Patterns of Interaction in a Mathematics Teacher Trainee's Classroom

by

Tina Lim Swee Kim
Maktab Perguruan Ipoh Perak
tina@cyberlite.net

ABSTRACT

Contrary to popular belief, mathematics is not a subject with minimal language demands. The communicative flexibility of a teacher affects the type of interaction in the class and is considered just as important as the careful planning that goes into any lesson. It is therefore the purpose of this study to draw understanding on the effect of the pedagogical purpose of communication and the pedagogical strategy employed by a mathematics teacher trainee, who uses the English Language as the medium of instruction for the very first time in a real life setting, on the pattern of interaction in the classroom. Analyses of teacher talk and student talk in the teacher trainee's class during practicum were based on audio-taped recordings of a lesson as well as the pre-written lesson plan. Among others, it describes the types of questions used by the teacher trainee, responses from students and feedback by the teacher trainee.

INTRODUCTION

Much research on classroom interaction has been carried out in English as a Second/Foreign Language (ESL/EFL) classrooms. The focus of such studies has been on teacher talk because of the potential effect on learners' comprehension and learning (Ellis, 1994). Analysis of classroom interaction within the mathematics and science classrooms in Malaysia may now be considered desirable since for both subjects, the medium of instruction is English, which is a Second Language (SL) in Malaysia. This is because, contrary to popular belief, mathematics is not a subject with minimal language demands. According to Dale and Cuevas (1992), as cited in Jarrett (1999), mathematics and language are intricately connected in that language facilitates mathematical thinking. One may then consider English as the communication vehicle for the learning of mathematics. Glew (1998) stressed that subject teachers with learners who are ESL learners need to examine the amount and type of language practice they provide because lesson content and the behaviour of teachers and students may prohibit or promote opportunities for interaction and negotiation in the classroom. This is to say that the communicative flexibility of a teacher affects the type of interaction in the class and is considered just as important to the quality of learning that takes place, as the careful planning that goes into any lesson.

REVIEW OF RELATED LITERATURE

Types of Classroom Interaction Analysis

Typically, analysis of classroom interaction may be done either at the micro or macro level. At the macro-level, observation schedules and coding systems have been used to categorise teacher and learner behavior during a lesson. Tally sheets are used to analyse teacher talk and student talk. Analysis of teacher talk may be based on the type of instruction, question, feedback and praise used by the teacher, as well as the frequency of use for each category of teacher talk. Types of instruction include suggestions, commands and requests whilst types of questions include divergent/convergent questions, procedural, display and referential questions. Types of feedback may be categorised according to corrective and positive or negative feedback. Praises accorded by teachers may be brief acknowledgements, praise on specific efforts or extended praise. Analysis of student talk may include type of response to teacher talk like one-word answers or extended answers. In SL or FL classes, student talk may be categorised according to the following: confirmation check, clarification request, information request, and hypothesis testing. In addition to that, student behaviour may be classified as on-task or off-task behavior.

The disadvantage of this type of analysis is that the overall organisation of a lesson and the features of context in the lesson cannot be examined. Besides that, such an analysis has been criticised as being too rigid and over-simplified. Seedhouse (1995) reiterated that classifying verbal interaction as discrete linguistic or pedagogic events fails to address the complexity of classroom interaction.

Micro-analysis of pedagogical practices is commonly conducted using conversation analysis (CA). Conversation analysis is rooted in the social-constructivist concept whereby the socio-linguistic and socio-cultural aspects are considered to play an important role in the classroom interaction. Linguistic details of the interaction that occurs in the classroom are examined as well as the sequencing of speaking turns (Kasper & Overstreet, 2002). The lesson becomes a unit of analysis and the aim is to uncover "the socially organized features of talk in context" (Atkinson & Heritage, 1984, p. 5). Other tools from CA include a procedural description of the lesson analysed as well as the discourse format and participation structures involved. The different types of discourse formats that may be present in a typical lesson are Initiation-Response-Feedback (IRF), lecture, question-answer pair, ordinary conversation and student-initiated discussions whilst participant structures could be of any of the following: teacher-student, teacher-students, student-student, or student-teacher.

Classroom Code Switching

A review of related literature on whether the use of the native language in an ESL environment should be allowed, reveal that native language plays an important role in learning a subject and that academic performance of students who are allowed to use the native language as well as English often improves (Kang & Pharm, 1995; Jarrett, 1999). Eldridge (1996) agreed that code switching is not necessarily counter-productive to the achievement of learning objectives of the lesson. He pointed out that premature attempts to reduce the use of the first or native language may have a negative effect on the students' motivation and confidence.

On the other hand, Franklin (1990) warned that ESL/EFL teachers who find it constantly break into the native language of students to deal with classroom management actually restrict the amount of meaningful input to which the learners are exposed, but also risk slowing down the acquisition process. She underlined the importance of establishing a means of helping teachers to maintain the use of the target language as the predominate means of communication in the classroom and further added that the teacher must be careful not to fall into the trap of inertia, that is, "having the tendency to continue the use of the native language simply because he / she has begun the lesson in that language, and because changing to the target language may result in problems of comprehension which the teacher may not feel competent to deal with in the foreign language" (p. 15). The reason given was that injudicious use of the native language might encourage the student "to expect that all problems of comprehension will automatically be solved in the mother tongue, if only he / she waits long enough" (p. 15).

The use of language by the teacher may also be analysed at two levels that is the Outer level and the Inner level as suggested by Willis (1992). Use of language at the Outer level refers to the teacher's use of the language for classroom management purposes for example socializing, organising, explaining, and checking students' understanding of the teacher's instructions. On the other hand, the use of language at the Inner level consists of the target forms of the language that the teacher has selected as learning goals. This type of analysis is particularly useful in examining code switching by the teacher in a classroom situation where the medium of instruction is not the students' native or first language.

Pedagogical Purpose and Its Importance

The pedagogical purpose of any type of communication in a lesson originates from the teacher's thinking during the planning stage of the lesson. This is especially so in the case of teacher trainees who write lesson plans according to what they hope will occur in the classroom proper. However, what lies on paper does not necessarily come to fruition a hundred percent because the teacher can never be sure of the type of responses he/she will get from the students. This is where the teacher trainee differs from the experienced teacher. More often than not, the teacher trainee usually works along the "technician" type of thinking during lessons, that is to say he/she tries his/her best to carry out procedures according to what has been planned. The lack of ability of the trainee to reflect-in-action would most likely result in being unable to realign the classroom situation back to what he/she originally planned especially so when a major deviation from what was planned occurs. On the other hand, the experienced teacher is able to draw upon his/her vast repertoire of knowledge and experience in handling situations which may not have been expected, in order to remain focused on the intended pedagogical purpose(s).

In ESL/EFL classes, the linguistic forms and patterns of interaction are invariably linked to the teacher's pedagogical purposes and this varies between lessons and within lessons (Seedhouse, 1995). In a similar manner, one might expect such a relationship to be inherent in the teaching of mathematics in English. What the teacher says and how he/she says it depends on the teacher's intention and that would certainly affect the pattern of interaction in the mathematics classroom. The possible pedagogical purposes in a lesson include recalling prior knowledge, explaining a concept, eliciting responses, supporting thinking, extending thinking and assessing students' understanding.

Pedagogical Strategies for Mathematics and Their Relative Interactivity

The various strategies available for mathematics instruction include lecture, discussion, guided practice, independent practice, and group work. The type of strategy a teacher chooses in delivering a lesson depends on the learner, the context and the content. Whilst lecture (which is expository in nature) tends to be highly teacher-centred, it can become much more interactive and student-focused with the appropriate use of questions to check for student understanding (Freiberg & Driscoll, 1992).

A discussion is the interchange of ideas between the teacher and the students or among students. It gives rise to greater student input and hence is considered to be more student-centred. Students participate actively, either through verbal inputs or from listening to responses from other students.

In guided practice, the teacher works through the mathematics problem with the students. It could be in a small group or a whole class setting. What normally follows is independent practice whereby the students are now expected to solve problems/carry out activities without the teacher's help. Independent practice problems model after the guided practice problems. Comparing guided practice and independent practice, one would expect guided practice to offer more opportunities for interaction between teacher and students.

In group work, the level of involvement of students may vary according to the group structure set by the teacher. Groups may be organized such that individuals in the group work independently, cooperatively or competitively. Depending on the structure set, opportunities for talking and listening will vary.

PURPOSE OF THE STUDY

The purpose of this study was to draw understanding on the effect of the pedagogical purpose of communication and the pedagogical strategy employed by a mathematics teacher trainee on the pattern of interaction in the classroom

SIGNIFICANCE OF THE STUDY

Ideally, the findings from this type of study should be presented to the teacher trainee herself so that the trainee may have a more holistic and better picture of her own pedagogical practices. Any contradictions in the actual practice as opposed to beliefs of her own practice could serve as a launching pad for initiating pedagogical change for the better. However, since this study was merely conducted to draw understanding on the effect of the pedagogical purpose of communication and the pedagogical strategy employed by the teacher trainee on the pattern of interaction in the classroom, the findings from this study may indicate possible areas of strengths and / or weaknesses in a mathematics teacher trainee's classroom discourse. Knowledge of this might help teacher educators be more aware of how to analyse conversations in the classroom and also to hold post-practicum conferences that are able to help the trainee improve on his/her talk in the classroom.

DEFINITION OF TERMS

The terms used in this paper are as follow:

Native language is the language commonly used by a learner in normal teaching-learning contexts and for all other official communication purposes. In the case of Malaysia, Bahasa Melayu is considered the native language.

A **second language** learner lives in the country where the target language is the dominant native language (lives in an input-rich environment). The English Language may be considered the second language in the Malaysian context.

A **foreign language** learner learns a language which is not native to the country in which he lives, and is therefore exposed to the target language only in the classroom.

Classroom interaction, simply put, is the talk that goes on between the teacher and students in any classroom situation.

Code switching occurs when a speaker shifts from one language to another, usually in the course of a single conversation. For example, a speaker in a typical Malaysian classroom might amongst others switch back and forth from English to Bahasa Melayu, from Cantonese to English, or from Cantonese to Mandarin.

METHOD

Participants

The participants in this study were a teacher trainee and her students in a Form Two mathematics class. The trainee was from the Postgraduate Teaching Diploma Course majoring in mathematics and at the time of study was into the seventh week of practicum in a rural co-education secondary school in Perak. The teacher trainee, a female, was from a Chinese medium school and had obtained a C6 for the English language in the Sijil Pelajaran Malaysia examination.

The students involved were mainly from a Cantonese speaking background and possessed low proficiency in the English Language but were otherwise of average ability in mathematics. At the time of this study, the students were in Form Two and into their second year of learning mathematics in the English Language. The medium of instruction for mathematics throughout their primary school was Bahasa Melayu.

The teacher trainee was teaching the concept of congruency under the topic “Transformation”. The duration of the lesson was thirty-five minutes. Prior to this lesson she had taught them the concept of translation, reflection and rotation.

Procedure

The lesson in discussion was audio-taped by the teacher trainee herself voluntarily. The researcher was not the supervising lecturer and hence under no circumstance was the teacher

trainee compelled to co-operate. The lesson that was taped was the fifth in a series of six consecutive lessons. As such, inhibition on the part of the trainee and her students of talking in the English Language may considered to have been reduced. This type of enquiry was deemed to be naturalistic in nature.

Data Analysis

Data obtained were analysed at the micro level. Teacher talk and student talk were transcribed word for word for the entire duration of the lesson. The transcription convention used is mostly based on the system advocated by van Lier (1988). Please refer to the Appendix attached. The transcribed lesson was then analysed based on the types of questions used by the teacher trainee, responses from students and feedback by the teacher trainee.

Besides the use of audio tape, the lesson plan prepared by the trainee was also used as a tool in examining the pedagogical purpose and strategy the trainee had in mind for that particular lesson. Reflective notes written by the trainee after the lesson were also utilized.

FINDINGS AND DISCUSSION

Interaction 1

Induction set: According to the lesson plan, the teacher shows examples of objects which are congruent (two fifty cent coins) and objects which are not (boxes of different shape and size), by placing the objects two at a time on the transparency and overhead projector. Teacher intends to use questioning to elicit responses and then introduce the word “congruent” and its meaning.

T: Look at the transparency here. Are the objects have exactly the same shape and size or not?

Ss: {Yes}

T: Two of these is fifty cent. You can compare. If you do not believe, you can compare … same shape or not?

Ss: {Yes}

T: Same size or not?

Ss: (Yes)

T: So I give you another object to compare. How about this 2 box?

Ss: {No}

T: How do you know? Which one is bigger? Which one is smaller?

S: (Cantonese = jutting out)

T: ((= jutting out?)) This one is more rectangle. This is not rectangle. Then you can compare. Then this is not the same shape. This is not the same size, ok? So today I want to introduce you another word. Two objects are congruent. /KON-GRU-EN/. We say that congruent is they have exactly the same shape and same size.

In Interaction 1, the discourse format involved is question-answer pair, and the participant structure is mainly teacher-students except for the last instance where it is teacher-student. The student gives a response that does not answer the teacher's question about whether the objects have the same size but gives a response that leads the teacher to discuss another aspect of incongruency that is the objects do not have the same shape. Although the student uses an appropriate description in Cantonese, the teacher just glosses over the Cantonese word used and does not try to elicit what the student means in English. She herself then explains how the two objects differ in shape. The teacher also fails to ask again if the objects are of the same size but merely tells the students that the two objects are not of the same size.

The analysis here shows that the teacher is able to proceed as planned when the answers given by the students are as expected. However, she was not able to capitalize on an unexpected answer which is relevant to the concept being discussed. The unexpected answer in fact throws her off her intended series of question-answer pairs. It appears that when the teacher code switched, she was not able to successfully carry out her lesson as planned.

Interaction 2

Development phase, Step 1: According to the lesson plan, the teacher shows another three triangles that have the same shape and same size but have different orientations. She wants the students to analyse if object that have the same shape and same size but different orientations may be considered congruent. The teacher intends to get a student to demonstrate using the transparencies she had prepared.

T: Today I want you to explore congruence. What is the meaning of congruence?

Ss: …….

T: Just now I taught you already.

S: (Cantonese)

Ss: ((laughter))

S: means have the same shape and the same size

T: Ya loh! Same shape and same size. … Ok, look at these three triangles.

S: What's this?

T: I ask you are these three triangles still congruent if they have different orientations?

S: No..!

T: What is the meaning of "orientation"? Who can answer?

Ss: ( )

T: (Mandarin = What is orientation? Different direction. Look at this triangle). If you observe this triangle, this orientation is that side. That side. How about this one? (Mandarin = look at the angle) The angle here is pointing here. How about this one? Pointing ..

S: Down

T: Down…that side. So their orientation is not the same. The questions ask you.. if they are not the same orientation, are these three triangles congruent or not? I want to ask, did they change their shape or not?

Ss: No

T: Did they change their size or not?

Ss: No

T: So that means congruent or not?!

Ss: YES..!

T: Very clever

Ss: (applause) {Very clever}

T: So that means those three triangles are still congruent even they are different orientations. As long as they are same shape and

Ss: same size

T: Very clever

This interaction starts off with the teacher trying to recall knowledge that has just been taught, that is the meaning of "congruent". She then proceeds to discuss that when some properties like orientation is altered, the figures are still considered to be congruent. When discussing whether the three triangles (as shown on the transparency) with different orientations but having the same shape and same size are congruent or not, the teacher and

her students seem to be involved in an IRF exchange. However, on close inspection one can see that they are involved in a rapid IR-IR-IR sequence. The F or Feedback is missing. When the teacher finds that the students do not understand the meaning of "orientation", she explains the meaning in Mandarin and then in English. After that, she almost immediately gives hints to the answer when she asks a series of questions to elicit appropriate responses. The teacher code switches automatically from English to Mandarin in trying to explain "orientation". Here again the teacher is the one who initiates the conversation.

The analysis here shows that the teacher did not give feedback to students' answers. It is most probable that she assumes the students know they have given the right answers. The strategy of getting a student to demonstrate that objects with different orientations but have the same shape and same size are congruent does not materialize. Instead she falls upon her question-answer technique in attempting to teach her students the concept. Here again, the teacher seemed unable to follow her original plan when she code switched.

Interaction 3

Development phase, Step 2: According to the lesson plan, the teacher guides students to identify congruence as a property of isometry by giving an illustration where polygon A is rotated to give polygon B and polygon B undergoes reflection to give polygon C. She plans to ask the students to determine if A is congruent to B and if B is congruent to C.

T: Listen here carefully. Congruence is a property of isometry. Isometry you know? Do you know what is the meaning of property? … Property?… What's the meaning of property? … Attribute? What is the meaning of attribute? (Cantonese = feature). So I have you to know.. Congruence is the same shape and same size. That means congruence is also a property of isometry. Because the object after transformation .. translation, reflection, rotation, the object is always congruent to its image. The object and the image are same size and same shape..that is called congruence ... That is why isometry sometimes called congruence transformation. Congruence transformation is equal to isometry, okay? Let's read the question here. In the figure, if B is the image of A under a rotation and C is the image of B under a reflection, determine whether A is congruent to B, B is congruent to C. …. So which is the image, which is the object?

S1: B

S2: A

S3: B

T: B is the …

S1: object … image…

T: Image! C is the image of B under a reflection. C is the ?

S1: Object

T: Image

Ss: (laughter)

T: C is the image! They told you already. C is the image! Now they want you to determine whether A is congruent to B or not.

S1: Yes

T: Whether B is congruent to C or not?

S2: Yes

S3: Yes, you are so clever.

Ss: (giggles)

T: Since A and B is a rotation, therefore A is congruent to B. Since B and C is a reflection ..

S: A is congruent to C ah?

T: B is congruent to C.

Analysis of the audio tape shows that the teacher gives a lecture that isometry is a congruence transformation, instead of guiding the students as planned. Finding that the students could not understand the meaning of property and attribute, she decides to use Mandarin to explain to them. After that she shows the illustration on the transparency and only then guides the students in understanding the concept. The questions she poses lack clarity, giving rise to conflicting answers from students. She does not attempt to rephrase her questions accurately nor correct the students misinterpretation of her questions. She even displays a slight impatience at the wrong answers given. Here she also does not give feedback to the students' answers. At the last turn of exchange, a student interjects by asking a pertinent question but the teacher does not pick that up and just proceeds to give her answer.

This piece of interaction illustrates that the teacher did some mid-lesson alterations; she decided to lecture the students instead of guiding the students to discover the concept. When her students gave wrong answers to the question as to whether B is the object or image, she did not attempt to rephrase her questions. She could have asked the students who answered to justify their responses or she could have other students to evaluate the answers given but she did not do so. This could be due to her lack of proficiency in the English Language or her inability to see that B could be either the object or the image, depending on which transformation was referred to. Finally, when a student asked whether A was congruent to C, the teacher failed to extend the students thinking by asking probing questions.

CONCLUSION

Limitations

The presence of an audio tape recorder in the classroom could have affected the degree to which the students were willing to respond to the teacher, either in Cantonese or in English. However, this might have been minimized since the lesson that was audio-taped was the fifth time it was done.

Secondly, the audio tape recorder was not able to pick up conversations among the students since it was placed at the front of the classroom. As such, information on interaction among students was inevitably lost.

Analysis of interaction for this study was not for the whole lesson but only for three particular parts of the lesson. Where students were asked to do group work, the interactions were not analysed.

Since this study was conducted without taking into consideration the teacher trainee's and students' post-lesson points of view, triangulation of data was not possible. As such, inter-subjectivity validity cannot be ascertained. Besides that, this study may be considered valid only for the particular participants and context examined. Findings therefore cannot be generalized to other classroom situations.

Implications

Thornbury (1996) suggested that for teacher training purposes, analyzing the teachers' lesson through recording, transcription and analysis of lesson sequences might raise the teachers' awareness and understanding of the interactional processes of their own classrooms. Also, as in SL and FL classrooms, the teacher teaching a subject matter using a second language might well benefit from analyzing his/her own lessons in that by doing so, he/she could develop a capacity to generate varied and situation-specific initiatives to further enhance the quality of teaching and learning in the classroom.

Suggestion for Further Research

Future research could be based on videotape analysis of lessons. This would enable to researcher to get a richer interpretation of the type of interaction that occurs in the classroom. Conducting interviews with the participants of the study would also give insider perspectives useful for triangulating what was seen to have happened, what the participants actually meant and why the participants did what they did and said what they said. This would give rise to a more accurate analysis of the events that occurred.

REFERENCES

Atkinson, J. M., & Heritage, J. (1984). Introduction. In J. M. Atkinson & J. Heritage (Eds.). *Structures of social action.* Cambridge: Cambridge University Press.

Dale, T. C., & Cuevas, G. J. (1992). Integrating mathematics and language learning. In P.A. Richard-Amato & M. A. Snow (Eds.). *The multicultural classroom: Readings for content-area teachers.* White Plains, NY: Longman.

Eldridge, J. (1996). Code switching in a Turkish secondary school. *ELT Journal 50* (4), 303 – 311.

Ellis, R. (1994). *The Study of Second Language Acquisition.* Oxford: Oxford University Press.

Franklin, C. (1990). *The use of the target language in the French classroom: Co-operative teaching as an aid to implementation*. Unpublished Ph. D. thesis. The University of Edinburgh, United Kingdom.

Freiberg, H. J., & Driscoll, A. (1992). *Universal teaching strategies*. (2nd ed.). Needham Heights, MA: Allyn and Bacon.

Glew, P. J. (1998). Verbal interaction and English second language acquisition in classroom contexts. *Issues in Educational Research, 8*(2), 83-94.

Jarrett, D. (1999). *The inclusive classroom: Teaching mathematics and science to English Language learners*. Portland, Oregon: Northwest Regional Educational Laboratory.

Kang, H., & Pharm, K. T. (1995). *From 1 – Z: Integrating math and language learning.* (ERIC Document Reproduction Service No. ED 381031).

Kasper, G., & Overstreet, M. (2002). *Conversation analysis as an approach to second language acquisition.* Online. http://nflrc.hawaii.edu/project/2006FmcreInfo.html [2005, May 8].

Seedhouse, P. (1995). L2 classroom transcripts: Data in search of a methodology? *Teaching English as a Second or a Foreign Language*, *1*(4). Online. http://www-writing.berkeley.edu/TESL-EJ/ej04/al.html. [2005, May 8].

Thornbury, S. (1996). Teachers research teacher talk. *ELT Journal 50*,(4), 279 – 287.

van Lier, L. (1988). *The classroom and the language learner*. London: Longman.

Willis, J. (1992). Inner and outer: Spoken discourse in the language classroom. In M. Coulthard (Ed.). *Advances in spoken discourse*. London: Routledge.

Appendix: Transcription convention used in this study

T indicates the teacher

S indicates a student

Ss indicates students

(Where more than one student speaks in a sequence, numbering is used. However, S1 in an exchange is not necessarily the same student labeled S1 in another exchange)

., .., … give an approximate idea of the relative length for pauses up to one second

{ } indicates overlapping utterances

( ) indicates uncertain transcription

(Cantonese =) indicates an approximate translation of the utterance that was made in Cantonese

(( )) indicates glosses

? indicates questioning intonation

! indicates a louder than usual tone of voice

/ / indicates phonetic spelling of non-standard pronunciation