Introducing Dialogic Pedagogy in Early Years Mathematics: Contrasting Authoritative and Persuasive Discourses

Carol Murphy
University of Tasmania
carol.murphy@utas.edu.au

Tracey Muir
Australian Catholic University
Tracey.Muir@acu.edu.au

Damon Thomas
University of Queensland
damon.thomas@uq.edu.au

The study presented in this research report aims to compare and contrast the pedagogical approaches in early years mathematics. We present transcript data from a baseline and end lesson from one teacher as part of a broader study to introduce dialogic pedagogy and collaborative group work. The pedagogical approaches are analysed in relation to Bakhtin's notions of authoritative and internally persuasive discourses and on the teachers and students' use of language. We highlight how language can balance authoritative and persuasive discourses and influence the way students collaborate and assimilate the mathematics.

Dialogic pedagogy is loosely defined as teaching that prioritises talk and interaction to engage students, stimulate thinking and advance understanding (Alexander, 2004). There is now a substantial body of literature in this field generally and in mathematics specifically (e.g., Mercer & Sams, 2006). There is also evidence that there is a relationship between the nature of classroom discourse and student outcomes (Howe, et. al, 2019) with high levels of elaboration and querying, typical of dialogic pedagogy, being positively associated with test scores. Despite this maturing knowledge, adoption of dialogic approaches in mathematics classrooms remains limited (Kibler et al., 2020) and more transmissive approaches related to the fixed authority of the teacher are often more prevalent. Teachers' concerns focus on their students' access to content knowledge and meeting curriculum objectives. As such a more authoritative approach may be adopted to transmit knowledge. A question arises how an authoritative teaching approach compares to a dialogic teaching approach that prioritises talk and interaction in supporting students' access to the intended learning. Such a question is of particular concern in early years mathematics classrooms where young students are less likely to engage in talk and collaboration.

In this paper, we focus on Bakhtinian notions of dialogicity, that refer to authoritative and persuasive discourses, and on Pimm's (1987) work that positions mathematics as a language. We examine the pedagogy of one teacher, Cathy and her Grade 1 and 2 (6- and 7-years) students, from two lessons that were part of the data collected for a larger study to support talk in early years mathematics classrooms. Our research questions are:

- How do the two lessons compare in relation to authoritative and persuasive discourses?
- How is the teacher language reflected in the two discourses?
- In what way do the discourses in the two lessons influence student collaboration in group work?

Literature Review

Despite the maturing knowledge regarding dialogic pedagogy and the evidence that collaborative dialogue with students in small groups suggests academic achievement, longer term retention and application of critical thinking (Mercer & Sams, 2006), the adoption of such practices in mathematics classrooms remains limited (Kibler et al., 2020; Moser et al., 2022).

(2025). In S. M. Patahuddin, L. Gaunt, D. Harris & K. Tripet (Eds.), *Unlocking minds in mathematics education. Proceedings of the 47th annual conference of the Mathematics Education Research Group of Australasia* (pp. 325–332). Canberra: MERGA.

In the literature review, we consider how dialogic pedagogy has been defined and then review studies that have investigated the introduction of dialogic pedagogy in mathematics classrooms.

Dialogic pedagogy has been defined by several theorists, including Alexander (2004) who characterised it as teaching that focuses on talk to engage student interest, stimulate thinking, and advance understanding. As such, Alexander positioned dialogic pedagogy as shared enquiry and contrasted this to the teacher-centred dominance of Initial-Response-Evaluation (IRE). Other theorists, such as Wegerif (2006), have gone beyond the notion of shared enquiry to define dialogic pedagogy as a multivocal discourse where meaning emerges within an open dialogue. Common to these two definitions is that dialogic pedagogy is multivocal, emphasising inquiry and problem-posing. As such, knowledge is treated ambiguously, creating space for interaction and rearticulation of thoughts with others.

In these regards, dialogic pedagogy is typically countered in opposition to transmissive, univocal pedagogies where knowledge is presented as fixed and presented in an authoritative manner either by the teacher and/or textbook. Mathematics teaching is often seen as objective, relating to established facts and processes (Artigue & Blomhøj, 2013), and a teacher's focus on objectives may defer to authority so that students gain the correct learning for the lesson (Murphy, et al., 2021). As such, teachers may not be prepared to tolerate students' engagement with ambiguity that is more evident in problem-solving or inquiry-based approaches.

Hence, tensions arise between teacher-centred dominance and the student-centred inquiry approaches in mathematics classrooms. Studies that have investigated the use of professional development in supporting dialogic pedagogy have uncovered such tensions in relation to the teacher's role in scaffolding learning (Klemp, 2020; Murphy et al., 2021) and the decentralisation of authority (Campbell & Teo, 2022). Other tensions relate to the positioning of mathematics (Ng, et al., 2021) and the need to attend to precision (Otten et al., 2015). These tensions arise despite the evidence from Howe et al. (2019) that dialogic pedagogy supports student performance. As such, the debate relating to authority structures and the need to achieve a balance, incorporating both dialogue and univocal discourses continues.

Theoretical Perspectives

In relation to the definitions of dialogic pedagogy above, we refer to Wegerif's theory of multivocal discourse and open dialogue where knowledge is treated ambiguously through inquiry and problem-posing, creating space for interaction and rearticulation of thoughts with others. Wegerif (2011) further proposed that dialogue has both an outside and an inside nature and these relate to Bakhtinian (1981) notions of authoritative and internally persuasive discourses. Bakhtin (1981) referred to an authoritative discourse as an inflexible kind of assimilation. The authoritative voice is seen as outside and one that forces acceptance or rejection. It presents a single, unyielding perspective, without acknowledging alternative viewpoints or engaging in meaningful dialogue. In the case of education, the authoritative voice would relate to learning by rote, recitation or following a set inflexible method unquestionably.

Wegerif contrasts the authoritative voice with Bakhtin's notion of an internally persuasive discourse as one that "enters into the realm of my own words and changes them from within" (Wegerif, 2011, p. 181). The discourse is "half ours and half-someone else's" (Bakthin, 1981, p. 345). A key tenet of dialogic theory relevant in teaching is how students learn to think (Wegerif, 2011). In this regard, education is about generating new meaning from others through social language (written or spoken), and this requires dialogue to be both inside and outside. In mathematics education, Williams and Ryan (2020) referred to the internally persuasive nature of dialogised discourse. Whilst there is an endpoint in the learning, there are opportunities for dialogue in the discourse of both teachers and students' multiple subjectivities.

In sum, Wegerif's (2011) perspectives distinguish between the authoritative voice and the persuasive voice. The authoritative voice directs you to do something and comes from the outside whereas a persuasive voice enters the inside. Wegerif viewed dialogue as the opening up of new spaces of meaning that include participants within it, that is as a "dynamic continuous emergence of meaning" (p.4) rather than a static space. Such a space allows for the persuasive voice. In this regard, Wegerif posited that, if education is about generating new meaning from others, then education is about being both inside and outside. In this paper, we refer to this position in relation to the language and discourse used by Cathy in her two lessons.

The Study

Research Design

This paper reports on data collected from the first year of a large-scale study which investigated talk in early years mathematics teaching. The first year of the study involved a school-based participatory design (Hennessy, 2014) with four teachers engaged in four cycles of teacher-researcher workshops. Video data of mathematics lessons were collected as baseline and endpoint data as well as interim video data during the four cycles. The first teacher-researcher workshop focused on strategies to promote collaboration and talk in small groups, based on Mercer and Sams' (2006) strategies to promote talk. In consultation with the research team, the teachers were encouraged to try out resources in relation to problem solving tasks. Subsequent workshops then reviewed the teachers' practice including use of resources and tasks based on the videoed lessons and identified the next steps forward. We affirm that the research participants and the children's legal guardians provided informed consent for publication of the non-identifiable data.

In this paper, we focus on Cathy's lessons from the baseline data and the endpoint data collection. Cathy's lessons were selected as they provided a consistent data set with evidence of her implementation strategies to promote student talk and collaboration. In this short paper, we include transcript extracts of Cathy's whole class introduction from two lessons, one before the design intervention and one at the end of the four cycles. We then include the transcripts from one pair of students in each lesson as they collaborate on an independent task. These data were deliberately chosen to illustrate differences in the discourse between the baseline and the end lesson and to consider the impact of the teacher discourse on the students' paired work.

The transcripts were analysed qualitatively to explore Cathy's pedagogical approach and how the students' interaction reflected the approach. Mercer's (2005) sociocultural discourse analysis (SCDA) is used to understand how the teacher used spoken language as a tool for introducing the mathematics content and how the students used language to share their understanding in their paired group work. Transcripts are presented and, as part of SCDA, analysis is provided as commentaries to determine language uses in the discourse. We then interpret the use of language in relation to the teacher's authoritative and persuasive discourses and to the shared thinking in the groups. To distinguish between the discourses, we refer to language-based perspectives. Of particular concern is Pimm's (1987) focus on use of the pronoun *we* as a linguistic practice and how it relates to either an authoritative or persuasive discourse. For example, a teacher stating "in mathematics we…" is referring to the authority of mathematics, whereas a teacher stating "we are going to explore…" suggests a shared endeavour. Another concern is the teacher and student use of modality, that is the expression of certainty, possibility, judgement or request (e.g., we might..., you could…, we should). This use is contrasted with the active verbs (e.g., we are going to…, we know that…).

The Baseline Lesson

In the baseline lesson, Cathy intended to build on students' existing knowledge of part-whole thinking and number bonds to ten and introduced bridging ten as a mental strategy. In the beginning of the lesson, Cathy revised number bonds to ten. She then introduced the bridging ten strategy, first using the numerical example 9 + 5, and then modelling the strategy using ten frames. These examples were displayed on the interactive screen at the front of the class with students on the carpet.

Cathy : We are learning to use an addition strategy called bridging ben. We can use this strategy whenever we are adding two numbers together when the answer is greater than 10. We start by adding on to make up ten and then we add the left-over parts. Let's have a look. So here is a sum. (Displays 9 + 5.) What is the sum?

S1 : Nine add five.

Cathy : Good boy, nine add five. Is that answer going to be bigger than ten?

Several students: Yes.

Cathy : How do we know that?

S2 : Because it's fourteen.

Cathy : I don't want the answer. That's not what I am looking for. How do we know it is going to be bigger than ten?

S3 : Nine like one more is ten

Cathy : So, there's only one more and we've got ten, haven't we?

In this introduction, Cathy used the pronoun 'we' several times, mostly to denote that, as a class, we are doing or knowing a piece of mathematics. As a class, the students will follow the mathematics and will be directed to a known strategy that is going to be taught. Active verbs were used.

Next, Cathy referred to the Little Thinking Man (a thinking emoji displayed on the screen) saying that the Little Thinking Man knows that nine and one is ten because he knows his ten facts and that the man then knows that four are left over. She then asks where the four left over came from. Students gave various responses: "From out of pocket; from fourteen; nowhere." To further support the students, Cathy wrote 9 + 5 on the board and then 9 + 1 underneath. She pointed to the 5 and 1. One student then answered that the four is from the five.

Cathy : From the 5, because we only added one and we want to add five. So, the difference between five and one is four. Then we know we've got ten because nine and one is ten. So, we have to do ten and four more is… Do we know what it is?

Several students: Fourteen.

The Little Thinking Man could refer to an outside voice, representing an authority in how the mathematics is done. Cathy does then open the discourse in asking how the man knows that four are left over. Student responses seemed random, and it is not until Cathy presented the sums and directly pointed to the numbers that one student provided the required answer. Cathy then used 'we' to indicate 'what we do' or even 'what we have to do' suggesting a requirement. Next, Cathy displayed two ten frame images for the same 9 + 5 problem with nine yellow counters on one frame and five blue counters on the other frame.

Cathy : How many have we got in the yellow one?

S5 : Nine

Cathy : How many have we got in the blue one?

S6 : Five

Cathy : So, if we want to add nine and five together our bridging ten strategy shows us we are going to make ten first. What would we do to make ten? Would we move the yellow ones into the blue one or the blue ones into the yellow one? Which would be the most efficient?

A student suggested moving the yellow ones and Cathy used the response to consider if this would be more or less efficient. Students agreed that moving the blue would be more efficient. When modelling with the ten frames, Cathy used 'we' to indicate what is evident in the mathematics. Whilst she used modality "What would we do…? Which would be more efficient?" she was eliciting a required response. She then continued to use 'we' in modelling use of the counters.

Cathy : We're going to take one of those blue counters into the ten frames. So what is this part of the sum? (Points to the yellow frame with the one blue counter).

S7 : Ten

Cathy : But what's the sum. Nine and…?

S8 : Four

S9 : It's fourteen

Cathy : I'm not up to that step yet.

S10 : Nine and five

S11 : Nine and one

Cathy : Yes, nine yellow and one blue. We now know we've got ten and our more. Ten and four equals fourteen.

In this last step, Cathy again required specific responses from the students relating to the strategy. Her use of 'we' referred to the taught strategy, but she also used the singular personal pronoun in referring to her process. Active verbs were used throughout.

The students then worked in pairs each using their own worksheet and supply of yellow and red counters. The worksheet was printed with two ten frames and addition problems within twenty. The transcript from one pair of students, P1 and P2 is presented. They were looking at the problem 9 + 4.

P1 : So, if we move one from here (moves one from four) that would be ten and three.

P2 : No, it would be nine and one. (Counts out in the nine red and one yellow counter in ones).

P1 : We don't have nine add one. (Looks at the problems on the worksheet and writes the answer 10 next to 9 + 4 on her worksheet).

P1 and P2 attempted to follow the strategy by moving counters to fill the ten frames for the sum 9 + 4. Their use of "If we…" suggested a modality in trying out the strategy. They then referred to a quandary ("we don't have…") suggesting they were confused how to record the intermediate step, 9 + 1=10, on the worksheet provided by the teacher.

P2 : Ok, so what does it equal? (Counts out all counters in ones to get thirteen.) No, it equals thirteen. Ten and three.

P1 : What does it equal again?

P2 : I'm not going to tell you.

P1 : Tell me

P2 : Let me do it first. (Takes pencil from P1 and writes 13 as the answer to 9 + 4 on his worksheet.)

P1 : Oh, thirteen. (She rubs out the 10 and writes 13 on her worksheet).

Despite having the ten frame P2 used count-all strategies to determine the answer was thirteen. The students' dialogue also suggested disputation. The use of pronouns shifted to 'it' in referring to the problem and to the singular personal pronoun "I". So, whilst students were directing each other to the problem their thinking was individual.

The End Point Lesson

The focus of the endpoint lesson was partitive division. The lesson was based on the book The Doorbell Rang (Hutchins, 1989). Images from the book were displayed on the interactive screen. Cathy started the lesson by reading the first pages where the mother presents a plate of cookies to the two children. Cathy then read the next page, "That's six each said Sam and Victoria… and then the doorbell rang". Cathy had prepared dynamic images of plates and cookies to model sharing the cookies for the students and showed an image of an array of twelve cookies (four rows by three columns) on a plate.

Cathy : How will we share six each?

S12 : Halves

Cathy : We're going to halve them that is exactly right because there are two halves.

S13 : Two equal parts

Cathy : Yes, two equal shares because we want to be fair.

Cathy : How might you go about doing that?

S14 : You put a line in the middle.

S15 : You could put a line straight through the middle to split them in half. We've been doing that.

Cathy : Think about what you would do if you were sharing lollies with your friends.

S16 : Give them halves.

Cathy : Yes, you are going to halve them but think about how you are going to halve them? How would you make sure they are a fair share?

Cathy's used the pronoun 'we' authoritatively ("we are going to…") and in the phrase "we want to be fair" it is possible she meant "we need to be fair". She then shifts to using the pronoun 'you' and modality, "how might you …?" When the students responded they also use the pronoun you and modality.

Cathy : Let's have a look at how I would do it. (Cathy moves one cookie at a time to each plate on the display board? and randomly positions them on two plates.)

Cathy : Am I sharing fairly?

Collectively students respond yes.

Cathy : Was that an efficient way to make sure that Sam and Victoria had the same amount?

Students murmur yes and no.

Cathy : If you have a better way keep it in your head because, guess what, you're going to do exactly the same activity.

Cathy had used the pronoun 'I' indicating her method for equally sharing the cookies. She then asked students to consider if they can think of a better way. Her reference is to their method rather than a prescribed method.

The students then worked in pairs. They were given two paper plates and 12 cookie picture cards to use between the pair. Their task was to find a way to share the cookies equally onto the two-plate remembering that 'we want to be fair." In the following example, P3 and P4 were working together. P3 placed 12 cookies in the array modelled by the teacher on the carpet in from of him.

P3 : So, I would have that one, that one, that one, that one, that one and that one. (He points to six cookies - two in each of the first three rows). So, these can come out the way…and put them on my plate. (He removes the third column of four cookies) and places the four cookies on the plate.

P4 : You know what I would do…

P3 : Plus, these two. (He takes the two from the bottom row to add to his plate.) And you can have six. He picks up the 6 remaining cookies and gives to P4 who places the six cookies on his plate).

P3 used his own strategy and counted in ones but then he took one column of four and the additional two. P3 used the modal phrase "I would…" providing a suggestion. P4 similarly used modality to provide his own suggestion. The dialogue then followed as the students checked.

P4 : Put them like this to make it fair. (He arranges his cookies on a plate to show two rows of two and then two additional either side.)

P3 : (Continues to rearrange the cookies on his plate.) I want to make sure there are no cookie shortages. (He rearranges his cookies into a two by three array.)

P4 : (Pointing at his plate.) You can do it like this.

P4 : Let's count how many each have. One, two, three, four, five six. (P4 counts his own cookies, then they then both count P3's cookies together.)

P4 : Now that's fair.

In this exchange, P3 and P4 continued to rearrange the cookies to help to determine if they had six each. P4 used an active verb "Put them like this…" but he also used modality in suggesting "You can do it like this…". They arrive a shared view that the arrangement of cookies was fair.

Discussion and Concluding Remarks

In the baseline lesson, Cathy broke the bridging ten strategy into small steps with explicit modelling. She referred to the students' knowledge of number facts and connected the numerical model to the use of counters with the ten frames. Her use of language suggested an authoritative discourse. The pronoun 'we' referred to mathematics in an authoritative manner and Cathy predominantly used active verbs. Furthermore, she referred to the Little Thinking Man as an authority as the way to think through the problem. Apart from when a student suggested moving the yellow counters, she did not attempt to acknowledge other thinking. Even though several students already knew the answer, her intention was to model the strategy so that students would independently copy the mathematics as directed. There was some use of modality in the paired student work but there was also evidence of disputation. However, there was limited evidence of any shared understanding, and it appeared that the students were struggling to assimilate the authoritative discourse.

In the endpoint lesson, Cathy set a context that was accessible to the students. She used modality in asking students how they might share the cookies. This shift related to how they could do the mathematics. Whilst there was a requirement to be fair and share equally, students were encouraged to explore their methods. When they worked in a pair, the students rearranged the cookies into arrays, coming to a shared agreement that it was fair. The students emulated modality in their language, suggesting that students' assimilation was both outside and inside. Whilst there was authority in the mathematics, the use of language within the context suggested a persuasive discourse.

In the baseline lesson, Cathy maintained an authoritative voice, often characterised by use of the pronoun 'we' in appealing to the authority of the mathematics in modelling the bridging ten strategy. The language of the students suggested they were focused on their own thinking in an attempt to assimilate the outside discourse. In the endpoint lesson, Cathy's language was persuasive in inviting students to investigate partitive division. The language of the students as they worked together suggested they were engaged in an intentional act, understanding what the other intended (Gallagher, 2012). Hence, there was a shared understanding or "insideness" as they worked on the task by coming together to check equal sharing with the potential to encounter and incorporate change (Wegerif, 2011). Dialogue was both inside and outside and the thinking became half the students' own and half the others.

The data in this paper is limited to only two lessons with one teacher so claims are not generalisable. However, the data illustrate the potential for contrasting teacher and student discourses within mathematics classrooms. Further analysis of teacher and student talk that focuses on language use in authoritative and persuasive discourses could help reveal some of the nuances associated with classroom discourse and student performance. Nevertheless, a key point to make is that, if we are to balance teaching and then teachers could be encouraged to incorporate both dialogic and univocal discourses in relation to persuasive and the authoritative voices. Instruction can be seen as both outside and inside. In this way, pedagogy can be both persuasive and authoritative in maintaining student-centred approaches that focus on skills and knowledge. Such a balance could move away from the dichotomous perspective of authoritative explicit teaching or dialogic problem-solving (Otten et al., 2015).

Acknowledgements

The research leading to these results received funding from the Australian Research Council under Grant Agreement No. DP220102744 and ethics approval H0027147 was granted by the University of Tasmania, and participating teachers and parents/caregivers gave informed consent.

References

Alexander, R. J. (2008). *Towards dialogic teaching: Rethinking classroom talk.* Dialogos

Artigue, M., & Blomhøj, M. (2013). Conceptualizing inquiry-based education in mathematics. *ZDM-Mathematics Education, 45*, 797-810. https://doi.org/10.1007/s11858-013-0506-6

Bakhtin, M. M. (1981), Emerson, C. & Holquist, M. (trans.), Holquist, M. (Ed.), *The dialogic imagination.* University of Texas Press.

Campbell, T., & Teo, S. (2022). Professional noticing of coordinated mathematical thinking. *British Educational Research Journal, 48,* 488-503. https://doi.org/10.1002/berj.3778

Gallagher, S. 2012. Neurons, neonates and narrative: From embodied resonance to empathic understanding. In A. Foolen, U. Lüdtke, J. Zlatev and T. Racine (Eds.), *Moving ourselves, moving others* (pp. 167-96). John Benjamins.

Hennessy, S. (2014). *Bridging between research and practice: Supporting professional development through collaborative studies of classroom teaching with technology*. Brill.

Howe, C., Hennessy, S., Mercer, N., Vrikki, M., & Wheatley, L. (2019). Teacher-student dialogue during classroom teaching: Does it really impact upon student outcomes? *Journal of the Learning Sciences, 28*, 4-5, 462-512. https://doi.org/10.1080/10508406.2019.1573730

Hutchins, P. (1989). *The doorbell rang*. Harper Collins

Klemp, T. (2020). Early mathematics – teacher communication supporting the pupil's agency. *Education 3-13*, 48 (7), 833-846. https://doi.org/10.1080/03004279.2019.1663893

Kibler, A., Valdés, G., & Walqui, A. (2020). Introduction: A vision for critical dialogic education. In A. Kibler, G. Valdés, & A. Walqui, *Reconceptualizing the role of critical dialogue in American classrooms* (pp. 1-22). Routledge.

Mercer, N. (2005). Sociocultural discourse analysis: Analysing classroom talk as a social mode of thinking. *Journal of Applied Linguistics, 1*(2), 137-168. http://dx.doi.org/10.1558/japl.2004.1.2.137

Mercer, N., & Sams, C. (2006). Teaching children how to use language to solve maths problems. *Language and Education,* 20 (6), 507-528. DOI: 10.2167/le678.0

Moser, M., et al. (2022). Student's vocal participation trajectories in whole-class discussions during teacher professional development. *Learning, Culture and Social Interaction,* 34, 100633. https://doi.org/10.1016/j.lcsi.2022.100633

Murphy, C., Abu-Tineh, A., Calder, N., Mansour, N. (2021). Teachers and students' views prior to introducing inquiry-based learning in Qatari science and mathematics classrooms. *Teaching and Teacher Education, 104*,103367. https://doi.org/10.1016/j.tate.2021.103367

Ng, O-L., et al. (2021a). How linguistic features and patterns of discourse moves influence authority structures in the mathematics classroom. *Journal of Mathematics Teacher Education,* 24, 587-612.

Otten, S., et al. (2015). Univocal and dialogic discourse in secondary mathematics classrooms: the case of attending to precision. *ZDM Mathematics Education*, 47, 1285-1298.

Pimm, D. (1987). *Speaking mathematically: Communication in mathematics classrooms.* Routledge.

Wegerif, R. (2006). Dialogic education: What is it and why do we need it? *Education Review, 19(*2), 58-66.

Wegerif, R. (2011). Towards a dialogic theory of how children learn to think. *Thinking Skills and Creativity, 6(*3), 179-195.

Williams, J., & Ryan, J. (2020). On the compatibility of dialogism and dialectics: The case of mathematics education and professional development. *Mind, Culture, and Activity, 27(*1), 70–85. https://doi.org/10.1080/10749039.2019.1686026