

Pairwork: Where Do You Sit?
**Perceptions of native and non-native speakers of English towards
pairwork as a learning tool in a mainstream mathematics classroom.**
http://english.unitecology.ac.nz/esolonline/teachers/prof_read/phil_doyle/home_e.php

Phil Doyle

Phil Doyle is a mathematics HOD at an Auckland multicultural school.

ABSTRACT

The increasing numbers of second language learners in my classroom caused me to wrestle with two issues. Firstly, as I noticed the makeup of the classroom change, the appropriateness and validity of my own teaching style came into question. I had always valued lessons where learners actively engaged in the learning process, built their knowledge through experience and a negotiation of meaning through interaction with others. I had found this more and more difficult to achieve, as communication with students and between students decreased. What distressed me more was that, as I lost confidence in pair work and cooperative learning, I found myself lapsing back into a transmission style teaching.

The second issue was the second language acquisition of the students themselves. A sense of powerlessness developed, as I felt unable to help my ESOL students develop their English language. More tragically, I felt unable to get these ESOL students to communicate their rich mathematical experiences and share the knowledge with their New Zealand counterparts.

In my sights I thought I could see a beautiful trade developing between students of language acquisition for mathematical insight.

INTRODUCTION

The last few years have seen mathematics teachers in New Zealand coping with a huge increase in the numbers of second language learners in their classrooms. As the lucrative international student industry has developed, mathematics teachers have encountered increasingly diverse classrooms, where mathematics teachers are "...too few teachers share or know about their students' cultural and linguistic backgrounds or understand the challenges inherent in learning to speak and read Standard English" (Fillmore & Snow, 2000, p. 3).

For many ESOL students in New Zealand schools, the mathematics classroom is one of their first experiences of a mainstream New Zealand classroom. It is here that teachers and students gather to share the joys of learning mathematics the New Zealand way.

WHERE I SAT

This influx of second language learners into my classroom was the beginning of an educational journey that continues today. Many of the issues around second language

learners in the mainstream classroom were probably always there and the growth in international fee paying students had just highlighted the issues for me.

I began to wrestle with two issues. Firstly, as I noticed the makeup of the classroom change the appropriateness and validity of my own teaching style came into question. As a teacher trained in a constructivist tradition, I had always valued lessons where learners actively engaged in the learning process, built their knowledge through experience and a negotiation of meaning through interaction with others. I had found this more and more difficult to achieve, as communication with students and between students decreased. What distressed me more was that, as I lost confidence in pair work and cooperative learning, I found myself lapsing back into a transmission style teaching.

The second issue was the second language acquisition of the students themselves. A sense of powerlessness developed, as I felt unable to help my ESOL students develop their English language. More tragically, I felt unable to get these ESOL students to communicate their rich mathematical experiences and share the knowledge with their New Zealand counterparts.

In my sights I thought I could see a beautiful trade developing between students of language acquisition for mathematical insight. This interest led to my enrolling in a teacher's TESSOL programme at the Auckland College of Education.

WHERE THEY SAT

"Group work is most commonly used to get learners talking to each other" (Nation, 1989, p. 20).

As a teacher in a multicultural Auckland high school I have long enjoyed the diversity and wealth of experiences brought by students to the classroom. The group of senior school students that I worked with for this research is also culturally and linguistically diverse. For example, a survey of my senior students shows that while over half of my senior students consider English as their first language, 42 out of a total of 58 students speak more than one language. While the majority of the ESOL students in my classroom still come from southern China, there are young men and women from South Korea, Tonga, northern China, the Philippines, South Africa, India, Iran, Sri Lanka and of course New Zealand.

The participants in this research are all between the ages of 15 and 19. All the students involved are currently enrolled in a NZQA national qualification in mathematics or mathematics with statistics. The students' competence in English ranges from beginner to intermediate through to native speaker. The majority of the ESOL students had already completed at least three years of high school mathematics in their country of origin

For my study I wished to focus on pair work with native speakers (NS) and ESOL students in 3 different mainstream mathematics classes. I have an interest in using 'learning through language' (see Appendix I) techniques in my mathematics classroom. I wished to harness the diversity in my classroom to develop a cooperative and inclusive classroom. I wanted to use ESOL students' desire to gain success in

mathematics as a way to help them learn English. I wanted New Zealand students to benefit from the mathematical experience of their classmates. I have seen that by getting students to work together, you could motivate and engage students in mathematics. I believed that by increasing the amount of group and pair work in the classroom I could reap the benefits of learner-learner interaction as a learning tool in a mainstream mathematics classroom.

Nation (1989) states that, in the context of group work, successful student interaction occurs when 5 different factors work together, encompassing planning and delivery of appropriate tasks, the learning goals and social relationships between students. Nation (1989) outlines the benefits to language learners, but offers a warning that if the principles of successful group work are not adhered to learning goals may not be met. Gundersen (2000) expresses the views of young language learners in Canada and their belief that the learning of English and content should be simultaneous. The research reinforces the benefits to second language learners of language learning being integrated with content in the mainstream classroom.

COULD I GET MY STUDENTS TO MOVE SEATS?

With my research I wished to investigate the perceptions of native speakers of English and non-native speakers towards learner-learner interaction as a learning tool in a mathematics classroom.

For my own teaching, what I wanted to answer was whether or not the 'competing' goals of language acquisition and content could be met in a mainstream mathematics classroom for the benefit of all students with the use of pair work or learner-learner interaction.

I wanted to see if I could change behaviour and attitudes of learners towards pair work as an instructional and pedagogical tool in mathematics teaching and learning before and after a series of lessons designed to promote effective pair work in the classroom.

I experimented with a series of pair activities. The pair work activities were integrated into the teaching programme. The activities were taken from a well-worn set of 'learning through language' tasks developed by experienced teachers. I modelled some of my tasks on those in Sue Thomson and Ian Forster's series [*Instant Lessons for Senior Maths*](#). These are a mixture of mix and match tasks, sequencing activities, information gap exercises, vocabulary tasks, cooperative learning problems, barrier games and argument tasks.

I also wanted to investigate the differences in the perceived benefits of pair work between the two groups. Gundersen (2000) alludes to the general differences between groups of students, where many immigrant students see education as a teacher centred activity while western teachers have been taught to see education as student centred.

SPEAKING ANXIETY SURVEY

At the beginning of the year, I surveyed my students about why they had chosen their mathematics course and what they wanted from the year. I told students that I was

undertaking some research regarding ESOL students in the mathematics classroom. As teachers normally do, I collected as much information about their previous mathematical experiences and some of the motivations and aspirations that the students had before starting the course. I surveyed students about their attitudes and learning styles. I asked students to indicate which language was their L1 (mother tongue). I also asked specific questions about student-teacher interaction, speaking in class and pair work. The responses that I analysed for this report were in reply to the following statements:

- Q1 I get nervous when speaking in mathematics/statistics class.
- Q2 I worry if I can't understand every word that the teacher says
- Q3 In pair work, I worry if my partner is better than me at English
- Q4 In pair work, I worry if my partner is worse than me at English
- Q5 In pair work, I worry if my partner is better than me at statistics/ maths
- Q6 In pair work, I worry if my partner is worse than me at statistics/ maths

The table (see Appendix II) shows the results of the survey. Responses were sought before and after the series of pair work lessons over term 2. Students responded on a scale from 1 to 5, where 1 represents a student who strongly agrees, 2 for a student who agrees, 3 for a student who neither agrees or disagrees and through to 5 for strongly disagrees.

There were 21 responses from ESOL students and 18 responses from NS students. Responses were collated and an average was taken for each question.

I was surprised by the responses to the first question, on how students felt about talking in class. Interestingly, neither the ESOL nor NS groups of students appeared to find it a daunting task to have to speak in mathematics class. This was at odds with my own observations, which were that students were often very reticent to speak and appeared uncomfortable when called upon to articulate an idea in class. Most students were actually quite adept at avoiding making any input to a lesson. I did notice that those ESOL students who scored high (4 or 5) in question 1 often scored low (1 or 2) in the neighbouring question where they were asked whether they worried about making mistakes in class.

The change in ESOL responses for the second question pleased me the most. At the beginning ESOL students appeared to be most concerned about how they understood me. They seemed to rely on my talk as their major source of input. After the series of pair work tasks they appeared more relaxed about the situation. In fact this question showed the second largest shift from before to after. I took from this that after spending time working with others, they were then more confident of getting the same input from their classmates.

When asked about how they felt about being paired with a student who was better in English than themselves, neither group seemed particularly worried. However, being paired with a student with weaker English skills was a significant issue for NS students. This question provided the greatest shift, with a move of 1.3 points. I was comfortable with the shift. It appeared that as NS students actually started to socialise with ESOL students they realised that they were not particularly different and that

they were able to learn just as much off each other, when working with ESOL students on mathematics tasks.

There were marked differences between NS and ESOL on what kind of mathematical ability they wanted in a partner. ESOL students were much keener to have a talented mathematician or statistician to work with while NS students appeared to be more comfortable with someone with similar or less ability than themselves.

Again, I believe as they got to know each other that these concerns diminished. In all cases, student anxiety about the mathematical or statistical ability of their partner reduced from the start to the end of the pair work programme.

The results of the survey definitely confirmed for me that the students perceived there was a benefit to the pair work happening in their mathematics class.

WHAT HAPPENED? PLAYING MUSICAL CHAIRS

Early on I had told my students that I was interested in using pair work in class to help their learning. I explained that I had a bias towards learner-learner interaction in the classroom, believing that there were benefits to students learning when they discussed mathematics with each other. I explained that I believed that they would learn better if they could develop ideas together rather than waiting for me to transmit knowledge from the front of the room. I acknowledged my bias when discussing the benefits of pair work with my students. However, I suggested that there was a large amount of research (Gass and Varonis, 1994; Swain & Lapkin, 1998; Mishra and Oliver, 1998) supporting the benefits of interaction between NS and ESOL students.

Early on, my students expressed a willingness to participate in my research. Many however, expressed scepticism over changes to the organisation of the classroom. While the 'Archie Bunker' effect was small, I was still surprised at the reluctance of many students to mix. I have always allowed senior students to choose their own social groupings, hoping to facilitate effective group work or pair work by instead manipulating the furniture.

During term 2, I began recording observations of both specific instances of student talk and more general comments in my journal. My first observations were about how the students arranged themselves in the classroom.

In a class of 32 year 11 students it did not completely shock me that many students could not name their classmates. However, I was somewhat distraught to find a similar situation in a class of only thirteen year 12 students. ESOL students almost exclusively sat with other ESOL students and similarly NS students with other NS students. Amongst the ESOL students themselves, groupings were also based down language lines, with Korean students sitting together, Indian students together and so on. It was only in a small year 12 class where a Chinese student, J, sat with a group of Korean girls as there were no other Chinese students to sit with. A friendship had developed between two of the girls. However, J confided in me her frustration with the class as the Korean girls often spoke in Korean and she did not understand.

I knew from my survey that the students who had chosen a senior mathematics course, regardless of whether or not they were a native speaker or an ESOL student, were positive about the subject. There was a general perception amongst NS students that the ESOL students were better at mathematics than students schooled in New Zealand.

Although many of the international students seemed to lack the English proficiency to fully communicate their ideas and understandings in mathematics, there were many ESOL students who already had the mathematical knowledge needed for success. In fact many of the second language students in New Zealand mathematics classrooms are talented mathematicians in their first language.

ESOL students were quick to play down their mathematical advantage as they found text rich word problems and statistics very challenging. The statistic and probability topics appear not to be covered in the high school mathematics programmes of Korea and China. I often used this as a justification for pair work, telling both ESOL and NS groups, to share their skills in one area to get help in another.

The ESOL students themselves believed that they were advanced in certain areas of mathematics studied compared to their New Zealand counterparts. They seemed particularly strong in algebra and trigonometry. Confirmation of this was reinforced by interviews conducted by the ESOL department for a NCEA assessment. The ESOL teacher remarked one day in the staff room that many of her students had talked about their experiences in mathematics during the interviews. When asked what subjects they enjoyed, several students had spoken of mathematics. The students were asked to say why they enjoyed mathematics more than other subjects.

M “I am good at mathematics. Very easy of all subjects [sic]. If I work hard I can get good marks. I am good like all students”

D “In China my maths was better. I get to spend time talking to other students. It is different from ESOL”

E “Mathematics. In other subjects there is a lot of reading and writing. Algebra is easy”

I would like to say here that while I found there were lots of opportunities to use the prior mathematical knowledge of ESOL students I would be more careful when doing this in the future. Although the international students may lack the English proficiency to fully communicate their ideas and understandings in mathematics class, many of the second language students in New Zealand mathematics classrooms are talented mathematicians in their first language. However, there is a danger of stereotyping all ESOL students as good at mathematics. Not all the ESOL students in my classes are confident solving math problems and I was making it twice as difficult by asking them to talk about it as well.

During term 2 I manipulated the pairings. I endeavoured to use pair work for two or three of the lessons per week. Tasks were used to introduce new topics, to scaffold the work covered in the textbook or on the board and as a revision exercise. Some activities lasted for only 15 - 20 minutes at the beginning of a lesson, others were

longer activities that took the whole lesson and had a feedback cycle included, where the class came back together to report on findings.

Brickman and Nuzzo (1999) in their suggestions for the use of pairings in the classroom, recommend frequent changes to the pairings to stop the sharing of the negative impacts (poor language use) as well as the positive (increased student talk, good language development for example).

On days that I wanted to have ESOL and NS pairings I had to make sure that I made it to class on time. At the start there was still some reluctance to move from students, so getting to class on time and having the materials ready and the furniture arranged was critical. However, the students soon got used to the situation and were usually quick to organise themselves. The organisation for like pairings was simpler as students sat in ESOL or NS groups already.

WHAT I SAW FROM WHERE I WAS SITTING

I noted down some of the examples of student talk during term 2. I tended to record in my journal at the end of lessons or at the end of the day. Often an exchange that I overheard led me to reflect on how to improve what I was trying. I have chosen these exchanges to illustrate what I believed to be the common themes running through the interactions between students.

Using pair work with ESOL students, I was worried that the class would lose focus. ESOL students often appeared to tune out of a whole class lesson. I supposed that this was because they found most of what I said as incomprehensible. I feared that ESOL students would carry that behaviour over to pair work. In an all-English speaking cooperative classroom I can listen for off task behaviour and things that might make the pair work less effective. If the students were talking Korean or Cantonese then I felt I couldn't tell what they were doing. However, I found that by demanding some kind of written or verbal output from tasks keep students focussed on the activities. When observing two Chinese speakers G and K (both ESOL), K, noticing my presence, stopped and turned to address me. They have been talking Cantonese.

K “Don't worry, we are talking mathematics”

The girls then attempted to continue their discussion in English. I believe that if I use the same strategies as I would normally use to promote good group work I could be confident that ESOL students were participating.

There were differences between NS and ESOL students in their attitudes to pair work. Many of the NS students were keen to take the opportunity to work with others, while ESOL students, especially students from China and Korea, showed a preference for working independently. Some students actually took it upon themselves to act as cheerleaders for pair work...

A (NS) “Do we need the scissors today? Where do we sit”

...or were at least tolerant of my attempts.

B (NNS) "More coloured paper today?"

However, the reluctance of some students to mix continued to frustrate me. The extent of the mistrust at times astounded me. One student called me over during the lesson. M (NS) is paired with L, an ESOL student.

M (NS) "Shouldn't I sit with P (a NS student)? L doesn't understand. He won't talk."

M makes this statement in front of L as if he is not present. L looks unsure but makes no comment. L continued with the task alone. It appeared that students who would have struggled with the tasks in their L1 were the least likely to get involved.

On a Wednesday afternoon towards the end of term, we were working on a mix and match activity with portions missing. The students had to fit the pieces together, write their own missing portions and then report back to the class. On this day I had ESOL students working together and NS students working together. I wanted students to notice the form that questions of this type took, identify the key vocabulary and restate solutions using the question. In the report back I wanted students to notice that you could give the same answer in different ways. B and Z (both ESOL) seemed to have missed my intention altogether.

B (NNS) "We can finish this now, but we have to study our notes as we have IELTS soon"

I felt I had to constantly convince students that the pair activities were valid and that they could help them achieve their goals. I reminded them that this was a perfect opportunity to practise their communication strategies. I felt that they were ignoring an opportunity to produce extended, coherent discourse to practise for an assessment that purported to test for exactly that. They were also going to get instant feedback from their classmates and a chance to then go back and make checks and repairs to their own language and form.

At times I felt that I was fighting a losing battle against entrenched attitudes held by some students. ESOL students often were dismissive of what I was doing. They seemed to want me to assign pages out of the textbook for them to study. They believed that they learned better by reading over their notes at night. They appreciated opportunities to talk, but only with other ESOL students.

Some NS students questioned whether I was holding them back so that the ESOL students could keep pace or worse that I was using them as ESOL teaching aides. This was very discouraging. However, there were successes and the more that pair work tasks became the norm in the class the better I felt. As the term wound on I saw less and less of the poor pair work practices I witnessed early on. Students picked up strips of paper or the coloured cards and discussed them with their partner instead of taking them and attempting to finish tasks individually.

Often when reporting back the NS student would take the lead, even when it was obvious that they did not have the deepest understanding. By changing how the class reported back to each other I was able to get ESOL students explaining ideas to NS students.

When I choose ESOL-ESOL and NS-NS pairings the report back phase became very important. Students could solve the problem in their own language, but then they had to join up with an opposite pairing. Students got much better at describing their thinking and the mathematical processes involved.

For me the interactions between NS and ESOL students were the most interesting. J (ESOL) and E (NS) were working on a series of algebra questions. There is as much non-verbal communication as verbal. However, J is careful to use the correct mathematical terms.

J (ESOL) “Go x by x , x squared. Then 8 minus 7 get 1, 4 times 7 minus 28”

E (NS) “Where did the x come from?”

J “um”

J points to the x in question on page and then points to E's book.

“Write down equal x squared”

B (ESOL) and S (NS) are working on a sequencing task. B has selected the correct numeric answer strip and wants to place it at the bottom of the problem.

B (ESOL) “This one is bigger.”

S (NS) “You mean that it goes first”

B “No, it is ...after”

S “At the end?”

B “Yes, at the end”

S picks up the solution rewritten as a sentence.

S “This one should go after that one because it is the answer written like the question”

Throughout the conversation S and B often negotiate meaning, finally coming to a joint construction. S corrects B after clarifying that bigger means that a strip goes towards the end and smaller means near the start. B correctly uses the words beginning, middle and end later on in the conversation.

W (NS) “Why not that one?”

R (NNS) “um ...the same here”

W “What?”

R “They are both geometric. They both have common ratio.”

These interactions were a perfect example of what Polio and Gass (1998) saw as the benefits of student interaction in a mainstream class. They stated that interaction has been shown to have a positive effect on non-native speakers' comprehension of their L2, but that interaction should also have a positive effect on native speakers' comprehension of non-native speakers speech because the interaction gives learners an opportunity to modify their speech upon a signal of miscomprehension.

WHAT CONCLUSIONS DID I DRAW FROM MY EVIDENCE?

1. The perceptions of ESOL and NS students towards pair work in your classroom can be changed.

I was explicit very early on in the year on why I thought pair work was a good idea in my mathematics classroom. I frequently told my students why I wanted them to work together and what I hoped that they would gain from it. I was prepared to find that my students disagreed with my point of view. However, I continue to hold the view that can learn as much, if not more, from each other than they can from students dominated lessons.

2. There are attitudes and beliefs held by students in your class that are different to the culture of a New Zealand mainstream mathematics classroom. Gunderson (2000) is clear that across linguistic and cultural groups, expectations for school and schooling cause real difficulty for students and, indeed, for teachers. The reluctance of second language students to engage in the cooperative learning in the mathematics classroom due to the huge difference in educational experiences from their home country to the New Zealand classroom may be why second language learner may not succeed academically or have difficulties with their studies for other reasons related to cultural adaptation. (Brickman and Nuzzo, 1999).

Brickman and Nuzzo suggest that this accounts for international students tending to form bonds and stay with students from their own ethnic background and continuing to use their native language, thereby reducing their exposure to English.

3. If pair work is to be used as a successful learning strategy, there is a need for professional development of teachers to help them facilitate it.

I had become very aware over the last few years that my teaching style was not facilitating interaction with the ESOL students in the classroom. I appeared to elicit much less meaningful output from the ESOL students than the native speakers in my classroom. In an attempt to address this I noticed that the type of questions that I posed to ESOL students limited them to mostly short phrase or single word responses.

Pair work was an attempt to change my instructional method. I have now had some training in effective ESL strategies through the [*Auckland College of Education's Diploma of TESSOL*](#). Even then I feel that I must continue to keep up with what is effective practice, if I am going to enhance the use of pair work and cooperatives learning.

I believe the sequencing of tasks is critical. By starting with mix and match and information gap tasks I was able to more readily engage ESOL students. Those tasks that required the least amount of English to solve were the easiest to initiate. This type of task got students involved and helped build the necessary vocabulary needed for the rest of a topic. I frequently observed students using more non-verbal communication, such as pointing, when in this phase.

The next move would be to move to sequencing tasks. These types of task often require a negotiation of meaning and often then a re-negotiation. I heard students restating their own meanings to each other, checking with their partner. It was here that I observed ESOL students modifying their language as the mathematical ideas when back and forwards between them.

The activities that require the most English appear to be the argument tasks. It was here that the ESOL students needed the greatest amount of vocabulary and content. In one of the classes I have, I suspect I may never get to the stage during the year where ESOL and NS pairings could accomplish this. It is with these tasks that the students get the least amount of scaffolding and have to produce the greatest output.

Finally, I have changed the way that I get students to report back. Traditionally I had asked three or four pairings from around the room to report back to the whole class. I believe now that this whole class report back takes time and should not be introduced straight away. I found this was putting pressure on ESOL students who were unwilling to speak to the whole class. I now get students to report to another pairing so they are in fours and then get the group of four to report back to the class.

By exploring the interactions between students in my classroom I feel that I have come to have a better understanding of what works in a pair work situation and what doesn't. I have seen the power of student-student interaction as a learning tool and I am determined to continue along this path.

As a final point, I would like to thank and acknowledge the work of my students. Over the course of the year while I have been undertaking this research I have benefitted greatly from the dialogue that has developed between my students and me. All students have been open and honest in their dealings. They have responded positively to all my attempts to improve my practice. They have been the most constructive of critics and the most enthusiastic of participants.

RECOMMENDATIONS

1. Use pair work with ESOL students in your mainstream classroom.
You can successfully run pair work activities in a mainstream classroom with a high proportion of ESOL students. However, you need to be aware of the differences in the cultural and educational backgrounds of your students and the attitudes and beliefs that they bring.
2. Choose your tasks carefully and sequence them in a way that develops the thinking and comprehension skills you want.
3. Become an advocate for cooperative learning practices in your school.
Although there have been attempts to enhance both ESOL and mainstream teachers' understanding of their role in helping ESOL students learn English, there needs to be more fundamental changes into how we teach. As Harklau (1994) says collaboration between ESOL and mainstream educators should also go beyond the classroom.

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Appendix I

Learning Through Language

Learning through Language is a professional development programme for secondary school teachers developed by Ruth Penton. It has been incorporated into the Ministry of Education's Effective Literacy Strategies published in 2004 and available through school support services.

Appendix II

TABLE

	Before pair work tasks		After pair work tasks	
	ESOL	NS	ESOL	NS
Q1	3.6	3.6	3.9	4.1
Q2	2.6	3.4	3.7	4.0
Q3	4.6	4.4	4.6	4.5
Q4	3.8	2.8	3.6	4.1
Q5	3.4	3.2	4.0	3.9
Q6	3.2	3.7	3.9	4.1