. If I don't have my hand up, I don't know the answer."):

> When the teacher asks someone for their answer they can be quite disrespectful as it's up to the student to want to share their answer; however, it's also quite respectful as they're taking an interest in their learning and their answers and ideas. (Student)

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Similarly, marking hard was seen by students both as respectful ("because it's showing that you are able to do it properly") and disrespectful ("it can give negative results as students think they're not good enough"). In contrast, students generally viewed lenient marking to be disrespectful ("it shows they have low standards of you and they think you can't fully cope with the questions").

Mathematics teaching suitable for individual learners

Consistent with the literature (e.g., Hattie, 2009), holding high academic expectations of students was described by teachers and students (78%) as very respectful ("pushing us to excel", "pushing us to try harder", "it shows they believe in us, and we should do the same"). Students found teachers giving clear signals and checking for understanding respectful. Both teachers and students emphasised that teachers keeping strongly focussed on their students' mathematics learning was important for conveying respect:

> I show students that I treat them with respect by making sure they know that if they are not sure… they should feel free to ask and see that I readily help them out. I prefer to run the class time as productively as possible so that students can show me that they understand the work. (Teacher)

The next quote conveys the teachers' urgency and signals the lesson's beginning, starter activity, and its place in the learning programme:

> Right, we will make a start. One extensive revision question to start with today. This is the last day we are going to be spending as a whole class going over modelling – writing the equations and answering questions from the equations. (Teacher)

The teacher interviews included emphasis on showing students respect through knowing them as individual learners, and enabling them to work at their own pace:

> …probably giving them time to work at their own pace as much as you can within a structure that you have to move the class forward, and trying to spend time with each student but with a larger class like this that's hard... (Teacher)

Teachers discussed the importance of learning about their students as individuals ("…if you accept that all the kids in your class want to learn… then if we have to understand our differences along the way, well, that's just part of the process"). Knowing individuals' learning needs well is also essential to show respect by maximising learning time and progress as it avoids students having to "listen to stuff when they've already understood it quite a long time ago":

> Things that probably would hinder respect is assuming the whole class is at the same speed, 'cause it could be quite annoying in some classes if you don't understand stuff and they are just going on ahead. (Student)

Similarly, students explained that teachers could make them feel disrespected by ignoring, rushing, or undermining their learning; "[respectful teachers] don't shut you down straightaway, 'cause if they shut you down or put you down, it's not good." Students appreciated their teacher using mathematics learning contexts of interest to them and asking them about their learning preferences:

> Interviewer: What indicates to students that the teacher respects them?
> Student: Maybe if they keep asking the students questions like 'oh, do you prefer doing this?' or 'do you prefer me writing stuff on the board or giving out sheets?'

Three of the teachers stated that to show respect for students they felt they should be using learning tasks that incorporated students' cultures and out-of-school activities, but

that they had more difficulty doing so in their senior mathematics and statistics teaching than they did when teaching younger students.

Discussion, Conclusion, and Implications

Mathematics learning is challenging for many students. Reducing barriers to mathematics learning is essential, particularly for students traditionally underserved in our education systems and schools. This study builds on work of others who have identified the importance for students' learning, and for culturally responsive teaching, of students feeling respected by their teachers (e.g., Australian Curriculum, Assessment and Reporting Authority, 2013; Gay, 2010; Cornelius-White, 2007; Ministry of Education, 2011). Understanding respectful pedagogies is vital for teachers and teacher educators to enable them to work in ways that are consistent with such research and reflect education policy strongly in their work, helping ensure our mathematics learners feel respected.

The study participants found describing respectful practice challenging, responding that they felt it easier to describe *dis*respectful actions and behaviours. Our study sheds light on respectful mathematics and statistics pedagogies, indicating that those that can convey respect include: careful preparation for instruction, including attention to potential cognitive sticking points; seeking and responding to students' questions, answers, and comments sensitively and constructively; making and capitalising on opportunities for students to make mathematical decisions; and providing assistance and support in ways that maximise students' mathematical agency. Examples of respectful pedagogical practices in the context of mathematics teaching and learning such as those provided here add important detail to the literature regarding how respectful teacher practice can be effectively employed in mathematics and statistics classrooms. The variation found within the student data highlights the need for teachers to be aware that pedagogical decisions (e.g., marking methods and assistance) are likely to be interpreted differently by different students. To know individual students sufficiently well to ensure the behaviours teachers intend to be respectful are seen as such, teachers must strategically engage with each student, determine students' learning preferences, be open about their teaching decisions, and be responsive to students' mathematical and pedagogical opinions and perceptions.

Implications of this study for teacher educators include the need for explicit teaching about respectful pedagogical practice to enable teachers to understand its importance and ensure their practice both is, and is perceived by their students as, respectful. As a final consideration, the findings in our wider study indicate that for mathematics and statistics students to feel respected, respectful pedagogical practices must be supported by respectful professional and dispositional teacher behaviours (Averill & Clark, 2012). As one student said "there is no one thing; it takes lots of small things that build to give you respect." Understanding respectful pedagogies for mathematics and statistics learning contribute to our understandings of those small, but very important, things.

Acknowledgements

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