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Abstract: Ten non-English speaking immigrant students shared their lived experiences in their secondary school mathematics classrooms in New Zealand. Through the voices of these students some understandings of the challenges they experienced as second language learners are brought to the fore. The students' perspectives of the language-related challenges that they faced, how they made sense of learning in an environment where the medium of instruction was dissimilar to their first language, and the impact that language-related challenges may have had on their perceptions of their ability in their new environment compared to their home country, form the basis of this paper.

While the transitional experiences in a new learning environment may be uncomplicated for some immigrant students, for others it can be a daunting experience, particularly if they are unfamiliar with the dominant classroom language. New Zealand has an increasing ethnic and culturally diverse society with increasing numbers of bilingual and multilingual students in the classrooms (Statistics New Zealand, 2013). Australia, like New Zealand has experienced similar immigration trends in schools (Luke, Comber & O'Brien, 1996; Swetnam, 2003). Therefore, it is crucial that teachers become aware, firstly, of the challenges faced by immigrant students, secondly, of the coping strategies that the immigrant students might employ when negotiating meaning, and thirdly, of the immigrant students' perceptions of their ability in a new environment. While language related challenges in the mathematics context may be well documented in literature, this paper offers understandings of these experiences from the immigrant students' perspectives in the New Zealand context, and the students' perceptions of their mathematics ability in an environment where the medium of instruction is not their first language.

Background

Literature on immigrant students transitional experiences demonstrate the key role that language plays in students' thinking, learning and their ability to communicate and negotiate meanings in the classroom environment (Bose & Choudhury, 2010; Parvanehnezhad & Clarkson, 2008). According to Tanners (1997, p. 244) the greatest challenge faced by immigrant students is to "speak, read and write" in a language that is unfamiliar to them. Learning mathematics in a language other than their first language may affect the quality of immigrant students' education and affect their perceptions of their academic ability (Niesche, 2009). Consequently leading to students feeling isolated, invisible and discredited and, according to Davidson and Kramer (1997), for the students it would be like looking into a mirror and not seeing their own reflection.

The New Zealand Curriculum (Ministry of Education, 2007) explicitly states the importance of cultural diversity and inclusion as part of its eight principles that direct curriculum decision-making at schools. While through an inclusive curriculum it can be

theorised that immigrant students ought to experience a smooth transition in their new mathematics learning environment, the reality, however, is that students who do not speak or understand the dominant classroom language may feel a sense of isolation (Bishop, 1991; Burton 1994; Endo, 2010; Flores, 1997; Zevenbergen, 1996). Furthermore, studies of immigrant students in other countries have found that students find ways to cope when faced with language barriers by using non-verbal gestures to communicate (Igoa, 1995), and by language switching from their home language to English (Bose & Choudhury, 2010; Niesche, 2009; Parvanehnezhad & Clarkson, 2008).

Switching from one's first language to a second language was also evident in Clarkson's study (2006) of Vietnamese bilingual students in Australia for whom certain mathematical processes were more attainable by switching from English to Vietnamese. A further study by Parvanehnezhad and Clarkson (2008) of Persian immigrant students learning mathematics in Australia also reported the use of language switching when dealing with more complex concepts. Language switching also seemed to be a popular strategy employed to cope with mathematics content in South African schools as a means for both teachers and students to communicate their ideas and thinking (Setati, 2002). According to Setati's (2002) study of second language learners, language switching helped improve student-student and student-teacher interactions in the mathematics classroom.

Teachers' awareness of how immigrant students negotiate meaning in the mathematics classroom has a key role to play in the success of their transitional experience (Clarkson, 2006). Teachers are, after all, in a very powerful position to orchestrate how learning takes place in the classroom. English being the primary language of instruction in New Zealand schools (Harrison, 1998) and the fact that immigrant students often come with a range of first languages other than English, necessitates a language focus when trying to understand their transitional experiences. In addition the study gained its impetus from the notion that for teaching and learning, our most valuable resources are not abstract theories and principles but the actual experiences of students in the classroom that inform our understandings of these theories and principles.

Research Approach

This paper emerged from my doctoral study which employed a hermeneutic phenomenological approach. The hermeneutic phenomenological approach is concerned with interpreting the human experience as it is lived (Laverty, 2003). The phenomenological aspect of the study focused on the lived experiences of immigrant students in their classroom as the phenomena (Van Manen, 1997). The hermeneutic aspect of the study presented understandings of these lived experiences through interpretation, which were subjective, multiple, complex and different for each individual (Van Manen, 1990).

Interviews and classroom observations were conducted to collect study data. Each student was interviewed prior to the commencement of the classroom observations and immediately after each classroom observation. The interviews were conducted in English with all but one participant being able to converse in English. An interpreter was required during the interview sessions with the one participant who was unable to converse in English. The duration of each interview was between fifteen minutes and thirty minutes, and was recorded on an audio digital recording device, transcribed and later analysed. During the interview each student was asked questions focused on what was observed in the classroom, indicative comparative questions of mathematics learning in New Zealand and in their home countries, and to provide a comparative self-rating of his/her mathematics ability, including what they felt their teachers' and parents' ratings would be (Appendix A). The analysis involved looking for broad themes that emerged from the individual transitional experiences.

In addition to the interviews, between three and five observations of each student in their respective mathematics classroom were completed. This involved recording the students' classroom interactions and classroom positions using protocol sheets developed from Hopkins' (1989) guide to classroom observations (Appendix C) and Neuman's (2000) spatial maps (Appendix B). While the lived experiences of immigrant students have been interpreted both from the students' perspective and my own at a particular point in time, I am mindful of the multiple realities that may continue to be extracted by readers of this paper, today and tomorrow, owing to the hermeneutic nature of the study.

The ten students in the study had come from non-English speaking backgrounds and had been residing in New Zealand for a period of two years or less (Tab. 1). These students had come to New Zealand from China, the Philippines, India, and Thailand, Fiji, Nigeria, South Africa and Saudi Arabia. They also presented with varied levels of English language proficiency.

Participant (Pseudonym)	Gender	Country of Birth	Duration of Stay in NZ	First Language	School Year
Andrew	Male	China	15 months	Chinese	9
Terry	Male	China	2 months	Chinese	9
Jess	Female	Philippines	11 months	Filipino	9
Abdulla	Male	Saudi Arabia	7 months	Arabic	9
Ian	Male	Nigeria	24 months	Igbo	9
Karishma	Female	Fiji	8 months	Hindi	10
Tim	Male	India	12 months	Hindi/Punjabi	10
Annie	Female	Philippines	18 months	Filipino	10
Babeloo	Female	South Africa	12 months	Afrikaans	10
Van	Male	Thailand	12 months	Thai	10

Table 1: Profile of the ten participants (adapted from *A hermeneutic phenomenological study of the lived experiences of immigrant students in their mathematics classrooms at a secondary school in Auckland, New Zealand*, p.50, by J.R. Jhagroo, 2012)

When Words Count in the Mathematics Classroom

The voices of the immigrant students highlighted some of the transitional experiences faced by the students such as the challenges they faced in understanding the role of the teacher in the new context, the language barriers to their learning, their interactions with classroom participants, their contributions to class discussion, classroom expectations with regards to punishment, behaviour and work ethic, and different levels of mathematics education. This paper focuses on the language related challenges faced by the students and is discussed firstly in view of the language barriers that they had faced, secondly, the coping strategies they used to make sense of their learning, and finally the students' perceptions of their mathematics ability in New Zealand compared to their ability in their home country.

Language Barriers Faced by the Immigrant Students

The challenges associated with learning mathematics or any subject in a language dissimilar to one's first language must also be considered from a linguistic perspective. Furthermore Begg (2013) has referred to the dichotomous problems that emerge in the mathematics classroom from the different language/cultural perspectives where for example Eastern languages are "verb-oriented" and in the East knowledge is embraced more

holistically, while West languages tend to be more "noun-oriented" and in the West knowledge tends to be compartmentalised. The discussion that follows captures some of the difficulties that the students experienced.

The comment by Terry, a student from China, was indicative of the language barrier which seemed to have inhibited his contribution to class discussions: *I'm not really good at English so I just do it in my book or just think it. I like to answer but my English is not good*. Interactions between the different classroom participants are often framed by their individual language structure and culture (D'Ambrosio, 1999). Terry choosing to be silent in the classroom may be explained as a necessary nurturing phase until he develops proficiency and confidence in expressing himself in English (Esmonde, 2009; Igoa, 1995).

This next statement made by Ian, a student from Nigeria, about not following an instruction that involved completing the totals of the rows and columns on a table: *I know how to add them, I didn't know I had to add them*, was suggestive of the how language barriers may prohibit students from accessing their prior knowledge. Thomas (1983) asserts that language-rich contextual problems have the potential to be more inaccessible to bilingual students than symbol-rich algorithm problems involving numbers and a plus sign. Another language-rich task that Ian was expected to complete demonstrated the language induced challenge that he faced. The task required him to draw a probability tree to show all possible gender outcomes of children if there were three children in a family. Ian's response to the task was an illustration including a duck, a tree and three houses. Ian's explanation for this drawing was: *for the kids… a tree and duck for the kids … to play with … and house to live in*. In spite of this response being mathematically unsound with regards to the student's understandings of probability trees, it demonstrated that Ian was trying to make sense of the task by drawing from his own cultural worldviews (Thomas, 1997). In addition, the multilevel challenges associated with language-rich tasks cannot be dismissed, for example understandings of the words 'gender' and 'if'. The task assumed that the student understood the word 'gender', and had knowledge of logical connectives such as 'if' within the context of probability.

The question that often arises as a consequence of language-related challenges is, 'how can mathematics learning be made accessible in a context where language is a barrier?' In response, students with a non-English speaking background are sometimes supported by out-of-class special programmes, however, while well-intended, this may be viewed negatively. Ian, for example, felt that he had: *missed out* and that the out-of-class special programme experience *was different and did not help* [him]. Andrew, a student from China, also expressed negative feelings towards being exposed to the out-of-class programme and attributed his lack of progress to the special programme environment: [students] *didn't work hard* [in the out-of-class programme]*… I need to change class to better one*. The negative sentiments expressed by the students towards special out-of-class programmes were consistent with the findings of Gunderson (2000), who found that such programmes have the potential to promote stigmatisation and segregation. Consequently, it is recommended that the perceptions of immigrant students towards out-of-class programmes be considered prior to placing them in these.

Language Switching as a Coping Strategy

The students in the study seemed to have developed strategies to help them cope with the language challenges that they faced in their mathematics classrooms. While various strategies were employed by the students including adopting a silent phase, and using a language translation dictionary, the discussion that follows focuses on language switching in the form of code switching and code mixing as a strategy employed by some of the students

in coping in an environment where the medium of instruction was other than the language in which they had previously learned mathematics.

The following words shared by Ian, a Nigerian immigrant student, demonstrated how he would switch from Igbo, his first language to the dominant classroom language: *I think in English when learn work in New Zealand. I think in Nigerian* [Igbo] *if learn work in Nigeria, and if work in New Zealand is same as one I learn in Nigeria, I think about it in Nigerian*. The strategy employed by Ian fits well with Yushau's (2009) study which speaks of mathematical language being better understood in one's native language. In this case the language in which Ian learned the concepts dictate the language in which his thinking occurs. The idea of switching between languages to make sense of mathematics concepts has also been consistent in the studies by Clarkson (2006) and Parvanehnezhad and Clarkson (2008) in the Australian classroom context, and Setati (2002) in the South African classroom context. Not only does this paper affirm that second language learners often switch between their first language and second or other language to make sense of their learning, it also speculates that habitus or the physical setting in which the learning occurs may have a pivotal role to play in the language in which bilingual or multilingual students choose to communicate and think.

This paper posits that learning through peer group support has the potential to enhance the learning of immigrant second language students. Jess a Filipino student, seemed to have enjoyed working with other Filipino students because she felt that she was able to learn more mathematics by switching between her first language and English: *we communicated in English and Filipino … for better understanding*. These sentiments paralleled the findings of Bose and Choudhury (2010) and Parvanehnezhad and Clarkson (2008) who asserted that code mixing and code switching play a significant role in students negotiating meanings, especially within groups of students that share a common language. Unlike language switching or code switching, code mixing involved conversations in one language with certain words being substituted in a second language without interfering with the structure and meaning of the original language (Bose & Choudhury, 2010). Furthermore, it is beneficial for immigrant students to have the opportunity to work in such groups as it not only promotes their mathematics learning, but also develops their first and second language skills (Flores, 1997) and improves social interactions with the different classroom participants (Setati, 2002).

Another strategy that one student welcomed was to be able to work with a partner who spoke the same language. Abdulla, an Arabic speaking student from Saudi Arabia, shared his sentiments about working with an Arabic speaking student in his class: *I would be very lost and would not know what to do because M…*[the Arabic-speaking student] *is the only one that can help me*. For Abdulla the language switching occurred when the student from his class interpreted what the teacher or other students were saying for Abdulla's benefit. Working in groups or pairs comprising students that spoke a similar home language seemed helpful in making Abdulla feel a sense of connectedness to at least one person in his classroom.

Teachers have a very important role in facilitating the learning of immigrant students by encouraging second language learners to switch between their first language and the dominant classroom language to promote understanding (Clarkson & Dawe, 1996). Unfortunately, however, finding students of the same linguistic background in the same class may not always be possible.

Students' Perceptions of their Mathematics Ability

The role of language cannot be overemphasised; it gives students the tools to make sense of their learning and become active participants in the mathematics classroom. A

student's cultural frame, embedded in their linguistic background, may be dissimilar to the classroom culture and this difference has the potential to affect the student's learning success (Moody, 2001) and their perceptions of their ability. In spite of the strategies employed by immigrant students to make sense of their learning, the language related challenges that the ten students had experienced seemed to have impacted their perceptions of their mathematics ability. The students were asked to rate their mathematics ability from their own perspective, from their teacher's perspective, and their parents' perspective. Tab. 2 presents the perceived self-ratings of three immigrant students.

Participant	Home Country			New Zealand		
	Self-Rating	Perceived Rating of		Self-Rating	Perceived Rating of	
		Parents	Teacher		Parents	Teacher
Abdulla	5	5	4.5	1.5	1.5	3
Andrew	3.5	3	2.5	3.5	3	Not sure
Terry	4	5	4	5	5	5

Table 2: Students' perceived ratings of their mathematics ability (adapted from *A hermeneutic phenomenological study of the lived experiences of immigrant students in their mathematics classrooms at a secondary school in Auckland, New Zealand*, p.115, by J.R. Jhagroo, 2012)

The discussion that follows focuses on the explanation offered by three students for their ratings, the first with a lower rating in New Zealand, the second, with a similar rating, and the third with a higher rating in the New Zealand context.

Andrew, a student from China, rated his mathematics ability as the same in New Zealand and in China from his perspective and from his parents' perspective. He could not answer how his teacher would have rated his ability in his New Zealand classroom. While Andrew did not offer an explicit explanation for his ratings and his declining grades: *In the first test I got an 'excellence'* [grade] *then I got a 'merit'* [grade] *and two 'achieved'* [grade], he felt that being able to converse with a peer that spoke the same language as he did would have had mutual benefit for him and his peer: *Being in my friend's class would be good because we can talk together about math. Maybe he can help me, I can help him for English, he can help me for maths*. Peer support seemed to be an essential factor in students coping with the complexity of a new classroom context (Bishop, 2002). Andrew felt that his mum and dad would rate his ability differently: *my mum think my maths is okay* [rated as (3)], … *because my dad thinks my maths is not really good. Also sometimes when he gives me some tests and I don't want to do it, he thinks I don't want to do it because it means I don't know how* [ability rated as (2)].

Terry, who was also from China, rated his ability higher in New Zealand compared to his home country. His rating may be linked to his notion that … *Maths is not all English ... have many number and just draw picture so it's easy to do*. He appeared to view mathematics as non-language based and therefore was able to make connections when faced with a task involving numbers and symbols. His explanation for rating his ability as lower in China was: *I would say (4) very good in China because maybe in China I did not work hard in maths. I thought my maths was alright so I spend more time learning science or Chinese*. However his rating of his ability in New Zealand was linked to his English language proficiency: *In New Zealand I would be excellent (5) because I think we learn maths through English. I'm not very good at English so I work harder in New Zealand*. Similarly, Terry felt that his teachers' ratings in China and New Zealand would have been associated with the effort that he had made in learning mathematics. He believed that his teacher in China would have rated him as very good (4) because: *I'm not work so hard in maths*, and his New Zealand teacher would have rated him as excellent (5) because: *In New Zealand excellent because I work harder in class*.

Abdulla, one of the two students who had perceived their mathematics ability in New Zealand to be lower than their ability in their home countries, attributed his ratings to the language challenges that he experienced. According to him: *I find it difficult to understand because I do not speak English…I understand a little bit, just words, small words. I don't understand the teacher. I did not understand the lesson... I don't understand people speaking*. Being unable to communicate with others or understand people speaking is not only a frustrating experience that contributes to students' perceptions of their ability but may create an environment of helplessness (Davidson & Kramer, 1997). This sense of helplessness was evident in Adbulla's comment: *I wish I could have got it across but if I can't explain it to her why would I bother*. In addition he felt that his mathematics teacher in New Zealand would have rated his ability lower: *New Zealand teacher would rate me as 1 or 2 because I do not work that much in class. Or maybe 3, she* [the teacher] *keeps telling me "you doing well, you doing well."* than his teacher from Saudi Arabia where he felt: *I work good* [well] *in Saudi Arabia*. This might be indicative of encouragement by the teacher being translated as ability by Abdulla. With regards to his perceptions of his parents' ratings, Abdulla felt that he would have been rated as excellent (5) in Saudi Arabia and poorly (1.5) in New Zealand: *because of English*.

Finally, Abdulla's comment about his grades improving once he was able to understand: *I cannot pass because I do not understand anything. I will be better if I can understand*, may suggest his perception of the temporary nature of his circumstances associated with his lack of English language proficiency. While the self-ratings of students are often influenced by a variety of factors associated with a changing context, including language challenges, for the ten immigrant students in the study, their beliefs in their potential to succeed in mathematics seem to be positive.

Concluding Remarks

The shared experiences of ten immigrant students, for whom the dominant classroom language was different to their home languages, offered some insight into the language-related challenges they faced, and strategies they employed to overcome their language-induced frustrations, and the impact that these challenges may have had on their belief in their mathematics ability. While these language-related barriers experienced by immigrant second language learners build on ideas presented by international studies as cited in the literature review and the discussion, this paper offers understandings of these experiences through the voices of ten immigrant students in the New Zealand context. Furthermore, the study avers that language-related challenges not be mistaken for lack of ability and recommends that teachers be mindful of how these language barriers may affect the perceptions that students hold of their own mathematics abilities in an environment where the medium of instruction is other than the students' first language.

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Appendix A: Indicative Questions for Initial Interview/Conversations

(Prompts: teachers, classroom setting, books, students, group learning, and tasks)

1. What did you enjoy most about Maths in [country student has come from]?
2. What do you enjoy about Maths in New Zealand?
3. Can you tell me about what you found the same in New Zealand and [country student has come from] maths classrooms?
4. Are there any differences? What are some of the differences?
5. Before you came to New Zealand where would you have rated your maths ability on a scale of 1 to 5?

POOR	SATISFACTORY	GOOD	VERY GOOD	EXCELLENT
1	2	3	4	5

Why?

6. Where would you rate your maths ability now?

POOR	SATISFACTORY	GOOD	VERY GOOD	EXCELLENT
1	2	3	4	5

Why?

7. How would your parents rate your maths ability?

POOR	SATISFACTORY	GOOD	VERY GOOD	EXCELLENT
1	2	3	4	5

Why?

8. How would your teacher rate your mathematics ability?

POOR	DEVELOPING	AVERAGE	GOOD	EXCELLENT
1	2	3	4	5

Why?

9. Did you think studying maths in [country student has come from] was?

NOT IMPORTANT	SOMETIMES IMPORTANT	NOT SURE	IMPORTANT	VERY IMPORTANT
1	2	3	4	5

Why?

10. Do you think studying maths in New Zealand is:

NOT IMPORTANT	SOMETIMES IMPORTANT	NOT SURE	IMPORTANT	VERY IMPORTANT
1	2	3	4	5

Why?

11. Is there anything else about mathematics that you would like to talk about?

Appendix B: Examples of Observation Protocol Spatial Maps (developed from Neuman's (2000) Spatial Maps)

Student: ..... (Pseudonym)
Observation Number: .....

Spatial map of the participants' positions in relation to the rest of the class

Key: ⊗ represents the student that was observed, S represented the other students in the classroom

Teacher's Desk		Front of Classroom				
S	S	S	-	S	S	S
S	S	S	S	S	S	S
S	-	-	-	S	S	S
S	S	S	S	S	S	S
		-	-	⊗	S	S

Spatial map of Van's initial position in class

Teacher's Desk		Front of Classroom				
S	S	S	⊗	S	S	S
S	S	S	S	S	S	S
S	S	-	S	S	S	S
S	S	S	S	-	S	-
		S	S	-	S	S

Spatial map of Van's subsequent position in class

Front of Classroom				Teacher's Desk	
-	S	S	S	S	S
S	-	-	-	S	⊗
S	-	S	S	S	S
S	-	S	-	-	S
S	-	-	S		

Spatial map of Tim's position in class

Appendix C: Observation Protocols - Direct Observation Recording Sheet (developed from Hopkins' (1989) guide to classroom observations)

<table>
<tr><td colspan="2">Direct observations
Classroom Talk</td><td rowspan="2">Inference</td><td rowspan="2">Personal Journal</td></tr>
<tr><td>Teacher Talk
Control – information – procedural</td><td>Participant Talk
Solicited – unsolicited</td></tr>
<tr><td colspan="2">Learning Strategies
• Engagement with text, other students, teacher</td><td></td><td></td></tr>
<tr><td colspan="2">• Independence/Dependence</td><td></td><td></td></tr>
<tr><td colspan="2">• Other</td><td></td><td></td></tr>
</table>