Raising Equity through Culture-fair assessment: A Sociocultural Perspective
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Abstract
This paper proposes that equity in relation to assessment is more of a sociocultural issue than a technical concern. In exploring ways to address the underperformance of Indigenous students in mathematics achievement the concepts of culture fair assessment and culturally responsive pedagogy are analysed. This study investigates how teacher awareness of ways to use assessment data formatively and their understanding of the literacy demands of mathematical assessment tasks are fundamental to promoting Indigenous student participation. The importance of the teacher's knowledge of the Indigenous students' ways of knowing, and being, for the achievement of successful teacher-student relationships is also emphasised.

Introduction
The context and background to the important issue of assessment and equity in relation to Indigenous students in Australia is given first. The paper draws on the first phase of a design experiment of an Australian Research Council (ARC) Linkage project that is examining questions about the validity and fairness of assessment. Ways forward are only beginning to emerge from a sociocultural approach to assessment that is considered to be culture-fair (Berlack, 2001).

Patterns of under-achievement by Indigenous students are reflected in national benchmark data (NAPLAN) and international testing programs like the Trends in International Mathematics and Science Study (TIMSS 2003) and the Program for International Student Assessment (PISA) that is discussed at the outset. The approaches developed highlight how teachers need to distinguish the 'funds of knowledge' that Indigenous students draw on and how teachers need to adopt culturally responsive pedagogy to open up the curriculum and assessment practice to allow for different ways of knowing and being. The research is only in its infancy so the findings are only tentative at this stage.

Context and Background
This paper is based on an ARC Linkage research project that is examining equity issues as they relate to the validity and fairness of assessment practices. The Industry Partners are Catholic Education Townsville and Independent Schools Queensland. The study aims to provide greater understanding about how to build more equitable assessment practices to address the major problem of underperforming Aboriginal and Torres Strait Islander (ATSI) students in regional and remote Australia. The aim is to identify ways forward by attending to culture-fair assessment.

Patterns of under-achievement by Indigenous students are reflected in national benchmark data and international testing programs like the Trends in International Mathematics and Science Study (TIMSS 2003) and the Program for International Student Assessment (PISA). Inequity in Australian education has occurred in the relationship between social background, and achievement, and participation in post-compulsory schooling (McGaw, 2007). A trend of underperformance in terms of equity

has continued over the past six years as evident from the comparative analyses of the Program for International Student Assessment (PISA) results, first administered in 2000, again in 2003, and in 2006. Although caution must be taken to avoid the invalid uses of the results of large scale tests there is consistent data across all levels – school, state, national and international to conclude that Australian schools are not addressing equity issues effectively (Sullivan, Tobias & McDonough, 2006) with Indigenous children scoring significantly lower than non-Indigenous children (Lokan, Ford & Greenwood, 1997).

Theoretical Underpinnings
The research adopts a sociocultural perspective on learning that views learning as occurring as part of our everyday experience as we participate in the world. This theory of learning does not view a separation between contexts where learning occurs, and contexts for every day life, rather these are seen as different opportunities for learning (Murphy, Hall, McCormick & Drury, 2008: 6). It is important to underscore this shift in view to the participants, the activities that they engage in, and the actions that they undertake using the resources and tools available, and moves away from the view that sees the individual as the determinant of learning. As Murphy and colleagues (2008: 7) stress when they cite McDermott (1996) "… we can only learn what is around to learn." It is therefore important from this view of learning to ensure that students feel as though they belong in a classroom of learners and have access not only to learning experiences but also to assessment tasks that are designed to develop their understanding through their participation in problem solving activities and the like.

Research Focus
This research is particularly timely and necessary against the background of Australia's underachievement in terms of equity for Indigenous students and the lack of an informed strategy in the Education sector to counter this trend. The key research questions are:
- What are the properties of teacher constructed mathematics **assessment tasks** that are culture-fair?
- What are the **culturally-relevant assessment practices**, as enacted in classrooms using these mathematics tasks, with a significant number of ATSI students?
- Does the use of culture-fair mathematics assessment tasks lead to **improved learning for ATSI students** as measured by the national statements for learning, the national Numeracy Benchmarks and 3 and 5 numeracy testing?
- In a standards-referenced context how can teachers **develop their assessment capacity** so that more appropriate support and assistance is given to Indigenous students to improve their learning?

Research Design
Two important understandings underpin this research. First is the urgent need for more culture-fair assessment tasks and practices and second, issues of teacher judgement and interpretation of assessment data. School performance data in Queensland (http://www.qsa.qld.edu.au) indicate that gender, race, cultural and socio-linguistic backgrounds, socio-economic demographics combine to impact on student achievement.

This project is using numeracy data for ATSI students in Years 3 and 5 to analyse current teaching and assessment practices. The case study Northern Queensland, Catholic and Independent schools (8) have a relatively higher proportion of ATSI students than schools in the south. The focus is on primary Year 4 and middle school Year 6 classes. The numeracy data for each school is being used to identify exemplary teaching and learning practices and the areas requiring support. The extent to which these teaching and assessment practices are effective in promoting achievement for ATSI students are being analysed and interpreted using qualitative and quantitative data analysis. National numeracy data is also being used to measure success and is supplemented by additional measures of achievement from the assessment and learning tasks, developed, moderated and reported.

The project is a 'design experiment' (Kelly, 2003) that involves several cycles of design and development of assessment tasks and eight case studies to identify theoretical principles and design implications for application of culture-fair assessment practice both within and beyond the immediate study.

In this first year of the study there are three schools and two teachers from two schools (a Year 4 and Year 6 teacher from each, one of the latter has a Year 6/7 class) and four from the third school (two Year 4 and two Year 6 teachers). There are therefore eight teachers involved in the first phase of this project. The teachers were asked to select students (preferably Indigenous) to focus on for this study. The total number of Indigenous students is 22 comprising, 14 Year 4 students and eight Year 6 students.

Phases of the Project
There are three phases to the research. The first phase is focused on establishing and developing the culture-fair assessment tasks and culturally-relevant pedagogic practices with these initial three schools. This process requires the iterative development of culture-fair assessment tasks, the culture-fair learning and assessment task development resources, and the in-service teaching of the teachers and the community. The intent is to develop principles through the following processes that include first, a comprehensive review and synthesis of relevant literature. Second, is the analysis and design of the assessment tasks. This is occurring collaboratively with the teacher sample, the mathematics specialists (who are the professional developers) and the Indigenous colleagues. Third, quality assurance of assessment tasks is occurring in collaboration with the teacher sample and assessment experts. Fourth, the researchers are documenting the implementation of the assessment tasks by the teachers and are collecting artifacts of student work and online teacher exchanges for analysis. Finally, the researchers are conducting student and teacher interviews. It is this phase of the project on which is the focus and given the limitations of space this paper will be restricted to the teacher development processes.

The second phase of the research project involves the extension of the development and implementation of the culture-fair assessment tasks and culturally-relevant pedagogic practices in 2010 to include a further five schools. The final phase in year three (2011) involves an evaluation of the implementation of the culture-fair assessment tasks, the culturally-relevant pedagogic practices and the learning outcomes.

Data Collection

In this first phase of the project the collection and analysis of data focuses on the culture-fair properties of the teacher designed assessment tasks, the cognitive and affective outcomes of these mathematics assessment tasks and learning resources, and the effectiveness of the development program in building teachers' capacity to use and develop assessment tasks that are more culture-fair. Data is being collected and analysed from the following sources: semi-structured, telephone interviews of teachers; focus group interviews of students; achievement data (from the NAPLAN 2008 results) and ethnographic observations.

The Professional Development Program
A series of professional development sessions have been organised for the primary teachers from the three schools. The two principal investigators (a Program Officer in Numeracy/Mathematics, from the Association of Independent Schools in Queensland (AISQ) and an Indigenous, Senior Education Officer from the Townsville Catholic Education Office) designed and developed the professional development program based on identified needs from previous research (Warren & de Vries, 2007). The focus of each professional development session has been developed to align with the demands of the Mathematics curriculum. The topics are number, chance and data, and patterns and algebra.

Teachers are also participating in regular workshops (every 6 weeks) designed to develop their skills in the use of a software package developed by HeuLab entitled Fun With Construction™ (FWC). This is an interactive digital web-board that enables students and teachers to use virtual construction tools such as compasses or protractors. It is a teaching tool for teachers and it includes the facility to record students' and/or teachers' conversations as they are using the program. It is intended that data related to the students' learning processes and problem solving strategies will be collected from this data source. The technical consultant has established a wiki on the website developed for this project. Each teacher has access to this site and to files and resources that have been developed specifically for this project (http://arc1.wikispaces.com/). The teachers are receiving regular in classroom support in using FWC and have access to the website where they can download resources and communicate with other project teachers and the research team.

The teachers have selected Indigenous students where possible to shadow their development for the purposes of this research project.

Indigenous Protocols and Procedures
At the first of the professional development mathematics sessions, the teachers from the project schools participated in a workshop focused on Indigenous cultural protocols and practices. The Indigenous Senior Education Officer, led the teachers in a discussion designed to raise their awareness of Indigenous culture and in particular the cultural protocols and cultural practices that teachers need to be aware of when interacting with Indigenous students and families.

In the articulation of the teachers' understanding of the cultural protocols and practices the primacy of relationships, and the need for teachers to build relationships with the families of their Indigenous students, were emphasised. This led to a discussion of the

'whole school approach' that involves two-way interaction between the school and community. That is, the school going out to participate in the community and members of the community coming in to participate in the life of the school. Indigenous protocols, practices and the whole school approach were presented as pillars that support the school's curriculum.

Table 1 Indigenous cultural protocols and practices aligned to Catholic Education Policy in Northern Queensland

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Cultural Protocols and Practices
- **Equal Opportunity** – each child is given the opportunity to become an effective learner
- **Include the community** – invite Indigenous community to conduct welcome to country or acknowledgement of country at school functions, build relationships by sharing personal stories
- **Acknowledge different perspectives** in communication – includes languages, knowledge and ways of working
- **Acknowledge Indigenous culture** – traditional, lore (values and beliefs), intellectual and moral property and cultural rights
- **Maintain connections with Indigenous communities** – engage traditional owners and elders, collaborate with Indigenous staff members as a resource
- **Honour cultural dates and events** - no segregation of rituals and family relationships, respect community celebrations such as NAIDOC
- **Acknowledge cultural dates and events** - Celebrate history, use Indigenous resources, ATSI flags, NAIDOC, invite Indigenous story telling

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When asked to explain how these cultural protocols and practices were enacted in practice, teachers were able to provide clear examples. Some of these included:
- Maintain interconnections such as acknowledging the close community between school family and home family

- Be culturally aware, some examples, given were to ensure that after funerals there is no reference to names of the people who have died, honour the mourning process, and acknowledge that the older brother takes the role of protector of the younger

- Include community through community projects such as the class café where Indigenous family members visit the school

- Recognise cultural differences in terms of the language used at home and adopt different modes of communication such as email, letters and oral language

- Be aware of particular behaviours such as in welcoming, eye contact, body stance.

Structure of the Program

The teacher development program involves regular visits to the project schools by visiting mathematics specialists and members of the research team. In February 2009 the principal investigator from AISQ led the first maths session on effective strategies for teaching the topic of number to Year 4 and Year 6 students, and included a focus on pedagogical strategies for Indigenous students.

The importance of changing pedagogy to incorporate hands on games and activities, to make use of eye contact and to increase the use of oral language to engage ATSI students in the learning of maths, rather than simply teaching didactically from the text book, were emphasised. It was also acknowledged that students (especially in the early years) need to see and hear the words, feel the sound of the language, and their parents need to be aware that this helps them to learn.

Particular focus was given to the NAPLAN Numeracy Test and the development of teaching strategies to effectively prepare all students for this test. It was explained that the NAPLAN test writers have to work within a framework that must include written literacy and numeracy incorporating: reading, comprehension, oracy (such as discussion), numeracy (such as calculation, graphics) or visual literacy or numeracy (such as diagrams, graphics and the like).

The language used in NAPLAN tests can be difficult for students to decode and understand. To illustrate, test items are often phrased in the negative whereas in the classroom and in the textbooks the language used is positive. It was suggested that teachers teach using the language used in the NAPLAN tests.

The issue of cultural inclusivity in relation to the NAPLAN tests was also addressed. NAPLAN tests are not currently culturally inclusive and this impacts on the Indigenous and LOTE students' performance in the tests.

Difficulty understanding test language and interpreting the graphics results in poor performance for all students. The graphical representations that appear routinely in numeracy testing have been analysed by Diezmann, Lowrie, Sugars & Logan (2009) and include the following:

Axis language - vertical or horizontal axes
> Number lines, temperature gauge, number tracks

Opposed position language – vertical and horizontal axis
> Grids, calendars, graphs

Retinal list language – rotated shapes
> Marks not related to position

Connection language
> Tree diagrams, network diagrams e.g. flow charts

Map language
> Road maps, topographic maps, scale in maps (Year 7 students often have difficulty with scales in maps)

Miscellaneous language
> Venn diagrams (often tested), circle graphs e.g. clocks

A study of graphical representations of the Mathematics tests in Years 3 and 5 over the past 11 years identified that opposed position language was used in 67% of tests and axis language was used in 11% of tests (De Vries, 2009). These statistics highlight the necessity for students to learn how to read and interpret these graphical representations so that they can access successfully the literacy (and/or the literacies) demands of the test items. Teachers also need to show students the many different ways in which the graphics can be used to represent opposed position language such as are used in calendars or temperature gauges.

Implications for Pedagogic Practice
A number of pedagogical strategies were recommended to the teachers and some were identified as being more culturally appropriate. For example, it was recommended that teachers read the questions aloud and instruct students to highlight key words. It was further suggested how students might adopt a process of elimination with multiple-choice answers. To engage Indigenous students more interactive, 'hands on' activities were suggested. Teachers were further asked to encourage the students to attempt every question or activity and to encourage students to deconstruct the question or item and then to talk about the process or strategy that had been used in completing it. Further suggestions included being more creative in the use of textbooks by opening up discussion about certain questions and giving more open-ended questions so students are required to solve problems. Further it was suggested that students learn from their peers and teachers were encouraged to provide opportunities for students to not only complete whole class or small group activities but to also engage in individual problem solving.

Inclusive practices were advocated and to begin it was emphasised that teachers should commence with an activity where all children could experience success and have fun in doing so. Sequential steps could then be introduced to build on number facts introduced and to gain confidence in answering questions and solving problems. Teachers were given clear guidance in how they should implement these strategies. To illustrate: "make a poster of different question stems and use them in the classroom. Students can put post-it notes onto the poster when they use a particular question stem." Teachers were further instructed to incorporate into their daily and weekly teaching activities certain practices such as the use of the discourse of testing, the deconstruction of test items so that students develop familiarity with the language of testing and the types of test questions or mini investigations.

A final activity was the use of number games to be completed for homework so that parents or caregivers can engage and encourage the enjoyment of mathematics learning both at home and at school.

The Chance and Data Professional Development Program
In early April another Mathematics consultant from a Brisbane university visited the project schools and worked with the teachers in their classrooms. He conducted demonstration lessons in the curriculum areas of chance and data, highlighting the use of concrete materials, real-world contexts, and the use of oral language in the

classroom. His teaching of chance included concepts of randomness and long-term results and involved interactive activities. His lesson on data included collecting, organising and representing data which he illustrated using a number of quick class surveys focused on:

- the number of children in the students' families
- written surveys of favourite ice-cream flavours, pizza toppings, sandwiches, movies, TV shows.

The teachers were encouraged to continue to use the games and activities to further develop concepts in chance and data and to encourage the students to articulate their thoughts and strategies in class.

Teachers' Implementation

The telephone interviews of the teachers sought to investigate:

- the extent to which the teachers had implemented these activities and strategies into their classroom practice and
- their views on how effective the strategies had been in assisting students' learning of the maths concepts that the tests and tasks are designed to assess.

Given the focus on culture-fair assessment the teachers were also asked the extent to which the professional development sessions had raised their awareness either in terms of culturally fair assessment or culturally responsive pedagogy.

All teachers (8) interviewed were very positive about the number strategies and activities and 25 – 50% indicated that they had used particular strategies/activities. However, only five teachers were interviewed regarding the chance and data professional development session and of these only two seemed very positive. One had already used some of the activities and the other had not as the preparation of students for the NAPLAN tests in May took precedence. This teacher was very open to using the ideas/activities once NAPLAN was over. She has a combined Year 6/7 class. The feedback from the other two teachers was mixed. One teacher indicated the limited time spent in her classroom by the consultant (forty minutes) although she had employed games to teach her students maths concepts she had not used those that had been demonstrated. The other teacher indicated that her class had not been taught the chance and data topic as yet and therefore the activities were not appropriate to be implemented at this stage. She had already learnt some of the activities at university during her preservice years and so indicated that she had not really learnt anything new.

The Software Program

At this stage of the project it is difficult to make a fair assessment of the value of the software program given that at one school the software had just been loaded on to the computers and in the other two schools the software had been loaded on to the teachers' laptops but not on to the classroom computers. Consequently only four of the teachers were positive about the potential for the use of this program in their classrooms. The teachers indicated that they did not have much opportunity to either learn the software themselves or to use it with their classes.

Two of the teachers had used a buddy system to teach the program to the students. That is, the teacher taught one student and then that student taught another and so on. They had also used it as an activity in a maths rotation lesson that had worked well. Two teachers used the program to draw and measure shapes however there were numerous perceived limitations given by the other teachers such as their limited experience with the software, the view that the program was not child-friendly, that it was time consuming, confusing and had limited use. Three of the teachers stated a lack of time as a major reason for not using the program. Yet despite the lack of activity, overall the teachers were more positive about the program than when previously interviewed.

A teacher who had used the program most was someone who had been very negative about it in the first round of interviews. This teacher was the only one who had uploaded her Maths Program for Term 2 onto the wiki site and had downloaded two activities that she planned to use with her class. She also commented favourably on the homework activities on the site and said that she was going to use them with some of her students.

Conclusion
These are early days for this project however the anticipated outcomes from the assessment and pedagogic approaches under development will advance knowledge to include more culture fair assessment practices. There is much data to be collected and to be more theoretically analysed. The view of equity, that underpins this assessment project, is that of a sociocultural perspective. Equity involves much more than a consideration of the specific design of the tests or tasks. As can be seen from the initial data collection and analysis whether all students have access to learning is fundamental, how the curriculum is defined and taught and how achievement is interpreted are equally important considerations. The opportunity to participate in learning (access issues) and the opportunity to demonstrate learning (validity and fairness in assessment) are deemed fundamental factors in developing culture-fair assessment (Klenowski, 2009).

The differential performance of students from different cultures may not be due to bias in the choice of test content or design alone, but may be attributable to real differences in performance because of these students' differing access to learning, different social, cultural contexts or real differences in their attainment in the topic under consideration due to their experiences and sociocultural background. As is apparent from the professional development program organized for this design experiment the content and mode of the NAPLAN assessment tests are outside these students' experiences and they limit their engagement with the tests as they position them as not knowledgeable in this particular assessment context.

The intention of culture-fair assessment is to design assessments so that no particular culture has an advantage over another. The purpose of culture-fair assessment is to eliminate the privileging or particular groups over others. It is however difficult to claim that assessments can be completely culturally unbiased. To achieve culture-fair assessment there is a need to address issues in language, cultural content, developmental sequence, framing, content and interpretation and reporting. The sampling of the content for assessment, for instance, needs to offer opportunities for all

of the different groups of students who will be taking the test. Assessment interpretations of students' performance need to be contextualized so that what is, or is not, being valued is made explicit as well as the constructs being assessed and the criteria for assessment. To achieve culture-fair assessment the values and perspectives of assessment designers need to be made more public. Further to understand how culture-fair assessment practice is developed and attained requires this careful study of how the learning experience is modified by teachers for particular students to achieve engagement, participation and improvement in learning. Such pedagogic and assessment approaches to improve young Indigenous Australians' educational performance will help them succeed in schooling and in developing skills for a more secure economic, social and cultural future.

References

Berlack, H. (2001) Race and the achievement gap, *Rethinking Schools Online*, 15 (4). Retrieved October 31, 2008, from: http://www.rethinkingschools.org/archive/_04/Race154.shtml

de Vries, E. (2009) Power Point Presentation, Cloncurry, Queensland.

Diezmann, C., Lowrie, T., Sugars, L. & Logan, T. (2009) The Visual Side to Numeracy: Students' Sensemaking with Graphics, *Australian Primary Mathematics Classroom,* Vol 14, No 1, 16-20.

Kelly, A. E., (2003) The role of design in research. *Educational Researcher,* 32 (1), 3-4.

Klenowski, V. (2009) Australian Indigenous students: addressing equity issues in assessment, *Teaching Education,* 20, 1, 77-93.

Lokan, J., Ford, P. and Greenwood, L. (1997) *Math and science on ling: Australian middle primary students' performance in the Third International Mathematics and Science Study,* Melbourne, Australia: Australian Council for Educational Research.

McGaw, B. (2007, August 1). Resourced for a world of difference. *The Australian,* p. 25.

Murphy, P., Hall, K., McCormick, R. & Drury, R. (2008) *Curriculum, learning and society: Investigating practice. Study guide, Masters in Education.* Maidenhall, UK: Open University.

Sullivan, P., Tobias, S., & McDonough, A. (2006) Perhaps the decision of some students not engage in learning mathematics is deliberate. *Education Studies in Mathematics,* 62 (1), 81-99.

Warren, E. & de Vries, E. (2007) Australian Indigenous students: The role of oral language and representations in the negotiation of mathematical understanding. In J. Watson & K. Beswick (Eds), *Proceedings of the 30th annual conference of the Mathematics Educational Research Group of Australia.*, Australia: MERGA Inc.