How Children and Their Teacher Use Different Ways of Talking During Whole Class Interactions in a New Zealand Primary Classroom

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The interactional role of language use in the mathematics classroom is explored in the last few decades. This paper adds to the knowledge base by exploring different ways of talking that children and their teacher use in a New Zealand primary geometry English-medium classroom. Bakhtin's concept of speech genres is used for an analysing transcript of one audiovisually recorded whole-class interaction episode from a geometry lesson in a Year 5/6 classroom. The analysis suggests that the teacher and children use various genres to participate in classroom interactions. The use of several genres provides insights into what children and the teacher construct as mathematical in the real sense. The paper finished with a few implications for teaching and research.

In the last few decades, mathematics education research has widely acknowledged and emphasised the role of language in teaching and learning of mathematics. This paper takes a discursive approach to explore how Year 5/6 children (aged 9-11) and their teacher used different ways of talking to display their understanding of geometric shapes and their properties as they engage in classroom interactions. The discursive approach takes interactions as discursive practices where the focus is on the social actions performed by participants' utterances instead of just the content. Analysing the discursive nature of classroom discourse, Van Oers (2001) argued that genres act as a means for participants to evaluate their utterances as a legitimate part of the ongoing mathematical discussion. He argued that it is the genres used in mathematical discussions that allow the initiation of children into a mathematical culture by exposing them to a way of speaking, doing, and interacting that is considered mathematical. This paper aims to explore different genres that children and their teacher may use to convey their understanding of geometric shapes during classroom interactions.

I draw on Bakhtin's concept of speech genres (Bakhtin, 1986). Bakhtin (1986) talked about "speech genres" as "relatively stable types of utterances" (emphasis added in original, p. 60) and are specific to a particular sphere of life in which those utterances are used. Speech genres reflect a speaker's ideology in terms of the participation role that they assign to their addressee through their use of common expressions (Joyner, 2018). Additionally, for Bakhtin (1986), speech genres reflect specific conversational conditions at a particular moment in time as well as reveal the specific intention or action orientation of the speaker at that moment within the conversational space (Bakhtin, 1986; Sullivan, 2012). In other words, speakers use a specific kind of speech genre depending upon the social action they engage in. For example, in criminal court proceedings, the defendant makes use of justifications as one kind of speech genre when defending their actions. Sullivan (2012) argued that speech genres are also important for understanding how the speaker brings "intonation or emotional attitudes" into speech (p. 109). Thus, speech genres account for the overall composition of the utterance with content, style, and intention embedded into it (Bakhtin, 1986; Sullivan, 2012).

Bakhtin (1986) further suggested that the diversity of speech genres is inexhaustible as "each sphere of activity contains an entire repertoire of speech genres that differentiate and grow as the particular sphere develops and becomes more complex. Special emphasis should be placed on the extreme heterogeneity of speech genres (oral and written)" (Emphasis added in original, p. 60). Bakhtin (1986) further argued that there are primarily two significantly different kinds of speech genres: primary and secondary. Primary speech genres are the simple genres used in everyday conversations. However, when these primary speech genres are adopted and shaped according to a

context, and become an integral part of a specific context, these primary genres combine with others to create complex secondary speech genres. For example, the act of formulating an argument in everyday life (a primary genre) may become part of the mathematics classroom, creating argumentation as a secondary speech genre where students are expected to provide either logic or evidence to support their claim, often identified in research as using socio-mathematical norm or argumentation.

Mathematics education research specifically focused on genres has studied genres as discursive practices to achieve a specific social action. For example, Gerofsky (1999) in one of her earlier studies analysed the Initial Calculus lectures of four mathematics professors at Simon Fraser University to explore the generic features of the lectures. In her analysis, Gerofsky found that the lecturers used 'we' to indicate a relationship of power and dependency between the lecturer and their students and seek conformity from the listener. Lecturers may also use tag questions, such as ("Ok?" or "Right?") to elicit consent from their students. She argued that there is a clear link between the language of persuasion and that of mathematics lectures. Rockwell (2000) used the Bakhtinian concept of speech genres to analyse the teaching of speech genres in a teacher's utterances during a lesson observed in a Grade 6 science classroom in a Mexican rural school. She noted that the teacher used a variety of speech genres, including informal talk, explanation, folklore and anecdote, although her analysis does not provide an exhaustive list of those speech genres. She found that the teacher often used two kinds of genre: "plática (informal talk or chat) and explicación (explanation)" (Rockwell, 2000, p. 267). She categorised informal talk as speech genres because they reflected generic overtones, established a particular way of expressing knowledge, and included relatively open turns for student utterances. She argued that explanation was interactionally used as another kind of speech genre, displaying assumptions that the students knew about the topic in question and were expected to provide details about the elements of that topic. Second, she argued that these genres both underwent and caused transformations in the structure of the student's participation each time they were used. She suggested that the teacher's use of a certain speech genre might create discursive conditions for the use of a particular kind of speech genre by the student. Finally, she claimed that teaching itself is like a complex speech genre, comprising several other speech genres which are embedded with "thoughts, values, and sentiments that are re-voiced and reinterpreted in each new situation" (p. 273). This paper aims to add to the existing research on using genres as different ways of talking in a mathematics classroom. The following research question informs the analysis in this paper:

- What speech genres do the teacher and the children use as they interact during a geometry lesson in Year 5/6 New Zealand primary classroom?

Research Design

Context of School and Participants

The paper reports on one aspect of a larger study. The study took place in a Year 5/6 class at a New Zealand English-medium primary school. This school catered to the multilingual children population. Participants included fifteen students with their mathematics teacher. Nine of the fifteen students were multilingual (1 Somali, 2 Tongan, 4 Māori, 1 Chinese, and 1 Filipino). The teacher had seven years of teaching experience. Parents filled out a short five-question questionnaire to provide information about languages that the children used at home or school and how long they have been in New Zealand. Informed and voluntary consent to participate in the study was sought from the participants.

Data Gathering Tools

Six lessons on geometric shapes and their properties were observed and audiovisually recorded. Each lesson lasted for 45 to 50 minutes. Relevant documents including the New Zealand Curriculum

(Ministry of Education, 2007) and resources, teacher's unit plan, and students' work samples were also gathered. Field notes were taken during observations. I noted as many details as possible with keywords to note what and how classroom interactions were unfolding which were later developed in fuller notes with descriptions of settings, events, analytic ideas, inferences, memos, personal feelings and reflections after each lesson observation. All six geometry lessons were also audiovisually recorded. Audiovisual recording enabled the recording of non-verbal cues like gestures, body movements, pointing, and facial expressions that were found to be of particular relevance in revealing mathematical thinking and meaning construction in the pilot study. Two directional cameras were used to audio and video record the whole class and group interactions. I also used eye gear with an inbuilt camera and voice recorder to closely record moments of interaction that captured my attention. In addition, four to five audio recorders were kept on table-tops to record talk-in-interaction in-group settings. Using different audio and video recorders enabled me to record interactions from different angles, which were later corroborated to produce thorough and detailed transcription of data for analysis. Teachers' unit plan, resources used by the teacher to develop the unit plan, children's worksheets, pictures, drawings, and other classroom artefacts were also gathered.

Data Analysis

Audiovisual data from one episode of whole-class interaction is presented in this paper, and participants' utterances in the selected episode are considered the unit of analysis. The analysis process involved analysing utterances using Conversation Analysis (CA) techniques to explore how the utterances were constructed and placed in the flow of interactions. CA techniques allow the explication of participants' utterances in terms of linguistic (including words, syntax, morphological and other grammatical forms) and paralinguistic (including prosodic features of the pitch, the volume of voice, silence along with gestures, laughter, and aspirations) features along with gestures, facial expressions that were used in an utterance. The selected episode was transcribed using an adapted version of Jefferson transcript conventions (Jefferson, 2004). The transcript is a product of an iterative process to ensure intra-rater reliability of the transcription process.

Paralinguistic features of the utterances were interpreted using insights from sociolinguistics research. For example, Hellermann (2003) found that repeating others' utterances with the same tonal pitch may indicate approval or acceptance; conversely, the repetition with different pitch may indicate disapproval. Ward (2019) has shown that English speakers use low pitch to signal authority over a knowledge claim. Moreover, the use of high rising intonation at the end of an utterance is often interpreted as a sign for questioning (Ward, 2019). However, in the New Zealand context, a high rising terminal (HRT) intonation pattern may indicate the speaker's intention to check if the listener is following the speaker or as a way to develop communicational solidarity (Metge & Kinloch, 1978; Warren, 2016). On the role of silence in interactions, Stubbe and Holmes (2000) argued that explicit verbal feedback is a norm of Pākeha (Pākeha is a Te Reo Māori term for a New Zealander of European descent) conversations, suggesting silence may be considered awkward by English speakers. Māori speakers, however, do not consider silence during a conversation problematic and may, therefore, refrain from giving immediate feedback in order to facilitate communicational solidarity (Metge & Kinloch, 1978). Māori participants have also been shown to engage in co-operating by overlapping, where they expand and elaborate on each other's suggestions (Stubbe, 1998). Since the data included children from multilingual contexts including Māori and Pasifica children, research insights from languages other than English were also used.

Peer consultation was also sought to receive comments and feedback on the interpretation and analysis from the other CA practitioners and Māori colleagues to ensure the reliability of the findings. Rockwell (2012) argued that intonation patterns (cues in the way utterances are made) act as an indication for the listener to identify the action and intention embedded in the speaker's

utterance. Therefore, it is the content, style and intention embedded in the overall composition structure of utterance including (linguistic (words, sentences) and paralinguistic features (pitch, silence, volume)) that defines the speech genre (Bakhtin, 1986; Rockwell, 2012; Sullivan, 2012). Sociolinguistic research insights allowed interpretation of the intended social action embedded in the utterances through interactional features such as pitch, volume, pauses, which led to the identification of the "relatively stable types" (Bakhtin, 1986, p. 60) of utterances that accounted for the speech genres at the macro-level analysis.

Analysis and Discussion

This episode is extracted from the audiovisual data from the second lesson. During this lesson, the teacher provided children with playdough to make shapes that they already knew. During this episode, Zara (a female 9-year-old Māori-English bilingual Māori child with greater proficiency in English) made a few shapes using playdough and claimed that one of the shapes she made was a "perfect square" (see the circled shape in Figure 1).
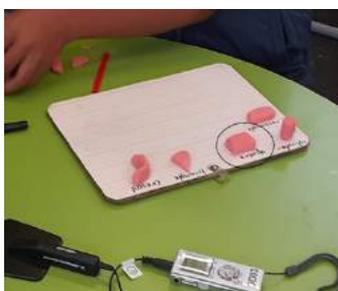
Figure 1. Playdough shape in a "perfect square" (circled).

The following transcript shows the conversation followed as Zara mentioned her shape.

#	Speaker	Text
189	Zara	>look whaea**a** Jenny:< (1.0) whaea Jenny (.) a
190		perfect square ((shows the shape by holding it in her hands))
191	Teacher	is it perf (.) why is it a perfect square? Zara
192	Zara	I dun↓no
193	Teacher	<u>what</u> makes it a perfect square(2.0)>come on zara ↑I
194		need< to ↑<u>kno:w</u>(0.5)because you said its perfect so
195		what makes a perfect square a perfect square
196		(1.0)=
197	Matiu	a ↑s[quare
198	Teacher	=[↑anyone ↑know <u>why</u> a <u>perfect</u> <u>squa:r</u>e a perfect
199		Square
200	Matiu	becoz its a <u>squa</u>re?
201	Garry	(h)(h)
202	Teacher	yeah <u>because</u> its a <u>square</u> doesnt tell me
203		much(1.0)ELIE what do you think
204	Elie	becau::se um: [if you have to= (2.0)
205	Zara	[you put(on)((rolled her eyes))

#	Speaker	Text
206	Elie	=um: because um::(1.0) <u>if</u> you have the right type
207		of shape. or <u>if</u> you (1.0)if or if you have(.2)
208		havin:g a right(0.5)type of equipment (.) °you can
209	have°	
210	Teacher	°okay°
211	Elie	so:: if you are trying to make square of that
212		one(1.0)you can roll into a ball then you
213		start pressing it down the other side >the
214		other side and you can [get square<
215	Teacher	[oh thank thank you Elie
216		(0.5)↑can any↑one ↑tell me why a perfect square
217		might be (0.2)might be perfect square <u>using geometry</u>
218		<u>Language</u>
219	Zara	[um ((looks at the roof trying to figure out how to say what she wants to
220		say))
221	Matiu	[um: °its got°
222	Teacher	Matiu
223	Matiu	be<u>cause</u> the <u>face</u> °no:(0.2)the si::des°(2.5) nah
224		°I dun know°
225	Teacher	yeah you re on the right track. the <u>si:des</u> <u>what</u>
226		(.)what would the sides be here
227	Matiu	perfectly:: aligned? with each other?=
228	Teacher	=aligned with each other?
229	Matiu	ah(1.0) perfectly the same?
230	Teacher	perfectly the <u>sa:</u>me the sides ↑<u>are</u> perfectly
231		the same (1.0)

aWhaea, meaning mother/aunt in Te Reo Māori, is used here as a term of respect to the teacher.

Zara tagged her teacher as the next speaker (lines 189 and 190) and claimed that the shape that she had made was a perfect square. She used a flat pitch with her claim of a perfect square. Ward (2019) suggests that English-speaker may use flat pitch to show their confidence in their knowledge claim. It seems that at this moment, Zara intended to declare her claim without providing any justification for the claim. This has been identified as one of the speech genres that children may use and is labelled as a *Declarative* speech genre.

To this claim, the teacher responded with a question to Zara, thus initiating the Initiation-Response-Evaluation/Feedback conversational pattern (McHoul, 1978) in the classroom. The Initiation-Response-Feedback (McHoul, 1978) In the classroom interaction, the sequence of the teacher's question in the first turn, the child's response in the second turn, and the teacher's feedback in the third turn were observed in the data. The teacher initially structured her question to ask if the shape was a perfect square (line 191); however, in the same turn, she rearticulated her question as

"why is it a perfect square?", thereby leaving more space for Zara's explanations. Initiating a conversation with a question and providing cues to support children's thinking is identified and labelled as the *Pedagogical* speech genre in this study.

Zara, in the following turn (line 192), stated she did not know, by saying "I dunno". She initially used a flat pitch and then lowered her pitch (indicated by ↓). Ward (2019) has shown that this type of construction, using a flat and low pitch, is often made to signal to the listener that the speaker has given in and is not able to provide any further explanation. Utterances signalling the action of giving up in a discussion were identified and labelled as the *Giving-up* speech genre.

Noticing that Zara is not able to provide reasoning for her claim, the teacher rephrased the question and emphasised "what" (line 193, indicated by <u>underline</u>) to encourage Zara to think about the shape's properties. The teacher used longer pauses of two seconds (line 193, indicated by (2.0)) and one second (line 196) in the same utterance to allow Zara to bring some explanation of her claim. This again signals the use of the Pedagogical speech genre.

In the next utterance, Matiu (male 11-year-old Māori-English bilingual child) self-selected and stated that being a square makes it a perfect square (line 197). In the following utterance (line 198), the teacher appeared to ignore Matiu's utterance. This may be because the teacher required children to raise their hands before speaking (Fieldnotes 1 to 6). It seems that the teacher ignored Matiu's response, probably because he had not followed this classroom norm. The teacher used high pitch (indicated by ↑) at the beginning of "anyone" and "know" to open the floor for all children to respond (line 198). Ward (2019) showed that high onset is often used for initiating a new topic. This time, the teacher looked at Matiu and provided him with her consent to speak. Matiu responded that a perfect square is perfect because it is a square, as he stressed the word "square" (line 200). The use of the HRT (indicated by ?) in English spoken in New Zealand often implies the speaker's intention to check if the listener follows what the speaker is trying to say (Warren, 2016). Thus, Matiu's use of HRT at the end of his utterance may be interpreted as his way of checking with the teacher whether she agrees with his response, which again may be interpreted as his way of declaring his knowledge claim, therefore using Declarative speech genre.

In the next utterance, Garry (a male 11-year-old Filipino-English bilingual Philippines child) might not have understood the use of this specific intonation pattern in New Zealand English as he laughed at Matiu's response (line 201). Jefferson (1984) showed that laughter within talk-in-interaction sometimes signals trouble, as the recipient engages in laughter to embarrass the speaker. In this case, it seems that Garry might have evaluated Matiu's response as wrong and redundant. It seems that Garry used his laugh as a way to show his assessment of Matiu's response. Utterances that suggest assessment of others' responses are labelled as *Assessment* speech genre.

It is interesting that the teacher often used the Assessment speech genre where she provided an implicit assessment of the children's responses as either incomplete or incorrect and selected another speaker as evident in the following utterance in the interaction. It appears that the teacher did not accept Matiu's response as she said that "Being a square doesn't tell me much" (line 202). Matiu (line 200) used HRT to seek approval from the teacher. She selected Elie as the next speaker to answer, "why a perfect square is a perfect square". In lines 204, 206-209, Elie used "um", stretches and pause of one second to construct her utterance. These features are often a mark of a non-response (Sacks, 1987). Thus, it may be that she was not sure of what the teacher wanted her to comment on about the square. In the following utterance, the teacher again used the Assessment speech genre as she provided implicit rejection of Elie's response as the teacher thanked Elie for her response, however, did not provide specific feedback on her response to support her thinking.

The teacher at this moment rephrased her question (line 216) and stressed the words "geometry language" to direct the children's attention to the geometry-specific features of the shape that made it a perfect square. It seems that the social action embedded in this utterance was to provide feedback

to children to provide their responses in a specific manner using geometry language. Thus, this could be interpreted as the use of the Pedagogical speech genre. Following this cue, Zara and Matiu self-selected. However, Zara used "um" as a filler and started looking at the ceiling of the classroom in an attempt to recall the shape (line 219).

Matiu (line 221) used "um" to hold the floor, and then he used his low tone (whispering, indicated by º) to state his utterance. The teacher continued to use this speech genre in utterances following Matiu's response as well. The teacher selected Matiu as the next speaker (line 222). He attempted to answer (line 223) by emphasising the word "face", but then he changed the term "face" to "sides". He used his whispering tone for his utterance. Ward (2019) suggests that speakers often use whispering at the end of their utterances to signal low confidence. Thus, Matiu's use of a whispering tone and pauses of 2.5 seconds (line 223) may be interpreted as doubt and uncertainty. He realised that he might be wrong, and therefore he stated that he did not know.

In the following turn (line 225), the teacher provided positive feedback and again stressed the word "side" as she stretched it and used a slightly high volume (for emphasis) to signify to the children that the answer she was looking for was related to the properties of a square in terms of equal sides. In doing so, she clearly showed her intent for children to use geometry-specific language by explicitly asking about the property of sides in the square. After receiving positive feedback from the teacher, Matiu responded that the sides needed to be perfectly aligned with each other (line 227). However, this time as compared to his previous utterance (line 223), Matiu used HRT to check if the teacher agreed with him. It seems that the teacher acknowledged that Matiu might have been looking for agreement as he used HRT; thus, in the following utterance (line 228), she responded with a question to Matiu to let him reconsider his response. She used HRT at the end of her utterance, probably to signal the partial correctness of Matiu's response. Matiu (line 229) realised that his answer was partially correct, but that he needed to restructure his response to meet the teacher's expectation. Thus, he used a filler and paused for one second to hold the floor while looking for the right word (line 229). He again used HRT with his utterance "perfectly the same" (line 229) to check with the teacher. This time, the teacher stretched the word "same" to emphasise its use (line 230). She used a slightly high pitch along with stretching the first syllable. Moreover, she reiterated the phrase "sides are perfectly the same" three times in her following utterance (lines 230-231).

Discussion and Conclusion

Speech genres are those preferred utterances that speakers use to accomplish a certain social action, and are always embedded with the speaker's intentions, values and sentiments (Bakhtin, 1986; Rockwell, 2012; Sullivan, 2012). The analysis identified several speech genres such as pedagogical, assessment, declarative, and giving-up speech genres. The use of speech genres suggests that there are implicit messages in the way utterances are constructed while engaging in classroom interactions. The finding is an extension to the finding presented by Rockwell (2000). Rockwell (2000) analysed primary speech genres in teaching episodes in a Mexican rural school and found that the teacher used speech genres from different aspects of life, including informal talk, explanation, folklore, and anecdotes. Moreover, Rockwell (2000) had suggested that the use of speech genres in a teacher's utterances may create specific discursive conditions for children's participation. This is also evident in this paper. For example, the use of the Pedagogic speech genre by the teacher often called for an explanation or justification by the child by responding to a question provided as feedback, whereas, the use of the Assessment speech genre may only highlight a child's incorrect response and provide no further feedback to the child, which may hinder further participation of the child whose response is assessed. Thus, it can be argued that the teacher's practices in the use of these two speech genres (Pedagogic and Assessment speech genres) may work as implicit messages to indicate to children the kind of participation expected from the children.

The paper does not provide an exhaustive list of speech genres that can be identified in a classroom, rather draws our attention to the different ways of talking that may have implications for engaging students in mathematics learning. The paper suggests that teachers' use of the Pedagogic speech genre may be helpful in eliciting children's knowledge. The use of the Assessment speech genre, however, may deter children from participating in classroom interactions, even though negative evaluations are not provided explicitly. Being aware of speech genres may support teachers to consciously use the Pedagogic speech genre in preference to the Assessment speech genre. On the research front, the analysis calls for more research to explore what different ways children and teacher may use in a mathematics classroom. The analysis shows that the children may also construct their utterances in a way to show their declining interest in continuing the conversation as evident here in the use of the Giving up genre by the students, which needs to be explored more in research. It is possible that children construct their utterances in a variety of ways to indicate that they are not interested in continuing the discussion which may further lead to a loss of learning opportunities.

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