UNDERTAKING AN ARCHAEOLOGICAL DIG IN SEARCH OF PEDAGOGICAL RELAY

Robyn Zevenbergen[1]
Griffith University, Australia

Steve Flavel
Consultant
stevef@upnaway.com

Abstract:

In this paper we discuss a method through which it becomes possible to identify elements of practice that constitute the learning environments of school mathematics. Through this process it becomes possible to identify those elements of practice that may contribute to the success (or not) of students, particularly those from backgrounds which are traditionally marginalised through school practices.

INTRODUCTION

Why is it that some students are more at risk of succeeding in school mathematics than others? And of those who are not successful, who are they and why are they more at risk of not succeeding. Historically and traditionally, success and failure in mathematics have been described within two main discourses. The first is that of innate ability where there is some inherent feature of intelligence that predisposes the student for success. The second ties strongly to work ethic whereby there is potential for less able students to be successful but through considerable 'hard work' and 'determination'. These two discourses dominate perceptions as to why students are successful or not. Yet as critical educators, such as Apple (yr) argued, there is a strong correlation between success and background. Within these discourses, this correlation is not seen as problematic as it supports the hegemonic distribution of capital and resources. It plays into the reproduction of the status quo. In this paper, we seek to challenge this position and argue that the practices through which mathematics is taught and learned position students in particular ways so that the status quo is reproduced. What becomes critical is for teachers and educators to understand the hegemonic practices of school mathematics. Far from being overt, such practices are subtle and coercive which is how they remain below the education radar and remain relatively impervious to change. One way in which the critical examination of practice can occur is through what we call an "archeological dig".

---

[1] Professor Robyn Zevenbergen, Centre for Learning Research, Griffith University
E-mail: r.zevenbergen@griffith.edu.au

***The Montana Mathematics Enthusiast*,** ISSN 1551-3440, Monograph 1, pp. 63-74

Drawing on Bernstein's notion of the pedagogic relay, we argue that both mathematics and culture are relayed to students through the pedagogical practices adopted in mathematics classrooms. Through the teaching of school mathematics, teachers enculturate students into particular ways of seeing and acting in the social world. Some of this is mathematics, some of it culture – where culture can be seen as mathematics culture but of a middle-class, Western form. Thus for students whose culture is not that of the pedagogic relay, coming to learn mathematics is as much about mathematics as it is about the hegemonic culture being relayed through the school mathematics discourse.

For Bernstein (2000), the pedagogic device regulates pedagogic communication through various rules and structures. He argues that the pedagogic device "constituted the relay or ensemble of rules or procedures via which knowledge (intellectual, practical, expressive, official or local knowledge) is converted into pedagogic communication" (Singh, 2002,p.573). This is achieved through three rules - *distributive*, *recontextualising*, and *evaluative* which are interdependent but hierarchical. The distributive rule serves to distribute knowledge (and power) differentially among groups so as to produce different pedagogical identities. The recontextualising rule shifts the pedagogic focus from the original discourse (in this case mathematics) into a new form (for example, everyday discourses such as those found in "real-world problems"). As the work of Cooper and Dunne (Cooper & Dunne, 1999) have poignantly shown this recontextualing rule has implications for who is able to access (decode) the discourse and respond appropriately to questions posed in mathematics examinations. The third principle, evaluative, defines what is seen as the valid acquisition of knowledge.

LEARNING AS A SITUATED ACTIVITY

Learning has often been construed as an individual activity that occurs within the head of the learner. This individualist position has been challenged over recent decades to one which is far more holistic and situated within and across contexts. By reconceptualizing learning to be an activity that arises from tensions between various factors, then a more comprehensive view of the complexity of leaning becomes possible. It has been widely recognised that coming to learn mathematics is as much about the mathematics per se as it is about the culture of mathematics. For students whose culture aligns with the practices of school mathematics, learning is not so difficult. In contrast, for students whose culture is different from that represented in and through mathematics practices and discourses, learning is far more complex since the cultural incongruencies are rarely explicitly acknowledged or even known. This makes it difficult for many educators to make explicit the invisible cultural messages contained within the practices and discourses of school mathematics.

The approach that we advocate in this paper draws on the epistemological position originating from the work of Vygotsky where learning occurred between an object and subject through the effects of a mediating device. Engestrom (2001) refers to this rudimentary approach to activity theory as first generation activity theory. Engestrom (2001) has developed this individualistic model to a more social model where learning becomes far more connected to the community within which it occurs. Internal contradictions become an integral component of the model and as cultural and social aspects of learning become embedded in the model, a third generation of activity theory becomes needed. The object of this more expanded model of activity theory is to consider learning as an activity which is situated in an "entire activity system in which the learners are engaged" Engestrom, 2001, p.139). In considering the practical application of this theory to learning within a mathematics classroom, learning at the first level is where students come to acquire the knowledge of what constitutes a correct response in the classroom. The second level is where students come to learn the hidden curriculum of

mathematics classrooms – what constitutes appropriate knowledge and how to express that knowledge. This is most often represented in the responses given in examinations where students are assessed on their mathematical knowledge but to be able to respond appropriately requires access to much more than the mathematics per se. The third level of learning comes about when students come to question the hidden assumptions about learning and knowledge so as to construct a much broader understanding of mathematics where the cultural, social and historical biases of the curriculum become known and expressed.

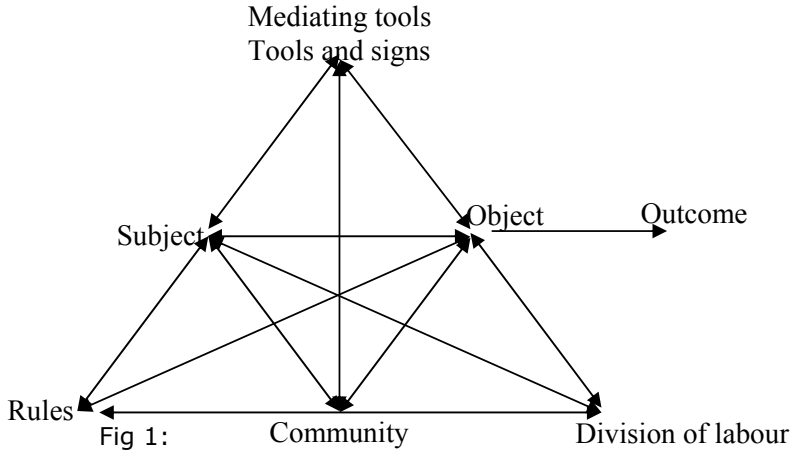

Fig 1:

What can be interpreted from the model is that the subject (the student) interacts with objects (learner's understandings of mathematics) through the mediating tools (which can be equipment, computers, pedagogies, and the symbolic systems and semiotic systems of schools mathematics). This top triangle is that which is usually representative of the initial work of Vygotsky. However, the model where the lower part of the larger triangle is considered, a much richer theory of learning can be developed. When considering Indigenous learners being placed in school mathematics classrooms, the community of schools and their communities become incorporated into the model. Similarly, the rules of the activity become a focus where issues such as values, the culture of school mathematics, and issues of assessment and other forms of accreditation become incorporated. The final aspect to consider in this larger representation is that of the division of labour where the roles of the participants (learners, teachers, elders) become part of the considerations. Stevenson (2003) describes the elements of the model thus:

> abilities contributing to the enterprise are the *objects* or motives of the collective activity"…. The subjects are those in the activity system working together towards this motive for example, the learner, teacher, [students, teacher aides, and elders]. Together, and with others who share the same common motive, [e.g. education authorities, members of the local region, business people] would make up the *community*. The collective teaching and learning activity is mediate by a large variety of *instruments* (tools) (e.g. equipment, materials, teaching and learning theories…manuals, texts). It is also mediated by rules if they adopted (cultural norms fo the setting), by the ways in which the activity is organized (division of labour) and the community involved in the setting. (249-250)

each of these elements interact with others as teachers go about their craft. Working in one aspect impacts on the others. If a teacher, for example, decides to develop new resources that embody aspects of the cultural group with whom she is working, then these tools will

mediate the teaching and learning processes. In so doing, it may well be that the resources (tools) undergo other transformations as the teacher learns more about the potential of the resources. The new resources may also impact on the rules of the activity. As the resource may require greater interaction among the students (where the interaction had been previously individualistic) then new rules for the activity will emerge.

When working in reform classrooms such as those identified by Boaler, the activity in the classrooms has been radically transformed in a number of the elements of the activity. Teachers designing tasks that embrace higher level thinking and engagement among students, change the rules of interacting within the classroom so that new rules have to be developed. Similarly, the changed expectations of students have created changed circumstances for the activities that are undertaken – students need to engage with different mediating tools – tasks, hands-on activities, performance assessment – which create changes in the objects.

To develop quality learning environments for students who traditionally have been excluded in and through the study of school mathematics, it is recognised that many features of school mathematics work against their success and participation.

ARCHAEOLOGICAL DIG

To uncover the cultural aspects of mathematics, we have coined the term 'archeological dig' as it is much like the digs undertaken in particular sites where the role of the archeologist is to uncover the ways of the world from the remnants left behind by the antecedents. By digging through the remnants left in classrooms, artifacts can reveal much about the culture of the site. Just as the archeologist digs, delves and dusts through obscure items in search for keys to unearth the mysteries of the culture to which the items belonged, so too the process can be adopted for classrooms. We suggest that there is, among all the varied forms of archeologists, is the ethno-archeologist whose task becomes one of searching through classroom artifacts to predict the cultural dimensions of mathematical classrooms.

Using an activity theory approach to understanding the archeology of a classroom enables us to unearth the antiquities of the classroom and in so doing make some observations about the potential learning made possible through that site. In this case, the artifacts that are uncovered through the dig can be seen as evidence of the mediating tools through which the teacher sought to facilitate learning.

Using the metaphor of the classroom being an archeological site, we contend that the principles offered through the archeological tradition enables us to think about the possibility of interpretation of artifacts and how such artifacts were used by the constituents of that community. For example, in a prehistoric dig, how does the archeologist interpret the use of devices that are unearthed, how do these provide insights into the ways of life of the participants. Excavating through the myriad of clues being unearthed, the archeologist continually uncovers clues that enable the construction of life at the time of that culture. The historicity of the site provide clues as to how life was lived at that particular point in time. Similarly, by unearthing the artifacts in a classrooms, the ethno-archeologist is able to make interpretations of the practice of that classroom.

As classrooms vary considerably in how spaces are organized, the use of space becomes a clue as to the approaches used by the teacher. This, in and of itself, provides clues as to the teaching practices and discourses that influence the culture of the classroom. If a simple analysis of classroom and school design are tracked over time, it becomes possible to interpret the mediating tools – in this case theories of teaching and learning – that permeated practice. Small classrooms with no or minimal storage space were common in

the early 1900s but many contemporary classrooms now have multiple classrooms connected with folding doors, withdrawal rooms and separate wet/cooking areas. At other times, team teaching was seen as a preferred model of teaching so classrooms were created as large spaces in which teachers shared students and resources. But as digs in these classrooms often show, teachers often 'create' walls to divide the shared spaces so as to create individual classrooms. Such changes in spatial configurations provide clues for the archeological dig as to the views of the participants on how best to organize for learning. Not withstanding the spatial constraint that classroom teachers have little or any control over, there is still some indicators as to how they come to organize that space that provides insights into the learning environment. We recognize that each classroom will be constrained by the physical space so in identifying a systematic approach to the archeological dig, we propose that various aspects of classrooms offer potential sites for collection of information. Below is a suggested list of what these sub-sites may be and what evidence may be found within these sub-sites.

Site	**Artifacts**
Teacher's Desk	Student record books, teacher note book, student work, teacher resource books, forms, OHTs, laptop, calculator, whiteboard markers, pens, assessment items, record books, professional journals, syllabus documents,
Student Resources	Writing instruments, books for recording work, text books, mathematical equipment (e.g. protractors, rulers, compasses, calculator), laptops, calculators, PDAs, MP3s, mobile phones,
Equipment Area	Books, teaching aids and resources, reproducible items such as worksheets, computers and other digital media,
Displays	Commercial posters, student work, teacher-made prompts, chalkboard/white board, data projector screen, concrete items (rocks, leaves, dolls, etc),
Classroom resources	Books, Chairs and tables (configurations), computers, laptops, internet connection, chalkboards, flip charts, interactive white boards,

Table One: Potential artifacts to be found in a mathematics classroom

In the following sections of the paper we draw on work we have been undertaking across a number of classrooms to explore the notion of the archeological dig. We present a compilation of a number of classrooms in which we have worked where the classrooms are in traditionally disadvantaged contexts. In presenting these classrooms as an amalgam, our intention is to illustrate the richness and potential of this method.

Triangulation: Keystone to Valid Interpretations

We recognize that it is not possible to collect artifacts and ascribe attributes to them. The archeological dig can only rely on artifacts, there is no scope for interview or follow up. Just as the archeologist can not ask the Mayan how they undertook particular astronomical observations, this must be interpreted from the evidence collected. Where multiple sources of evidence offer similar or same interpretations, a more accurate representation or interpretation can be made of the site. For example, if books were found that focused on

the implementation of particular computer technologies and yet no computers were found in the classroom, no digital displays strung across the room, no entries into the teacher's work plan or no evidence of student work in their desks, then it is increasingly likely that the teacher did not engage with this mediating device as a potential for student learning. Conversely, where there was substantial and multiple sources of data that illustrated the use of digital technologies being used to develop, enhance, extend and/or document student learning, then there is a greater chance that this pedagogical tool was an integral part of that classroom. For us, this triangulation between data sources is key to the approach, in that it provides rigour to the analysis and eventual conclusions about the classroom.

MEDIATING TOOLS IN THE DIG SITE

In undertaking a dig within a classroom, the mediating tools are often the first to be uncovered. These tell-tale toolmarks are not only evident in the concrete resources that are unearthed but also in the mediating signs and semiotic systems found in the classroom. The concrete resources include books; teacher planning documents; mathematical and digital resources as discussed in Table One. However, as meaning is made through the cultural message system – that is the discourses used within the classroom, other forms of analysis are also needed. Through careful analysis of resources such as student work samples, student work books, videos, displays in the classroom, it becomes possible to identify the discourses and discursive practices that come to make up the classroom. For example, many Indigenous students come to school speaking their home language which may not be a legitimate one for school language. In some cases, students may speak a number of different languages before they come to school so that the school language is just another language. Multilingualism is common among indigenous students living in remote areas of Australia. How teachers who recognize this diversity of language (and culture) can be identified through the artifacts found in the classroom. For example, some teachers encourage a bilingual classroom that displays both school language and home language signifiers (words) against particular signifieds (concepts) are evidence that the teacher encourages a bilingual classroom where the language and the culture of the learner is valued.

Background to Issues in Indigenous Education

Indigenous students' world views are often very different from that represented in school mathematics. From the outset, the world view of most Indigenous cultures is one of quality and relationships rather than quantity (Watson, 1988). In her work with Yolgnu people of Arnhem Land, Watson (1988) provided very detailed analysis of the complex networks developed by Yolgnu people that provided frameworks on how they saw the world and acted within the social world. Documenting the recursion in these networks she argued that this was a very different organization of the social world from that of the decimal recursion found in Western number systems. Similarly, she documented the ways in which these people also 'sang and signed' the land through cultural and social markers thus creating very different maps than those of Western traditions. In studying time, Harris (1990) documented the qualitative aspects of various people from northern parts of Australia. She shows very different constructs of time and the passing time – where units of time are natural divisions (seasons, night/day); where time is cyclical, and where time is an event. These conceptions of time are in stark contrast to the linear and measured calendars of Western cultures. Such students show the stark differences in how people come to organize and understand their worlds. Such understandings create very different ways of mathematizing the world.

Language is a key aspect of the teaching process. Many Indigenous students coming into Western classrooms are multilingual with school English being a third or other language. Cracking the code of mathematics is as much about learning the language of the subject as

it is about the mathematics *per se* (R. Zevenbergen, 2000). When teaching mathematics, teachers need to be aware of the specific language of school mathematics and make this explicit to students in order that they can access the concepts. In observing a very astute teacher of Indigenous students, it was noted that teaching language to multilingual students is a key pedagogical tool (R. Zevenbergen, Mousley, & Sullivan, 2004).Learning takes place within social contexts. The social rules and norms which govern and shape the interactions within these social contexts are bounded by various aspects of culture. Rules of who speaks when shape the discursive interactions of those participating in dialogue. Indigenous people often have oral cultures so that talk is an important part of how they come to see and position themselves. Respect for elders is a key aspect of many indigenous cultures so that the relationships between speakers can be constrained by the rules of status. Similarly, in some indigenous cultures, judgments of learning are not made by the answers given to questions but by the questions that are posed by the learner. Malin (1990) argued that indigenous families encourage independence in their children so that many of the customs adopted in schools (such as asking to go to the toilet) are seen as 'begging' by indigenous people.

For students coming to learn school mathematics requires an explicit recognition that this represents a significant different way of learning but also a very different way of seeing, organising and translating the social world. Western mathematics is premised on a very different set of cultural assumptions than many indigenous cultures. Within Australian Indigenous cultures, there is a strong tendency to see the world within a qualitative framework and where networks between objects/people is fundamental to the social world. It is a most common introduction among indigenous people to find out where a person comes from, who is her/his family so that a set of networks and connections can be developed between the speakers. This is a very different worldview from Western societies where the emphasis on quantity. In these cultures, number is more important –for example, when talking with young children one of the first questions posed is most frequently about the age of the child, how many siblings, their ages and so on. These very different world views significantly shape how the social world is organised so that coming to learn school mathematics for students whose world view is very different from that represented in and through school mathematics, becomes a task of constructing new ways of seeing and viewing the social world. As such, learning school mathematics is not so much about coming to learn numbers and shapes but about a very different orientation towards the world.

A MYTHOLOGICAL EQUITY CLASSROOM

Drawing on our work in classrooms in general and equity sites in particular, we construct a mythological dig on what may be uncovered in a classroom where the teacher was engaged in anti-racist (not the right word) teaching. In this classroom, the teacher drew on many resources to support her teaching and where the object of the lesson was mathematics. The outcome she sought was higher order mathematical thinking for her Indigenous students recognizing that the community wanted their children to be able to walk in both worlds – that of the Indigenous groupings to which they belonged but also have access to white, powerful knowledge. Elements of such classrooms include:

- High achievement
- High expectations
- Oral culture – appropriate communicative practices
- Quality use of technologies – digital and other
- Engagement
- Explicit criteria – students need to know what is expected of them
- Connected learning – connections with the culture of the students
- Integration of culture of students in a genuine partnership
- Recognition of cultural diversity

We are mindful that when conducting the dig, that evidence does not necessarily equate to quality practice. For example, finding a laptop on the teacher's desk does not necessarily mean that the classroom is technologically-rich. Other evidence will confirm or refute the approaches being used. For example, where there is evidence that students have been using computers to foster deep understanding, we would expect to see other sources to confirm deep learning. These could include computers scattered throughout the room, student displays, student work, newspaper clippings where students' contributions have been celebrated, prizes (state, national), etc. Other evidence of quality computer usage could include print outs of a data summary table and analytical report using appropriate software; computer generated representations in both electronic and printed form (graphs, tables, spreadsheets); and computer generated artefacts that support oral presentations (graphs, images, powerpoints). Collectively these artifacts provide the evidence to show that computer technology was an integral aspect of the classroom but also the pedagogical approach used by the teacher. As such, the multiple sources of evidence is key to being able to make valid claims about the approach being used by the teacher.

EVIDENCE FROM A DIG

In considering the dig, it is a collection of evidence at a given point in time. It is reasonable to expect that at any time, teachers focus on particular topics and alongside this topic are pieces of evidence to document student learning; the pedagogy that was adopted; the types of assessment that were used; ways in which the topic was linked to other areas of learning – mathematical, cultural, social. In presenting the data in the following section, we draw on our experiences across a number of classrooms. We do this intentionally to illustrate the approaches taken by a number of teachers as they move towards a socially inclusive classroom. However, we also add, that the data is used to illustrate the approach we are advocating.

In this section we discuss evidence that would be expected when an inclusive approach to teaching mathematics was adopted. Such an approach draws on high expectations that students can and will learn complex mathematics and where there is a recognition and embodiment of the cultural norms of the culture as part of the classroom practices. For many indigenous communities, there is a recognition that the community needs access to Western forms of knowing but this is juxtaposed with the concern that such knowledge can come as a cost to the indigenous culture. As such, many communities seek to adopt an approach where both cultures are part of the approach taken within schools.

Seating Arrangements

Students' desks were organized in small groups of 4 – 6. At each configuration, central collections of pens and other instruments were provided; cards with roles (leader, recorder, gofer) were placed in a packet on each set of tables. At each collections of tables, was one piece of large, white paper. Student marks (drawings, notes, figures, working out and writing) were on these papers. Writing was in different handwriting suggesting that individual students contributed collectively to the work. There was no evidence to suggest individual recording of work.

Student Constructed Posters

Posters made by the students are hung around the classroom. The topic - percentages – shows a deep knowledge of the concept where students have made links between the various representations. The examples they draw on are ones from their community – demographics of the population, statistics on community issues (wealth/poverty; health, etc). Stories are provided in a narrative and supported with pictures (photographs, drawings).

Student work

Students have individual crates that contain their work. These are placed to the side of the room as it appears that there are no assigned desks to individual students. The work in these boxes indicates the level of work and presentation of that work. The examples in books and on loose leaves of paper indicate high levels of mathematics being undertaken by the students. In many cases, these are embedded in multiple forms of representations. There does not appear to be any worksheet-type activities in the crates. In most crates, there are computer printouts of work where students have presented their learning in a narrative style and often taken to explain/justify their responses.

Teacher's Planning Documents

The teacher has a large folder in which she has her daily, weekly and term plans. The documents show the expected learning of the students. This is at the expected state levels of achievement and in some cases, exceeds state benchmarks. There is a high level of cultural 'sensitivity' in overt planning in teacher's planning documents. There is explicit recognition of the need to draw on culturally relevant experiences and resources. Notes indicate how she will involve members of the wider community in planning and implementation of rich tasks.

Teacher Resources

On the teacher's desk, there are a number of resource books. There are no schemes but resources that draw on a range of materials. There are some books published by the Western Australian Dept of Education on Indigenous Education (Department for Education of Western Australia, 1999) that outline issues of language and culture in the teaching of Indigenous students; resources created by other teachers in the area and shared through a network; books produced by other sources that outline issues (and statistics) for Indigenous communities; downloads from the web on aspects related to the Bush Medicine Rich Task.

Prompt Sheets

There are two main prompts being used in the classroom. As most students are multilingual and school English is a third or other language, there are many prompts that draw the synergies between the students' language and the mathematical concepts/language. The second prompts are sheets that outline the explicit criteria for work the students are doing. These prompts are useful to the students to enable them to unpack the demands of the tasks but equally important to aides and visitors to the room to access what the students are doing. The use of these resources enable students to be independent in their learning and not have to rely on teacher support for clarification of particular issues that might arise in the lessons.

Assessment

The teacher uses a format of rich tasks where the learning is expected to be transdisciplinary and draw on authentic experiences for the students. The next rich task that is being planned is for the students to plan and build a medicine garden in the school ground. There is substantial mathematics in the task ranging from spatial representations to budget management. There is community consultation and engagement, and the conduct of a survey. Elders will be invited to share their knowledge of bush medicine with the students and to be involved in advising the class on the foods to be planted. Elders will be a key part of the rich task as they will be the source of knowledge upon which the students will need to draw.

Computers

There are a number of computers in the room – some are scattered around the room, and a set of four are placed in one corner of the room. Two seats are with each computer suggesting that students work in pairs at the computer. Prompt sheets at each computer have a list of words (related to bush tucker) and some websites that have been found. These sites are in students' handwriting suggesting that students have found these sites and are sharing their knowledge with their peers. Another prompt sheet (the size of a small poster) is placed behind the computers and shows how to open and enter data on a spreadsheet. Visual prompts are used within this poster along with written instructions.

Physical Space

Room adjoining classroom has been made available for elders to come into the classroom/school. Chairs scattered around the room and tables where elders come and work with students on medicinal plants – drawing on their knowledge.

Biography – student of the week

At the front of the class there is a student of the week poster. It contains the biography of student includes photos of family, interests, where he comes from (family). There is a strong emphasis on his (extended) family. The reason for the award is also listed. In this case, the award was given for participating in out-of-school activity (something to do with community)

Class Portrait

A photograph of the class has been blown up on a large piece of paper. Students have drawn arrows to other students and written their relationship to the other person (cousin, sister, etc). Some students have made links that show their family or kinship links to other students.

Class Motto

A large runner has been made with successive pieces of paper joined together and painted with an indigenous design. This runner contains the school motto which represents a celebration of culture and strength – pride in being indigenous and that they can achieve well in school.

Photos of Parent Helpers

To the side of the room is a large pin board that contains photographs of helpers that support the classroom/school. In some cases it is of the person alone, in others they are with children or family. In each case, there is a text that joins the photograph that explains the ways in which the person supports the school. Family and community are strong elements of indigenous people. Recognizing the contribution of family in the school pays respect to those working with the education of their children.

Mathematical resources

While there is a large area adjoining the classroom which is often used in other contexts for storing materials, the teacher has all mathematical materials and equipment available in the room. These are placed in a section on the side of the classroom and displayed in a way that students easily can see the resources. A prompt sheet is with each box that lists its contents and reminds students to place the equipment back in the box so it will be there for the next student. Students are able to access these resources when they need them so they do not need to ask for permission or need to leave the room.

Attendance Roll

One of the biggest issues in indigenous education is the attendance of students in schools. Many indigenous students have considerable gaps in their learning due to non-attendance in schools. Some of this may be due to cultural issues – such as deaths in families where the family may need to attend a funeral a considerable distance from their home and then remain on to support the family. In other cases, non-attendance may be due to lack of relevance and purpose of Western education to Indigenous families so that non-attendance can be seen as a logical choice to an imposed curriculum. Where schools have turned around the provision of quality education to Indigenous communities, there has been a significant turnaround in attendance. Within an archeological dig, it would be expected that a relevant curriculum that engaged students would result in high attendance.

THE POWER OF THE ARCHAEOLOGICAL DIG

From this mythical dig, it becomes clear that there are a number of features that are reinforced. There are high expectations (mathematical) of the students as evident in the work being presented and the listed expected outcomes in teacher planning. These suggest that the teacher has expectations that the students can and will learn. This is a significant shift from other approaches that focus on deficit and impoverished models of learning. There is strong evidence of cultural recognition and its integral aspect of learning. This is evident in many aspects of this classroom from the students' work, through to teacher planning and the physical layout and resources in the classroom.

The data that can be collected from a classroom provides key insights into the pedagogic device adopted by the teacher/s. In the case presented in this paper, we illustrate the principles identified by Bernstein. In the artifacts identified in this dig we are able to make a number of recommendations. The teachers in these sites were clearly challenging the distributive rule that is common in classrooms working with disadvantaged students. Through the provision of high quality, high expectations and strong scaffolds, the teachers were seeking to shift the relationships of power so that the indigenous students were able to access rich forms of mathematical knowledge and knowing. While we are not able to make comment as to the success of the students in the longer term, the archeological dig provides evidence to suggest the quality of the learning environments in challenging the status quo. The recontextualizing principle was also evident in the ways in which teachers sought to make the mathematics culturally explicit to the students. Not only was the school mathematics a form of recontextualisation for Indigenous students – that is, it represents a very different worldview, teachers sought to make this recontextualisation principle explicit to the students so that they could decode the messages contained within the pedagogic relay. The evaluative principle was evident in the forms of assessment being used by the teachers. Using tasks that enabled the students to represent their forms and ways of knowing mathematically in discourses and practices with which they were highly conversant and in the contexts that were enabling, created opportunities for students to demonstrate their understandings in ways that were culturally relevant and enabling.

REFERENCES

Cooper, B., & Dunne, M. (1999). *Assessing children's mathematical knowledge: Social class, sex and problem solving*. London: Open University Press.

Department for Education of Western Australia. (1999). *Two-Way English: Towards a more user-friendly education for speakers of Aboriginal English*. Perth: Edith Cowan University.

Engestrom, Y. (2001). Expansive learning at work: toward and activity theoretical conceptualisation. *Journal of Education and Work, 14*(1), 133-156.

Harris, P. (1990). *Mathematics in a cultural context: Aboriginal perspectives on space, time and money*. Geelong: Deakin University Press.

Malin, M. (1990). The visibility and invisibility of Aboriginal students in an urban classroom. *Australian Journal of Education, 34*(3), 321-329.

Singh, P. (2002). Pedagogising Knowledge: Bernstein's theory of the pedagogic device. *British Journal of Sociology of Education 23*(4), 571 - 582.

Stevenson, J. (2003). Integrating approaches to developing vocational expertise. In J. Stevenson (Ed.), *Developing vocational expertise: Principles and issues in vocational education* (pp. 247-265). Sydney: Allen and Unwin.

Watson, H. (1988). Language and mathematics education for Aboriginal-Australian children. *Language and Education, 2*(4), 255-273.

Zevenbergen, R. (2000). "Cracking the Code" of Mathematics: School success as a function of linguistic, social and cultural background. In J. Boaler (Ed.), *Multiple Perspectives on Mathematics Teaching and Learning.* New York: JAI/Ablex.

Zevenbergen, R., Mousley, J., & Sullivan, P. (2004). Disrupting pedagogic relay in mathematics classrooms: Using open-ended Tasks with Indigenous students. *International Journal of Inclusive Education., 8*(4), 391-405.