

# Exploring Whether Multiple Intelligences Facilitate ‘Valuing and Working With Difference’ within Mathematics Classrooms

Fiona Jackson  
Griffith University  
<fionajackson@aapt.net.au>

Raymond Brown  
Griffith University  
<ray.brown@griffith.edu.au>

This paper employed observational and interview data to explore how Gardner’s Multiple Intelligences *points of entry* assist teachers in catering for student diversity within primary mathematics classrooms. Drawing upon a sociocultural research approach the study found that Gardner’s multiple *points of entry* facilitate some ‘valuing and working with difference’ within classrooms.

Catering for the diverse needs of students within primary school mathematics classrooms is becoming more relevant than ever. Statistics show that Queensland’s population is becoming increasingly diverse (Department of Education Training and The Arts, 2006). However, the Queensland School Reform Longitudinal Study (2001) study showed that ‘valuing and working with difference’ was virtually non-existent in many primary classrooms. At an international level, Boaler’s (2007) research noted that teacher’s pedagogy can unknowingly portray the mathematical ideas of the dominant culture and undermine concepts from non-dominant cultures. To this end, teachers need to identify and embrace teaching strategies that value all students’ backgrounds, both socially and culturally to ensure that students are successful within mathematics classrooms (Cobb & Hodge, 2002).

In mathematics classrooms, ‘difference’ has mainly been identified as differences in ‘ability’ and addressed by teachers through ability grouping strategies. However, research shows that ability grouping has negative effects on the social and personal development of students in the lower ability groups (Hallam, Ireson, & Davis, 2004; Zevenbergen, 2003) and that low-income minority students are disproportionately represented in these groups (Boaler, 1997). In addition, there is evidence that mixed ability within-class grouping is more effective in attaining high standards of outcomes for *all* students (Jones & Bouie, 2000).

Howard Gardner’s Multiple Intelligences (MI) framework offers a possible strategy for addressing the ability grouping issue because MI theory acknowledges individual difference as a resource rather than as a problem and looks at pedagogical and contextual differences to recognise, respect and respond to student differences. In particular, Gardner’s (1999) six *points of entry* places the onus on the pedagogical activity of teachers rather than on the individual differences of students.

Gardner’s MI theory has been positively employed in practice by many concerned educators that have experienced first-hand that all students do not learn in the same way, feeling it promotes a more balanced approach to education in the context of a standard classroom (Kornhaber, 2004). In response to some Multiple Intelligence misconceptions, two of Gardner’s books *The Unschooled Mind* (1991) and *The Disciplined Mind* (1999) address how MI can be adapted to the education environment whereby teachers can use multiple *points of entry* (hooks) to approach a lesson or a topic to reach students differing ways of thinking. Gardner’s *points of entry* approach is different to his general intelligence theory whereby he identifies that students have nine ways of thinking because the *points of*

entry shift some of the responsibility of learning from the students onto the teacher's practice.

This paper explores whether Gardner's Multiple Intelligences six *points of entry* (see Table 1), when used as part of teachers' pedagogical practice, support and add value to *all* students within mathematics classrooms. In particular, it looks at how teachers present the meaning of a mathematical topic or concept and evaluates these ways in terms of how they build on the diverse backgrounds and experiences of students.

Table 1  
*Gardner's six points of entry (Gardner, 1999)*

Multiple Intelligence	Description
Narrative	As its name suggests, this entry point uses personal stories as the central theme to explain the topic.
Numerical or Logical	Focuses on numerical aspects or logical reasoning to explore the quantitative aspects of a topic.
Aesthetic	Engages artistic or sensory features associated with a topic.
Experiential	Provides opportunities for students to be 'hands-on' to learn about a topic.
Interpersonal	Involves students working and interacting together to learn about a topic.
Existential	Deals with fundamental inquiry questions about a topic.

Inherent in Gardner's *points of entry* framework is the belief that all students enter school with different knowledge that is influenced by background, experiences and cultural practice. Therefore, it leads to the possibility that when teachers use Multiple Intelligences *points of entry* within a mathematics classroom that the diversity of students may be recognised and valued.

## Methodology

The methodological approach adopted in this study (Jackson, 2008) drew upon qualitative research principles and practices based on Vygotsky's (1987) theory of learning and development. The research method was passive participant observation (Key, 2001) which included semi-structured interviews and classroom observations within three mathematics classrooms at a co-educated Independent Primary School. The analytical approach taken was thematic analysis for manifest content as opposed to latent content (Wallen & Fraenkel, 2001). The emergent themes from the analysed data were compared to the literature review to help explore the research question "Do Multiple Intelligences facilitate 'valuing and working with difference' within mathematics classrooms?"

The participants in the study consisted of three female teachers responsible for year one, year two and year four classes. The year one teacher had been teaching for seven years and her class had thirty students; eighteen boys and twelve girls. The year two teacher had five years teaching experience and also had thirty students; sixteen boys and fourteen girls. The year four teacher had twenty-five years experience and she only had eighteen students; ten boys and eight girls. The year four class was a 'streamed' mathematics class where the students showing the lowest mathematics ability (according to

school records) were grouped. These eighteen students were taken from their ‘normal’ grade four classroom and brought together to form a new class for mathematics.

## Analysis and Results

The findings of the study were realised through synthesising two pedagogical frameworks; Gardner’s *points of entry* (Gardner, 1999) and the Productive Pedagogies ‘valuing and working with difference’ dimension (Education Queensland, 2002). The interviews and classroom observations were tabulated and analysed to provide parallel evidence in relation to the ‘valuing and working with difference’ elements and Gardner’s six *points of entry*. This allowed connections between the two frameworks to be observed and commented upon systematically.

Table 2 summarises the number of instances that all three teachers were observed acknowledging each *point of entry* and ‘valuing and working with difference’ element. The predominant *points of entry* observed were numerical/logical, interpersonal and existential. The narrative *point of entry* was not evident during any of the classroom observations and the aesthetic *point of entry* did not feature in any of the interviews or classroom observations. The Productive Pedagogies that featured strongly during all the classroom observations were inclusivity, group identity and active citizenship. The ‘valuing and working with difference’ element narrative, was observed only twice and cultural knowledge was absent from all classroom observations.

Table 2

*Summary of Data From all Three Teachers’ (T) Interviews and Classroom Observations*

	Interviews with teachers				Classroom Observations			
	T1	T2	T3	Total	T1	T2	T3	Total
<i>MI Points of Entry (POE)</i>								
Narrative	2	2	5	<b>9</b>	0	0	0	<b>0</b>
Numerical or Logical	5	1	5	<b>10</b>	6	6	2	<b>14</b>
Aesthetic	0	0	0	<b>0</b>	0	0	0	<b>0</b>
Experiential	5	3	1	<b>1</b>	2	1	4	<b>7</b>
Interpersonal	10	7	20	<b>37</b>	5	6	9	<b>20</b>
Existential	2	4	5	<b>11</b>	2	5	6	<b>13</b>
<i>Valuing and Working with Difference (VWD)</i>								
Cultural Knowledge	5	4	2	<b>11</b>	0	0	0	<b>0</b>
Inclusivity	5	17	10	<b>32</b>	2	8	11	<b>21</b>
Narrative	2	0	4	<b>6</b>	0	2	0	<b>2</b>
Group Identities	5	7	13	<b>25</b>	6	5	8	<b>19</b>
Active Citizenship	8	3	9	<b>20</b>	4	2	6	<b>12</b>

The year four teacher (T2) data will now be discussed in more detail. The data analysis is based on two sets of information; the interview data (Table 3) and the classroom observation data (Table 4). Only a sample of questions and responses from the data are shown here.

Table 3  
*Sample of Interview Transcript and Analysis Chart for Teacher 2*

Question	Line	Response	POE* Observed	VWD** Observed
2. What ethnic backgrounds do your students come from?	01	We probably have seven or eight		Cultural knowledge
	02	different types of ethnic background		
	03	if not more. We are very		
	04	multicultural.		
3. How many have English as a second language?	01	Yes, two of them have English as a		Cultural knowledge
	02	second language.		
5. How would you describe the diversity of the students in your class?	01	Well, because we are the lower		Cultural knowledge
	02	mathematics group, we do have more		
	03	behaviour issues. There is such a		
	04	huge range of function skills, so the		
	05	diversity of how their maths thinking		
	06	is quite diverse.		
	07	I do feel very passionate about these		
	08	kids, particularly this group and		
	09	bringing them up with their self-		
	10	esteem. When they first came into my		
	11	classroom, they were beaten. It was		
	12	very sad.		
7. When you are planning a maths unit of work or a lesson, how do you consider the students' ethnic backgrounds?	01	I honestly haven't thought about it		Experiential
	02	much in maths.		
	03	We're going to have visual learners,		
	04	auditory learners and there are kids		
	05	that have to have concrete materials		
11. What type of student grouping do you encourage?	01	Oh, we'll do whole group, pair up,	Inter-personal	
	02	we'll do threesomes.		
	03	As far as skill level, I will pull		
	04	different kids that are at the same		
	05	level and put them together to narrow		
	06	that group down even further.		

\* Points of entry \*\* Valuing and working with difference

Table 4 shows a fifteen minute segment of the ninety minute classroom observation along with the MI *points of entry* and 'valuing and working with difference' elements that were observed. The overall purpose of teacher 2's lesson was for students to understand why graphs are drawn to represent data. Each student was given a box of raisins and asked to predict then count the number of raisins in their box. The students then had to draw a graph representing the number of raisins in each of the sixteen students' boxes.

Table 4

*Sample of Classroom Observation - Transcript and Analysis for Teacher 2*

Time	Classroom Activity	MI Points of Entry Observed	Valuing and working with difference Observed
9.45	<p>She then asked the students to open the box of raisins and guess how many were in the box. She typed on the whiteboard, What is your prediction? She asked them to write down how many raisins they thought were in their box.</p> <p>Several of the students counted the top layer and then tried to guess at how many layers were in the box. The teacher waited until all the students had written a prediction, then she asked each student what number they had chosen and wrote their answers on the whiteboard.</p> <p>The teacher then asked all the students to empty their box of raisins and count how many were in their box. On the whiteboard, she typed Actual number of raisins.</p>	<p>Narrative</p> <p>Numerical or logical</p> <p>Aesthetic</p> <p>Experiential</p> <p>Interpersonal</p> <p>Existential</p>	<p>Cultural Knowledge</p> <p>Inclusivity</p> <p>Narrative</p> <p>Group Identities</p> <p>Active Citizenship</p>
9.50	Each student counted the number of raisins that were in the box.	<p>Narrative</p> <p>Numerical or logical</p> <p>Aesthetic</p> <p>Experiential</p> <p>Interpersonal</p> <p>Existential</p>	<p>Cultural Knowledge</p> <p>Inclusivity</p> <p>Narrative</p> <p>Group Identities</p> <p>Active Citizenship</p>
9.55	<p>The teacher asked how many each student had counted and wrote their answers on the whiteboard.</p> <p>Prediction: 56, 40, 255, 57, 62, etc</p> <p>Actual : 101, 104, 107, 110, 110, 110, 114 ... 132</p>	<p>Narrative</p> <p>Numerical or logical</p> <p>Aesthetic</p> <p>Experiential</p> <p>Interpersonal</p> <p>Existential</p>	<p>Cultural Knowledge</p> <p>Inclusivity</p> <p>Narrative</p> <p>Group Identities</p> <p>Active Citizenship</p>

The semi-structured interview data (Table3) and classroom observation data (Table 4) were subjected to thematic analysis to identify themes, concepts and meanings emerging from the data. Five main themes transpired: (i) Grouping by ability, (ii) Productive Pedagogies observed, (iii) Connections between MI and Productive Pedagogies, (iv) Teacher actions and student actions of Multiple Intelligences and (v) Perceived and actual practice.

*Grouping by Ability*

This set of students leave their classmates everyday when they are brought together to form the ‘lower mathematics group’ (question 5: line 1 & 2). Teacher 2 describes this group of students as being ‘beaten’ with low confidence (question 5: lines 10, 11 &12). To further emphasise this grouping by ability, teacher 2 groups them further by skill level (question

11: lines 3, 4, 5 & 6).

### *Productive Pedagogies Observed*

Inclusivity, group identity and active citizenship were the three predominant Productive Pedagogy elements identified in both the interview and classroom observation. Narrative was not observed during the classroom observations and narrative was only mentioned during the interview in the form of ‘story problems’.

It is clear from the teacher interview responses in Table 3, that teacher 2 recognises that her class are from differing cultural groups (question 2: lines 1, 2, 3 & 4) as she states that more than 40% (7 out of 16) of her class come from different ethnic backgrounds and two of these students have English as a second language (question 3: lines 1 & 2). However, she does not take this into consideration when she is planning mathematics lessons (question 7: lines 1 & 2). This was reflected in her practice as *cultural knowledge* was not observed during the classroom observation.

### *Connections between MI and Productive Pedagogies*

Teacher 2 used a combination of numerical/logical and existential *points of entry* throughout the lesson and this linked to inclusivity being observed (Time: 9:45 & 9:55). There were also patterns of group identities and active citizenship observed, triggered by the interpersonal *point of entry*. The teacher never initiated the narrative *point of entry* during the lesson but two students responded with a narrative explanation of their data.

### *Teacher Actions and Student Actions of Multiple Intelligences*

For the majority of the time, teacher 2 led the lesson using four of the six MI *points of entry*. However, for a twenty minute period, the students worked individually without input from teacher 2. During this time, the students exhibited numerical/logical and intrapersonal Multiple Intelligences which were instigated by a numerical/logical *point of entry* by the teacher.

### *Perceived and Actual Practice*

There were some discrepancies between how teacher 2 perceived her pedagogy (see Table 3) compared to her actual pedagogical activity (see Table 4). For instance, during the interview, teacher 2 only mentioned the numerical *point of entry* once but it was more prominent in the classroom observation (Time: 9:45 & 9:55). The *narrative point of entry* and the ‘valuing and working with difference’ *cultural knowledge* was mentioned in the interview but not demonstrated in the classroom observation. The aesthetic *point of entry* was absent from both the interview and classroom observation data for teacher 2. This may be an indication of what is valued/not valued by teacher 2, intentionally or unconsciously.

## Discussion

Frameworks such as MI *points of entry* explore difference in ways that actively support individuals in participating and having their individual perspectives and experiences acknowledged and valued. The Productive Pedagogy Framework allows teachers to recognise the numeracy practices of different cultures and to understand that language and cultural differences may cause children to have difficulty in engaging with Western style mathematics. During all the lessons, there seemed to be opportunities where the students

could include non-Western ideas about mathematics, but the teachers did not explicitly express or encourage this way of thinking. From a sociocultural standpoint, it is imperative for teachers and students to value their own and each others' cultural and linguistic ways of knowing (Bishop, 2001).

The data analysis from the interviews and classroom observations showed that all three teachers who participated in the study followed some aspects of a constructivist approach to teaching as there were many social interactions promoted through the asking of inquiry questions, the use of whole class discussions and students working in pairs. The fact that certain Productive Pedagogies were not observed was not unexpected as the QSRL study (Education Queensland, 2001) indicated that within the 'valuing and working with difference' dimension, teachers scored the highest in group identities and inclusivity and the lowest in cultural knowledge. The QSRL study also noted that 'group identities' were prominent in classrooms as it aligned strongly with the Productive Pedagogy dimension of 'supportive classroom environment' which is where teachers' pedagogy scored the highest.

In the year one and two classes, the teachers stated that they never group the students by ability, preferring table or friendship groups. Interestingly, the highest percentage of sociocultural diverse students (more than 40%), including students with English as a second language, were in the year four mathematics class where the lowest performing mathematics students were grouped together. These were the only students that were described as being low in confidence, which just affirms the negative effects that grouping by ability has on students.

It seems that more emphasis should be placed on non-dominant perspectives, to help the goal of equity and access to school mathematics become more achievable. This would entail teachers accepting students' out-of-school cultural knowledges and valuing how they communicate these strategies to help all students to become a member of a mathematical community of practice.

### Directions for Further Research

Further research is required to narrow the theory-practice gap in establishing the conditions that are conducive for the *points of entry* framework (Gardner, 1999) and the 'valuing and working with difference' framework (Education Queensland, 2004) to operate together effectively to bring about improved learning within mathematics classrooms. Future studies need to be undertaken in a wider range of educational settings, including but not limited to, rural and remote, indigenous, low socio economic and secondary schooling educational contexts.

Bearing in mind, that this study only represented a small sample of teachers, the aesthetic and narrative *points of entry* were not present in the teaching of mathematics. These *points of entry* may be the key in addressing 'valuing and working with difference' elements, particularly *cultural knowledge* as this was also absent from the findings. Teacher's may incorporate or omit *points of entry* based on their own strengths or weaknesses, so this may need to be investigated further as it may limit students' educational options.

### Summary and Conclusion

The concept of Gardner's *points of entry* framework should help teachers to approach topics from multiple perspectives so as to appeal to students' differing thinking processes. Gardner stated that each topic should be addressed by all *points of entry* but not during one

lesson. However, what is interesting in this study was that the narrative and aesthetic entry points and the productive pedagogy elements of cultural knowledge did not feature during any of the mathematics observations. When these *points of entry* are omitted from mathematics lessons, the contributions of some students may be silenced as they may be perceived to be underrated for the strengths they bring to the community of learners.

The practice of mathematics teaching that is currently used in schools tends to reflect a Western frame of reference and the desire to stratify populations of students into ability groups. The reform emphasis in mathematics teaching and learning, especially for students who struggle with mathematics, should be on pedagogy and not how students are grouped. As student diversity continues to increase, MI *points of entry* provides a practical framework that may help teachers to refine their practice and expand opportunities for students to successfully participate in mathematics, for the purpose of creating more equitable learning environments.

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