An investigation of developing teachers' understanding of using a dialogic approach in Saudi primary mathematics classrooms

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Classroom talk and dialogue is fundamental to students' learning mathematics. Much research has focused on the ways teachers interact with their students and the quality of dialogue between them. Drawing on recent developments in dialogic approaches to learning and teaching mathematics, this study investigates how Saudi mathematics teachers develop their understanding of classroom dialogue through a professional development process in mathematics teaching. The study involves multiple case studies collecting qualitative data on i) teachers' espoused beliefs about their teaching practice and dialogic teaching and ii) teachers' enacted practices using dialogic teaching principles. The participants were three male primary mathematics teachers in third-, fifth- and six-grade classrooms. The paper utilizes an early analysis and discussion about a teacher named Ahmad as one case study.

Key words: classroom talk; dialogic teaching; professional development

Introduction

Research on mathematical discourse and the National Council of Teachers of Mathematics standards claim that students' participation in meaningful mathematical discourse provides opportunities for developing understanding (Hiebert & Carpenter, 1992; Wood, Cobb & Yackel, 1991; Yackel & Cobb, 1996; Sfard & Kieran, 2001; NCTM, 1991, 2000). Many studies from outside mathematics education have identified different types of talk as crucial to developing students' understanding (Barnes 1976; Barnes & Todd, 1977; Duffin, 1986; Edwards & Mercer, 1987; Mercer, 1995, 1998; Alexander, 2006, 2008), including exploratory talk (Barnes, 2008), which 'enables the speaker to try out ideas, to hear how they sound, to see what others make of them, to arrange information and ideas into different patterns' (Barnes, 2008, p. 4). A key element in all of this research is that students need to become active participants in classroom discussions in order to use language to develop their thinking (Vygotsky, 1978). These ideas (amongst others) have led to the notion of dialogic teaching, which Alexander (2006) defines as follows:

- **collective**: teachers and children address learning tasks together, whether as a group or as a class;
- **reciprocal**: teachers and children listen to each other, share ideas and consider alternative viewpoints;
- **cumulative**: teachers and children build on their own and each other's ideas and chain them into coherent lines of thinking and enquiry;

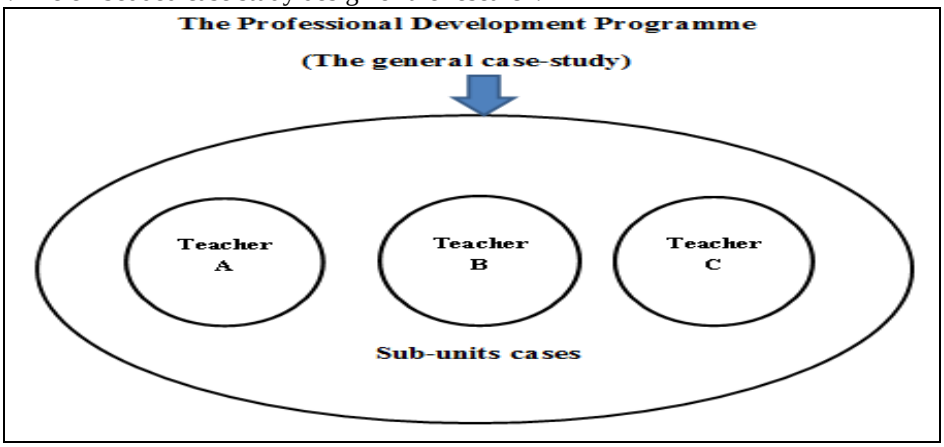
- **supportive**: children articulate their ideas freely, without fear of embarrassment over 'wrong' answers, and they help each other reach common understandings;
- **purposeful**: teachers plan and steer classroom talk with specific educational goals in mind.

Therefore, we can argue that research in mathematics education has increasingly examined the ways in which teachers interact with their students and the quality of dialogue which takes place (Black, 2004; Kyriacou & Issitt 2007; Solomon & Black, 2008; Mercer & Sams, 2006). Professional development can provide opportunities to influence teacher knowledge and beliefs while also exposing them to classroom practices. According to Guskey (1986), teacher professional development approaches are an attempt to bring about 'change in the classroom practices of teachers, change in their beliefs and attitude, and change in the learning outcomes of students' (p. 5).

The research methodology

The study applies a case study approach (Yin, 2003) to collect qualitative data. The approach was chosen due to its appropriateness when investigating 'a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2003, p. 13). Classroom observations and video recordings were used to collect data about the teachers, focusing especially on the communicative strategies they use in the classroom and the quality of discussions which take place. Moreover, interviews were conducted with the case teachers to collect data about their beliefs. The design of this research involves an ***embedded case study*** focusing on a teacher development programme (TDP) for Saudi primary mathematics teachers in relation to their use of dialogic teaching. An ***embedded case study*** design involves a larger case study containing more than one sub-unit of analysis or sub-case (Yin, 2003). The large case study for this research is the professional development programme; the sub-cases focus on the development of three teachers within this TDP (see Figure 1 below). The participants are three male primary mathematics teachers.

Figure 1: The embedded case study design of the research:



The data were collected in two phases. The first phase involved general observations in teachers' classrooms and initial interviews with them. Five lessons with each of the three teachers were video recorded. The second phase involved the

implementation of the Professional Development Programme which consisted of eight workshops with subsequent observed lessons and teacher interviews/discussions.

Data analysis

The analysis of Ahmad's first phase lessons

This is an early analysis focusing on Ahmad, who teaches the fifth grade, and will be used as a case study. The analysis focused on Ahmad's first and third lessons during the first phase of the research. In these two lessons, all students were individually seated in rows, facing the whiteboard. From these lessons, different classroom interactions between Ahmad and his students show how students learn mathematics in Ahmad's classroom and what type of teaching methods Ahmad uses. The analysis of Ahmad's students' talk shows the following three types of talk: collective repeated statement, a one-word answer and a short answer. The students could not initiate classroom talk, as indicated in the transcripts from these two lessons during the first phase. In addition, many students did not have a chance to even provide a correct answer or talk about it because Ahmad ended the classroom talk whenever a student answered the question correctly.

Regarding Ahmad's talk, he used a whole class teaching approach which involved him talking the most during the classroom talk by introducing the facts and ideas using repetition and direct prompting. Ahmad focused on explaining mathematical facts and procedures and telling students what to do to solve problems. He explained the content and sometimes answered his own questions instead of allowing his students to do so. Ahmad initiated his talk, which took place in front of all the students. His role was to control the classroom talk.

It is clear that the norm of Ahmad's classroom practice is that the teacher evaluates every student's response. Ahmad responded to students immediately about whether their answers were right or wrong and then moved on to the following question. Ahmad's feedback did not have any effects on subsequent interaction because each instance of feedback was to close the IRF (Inquiry- Respond- Feedback) exchange and start a new one without posing any further questions or enquiries. The following table (Table 1) shows an example of IRF exchange from the two lessons.

Table 1

The median and mode lesson
Teacher Come on, Mohammed. What is the median? (*the numbers are 12, 10, 13, 14, 11, 13, 11*)
Mohammed Thirteen.
Teacher Thirteen? *(in a surprised voice*).
Mohammed No, 12.
Teacher Ok, let's see. We exclude 10 from the right and 14 from the left, then 11 and 13, then 11 and 13, which leaves 12. Excellent, Mohammed.

The analysis of Ahmad's final lesson:

The analysis focuses on Ahmad's final lesson. This lesson occurred during the final week of phase two and after the eighth workshop. The analysis of the final lesson shows several changes in Ahmad's classroom practice. The nature of the classroom questions in Ahmad's classroom began to develop as he focused more on open questions than closed ones. He relied on questions that focused on "how" and "why" instead of asking questions that he had not prepared himself, as shown below in Table 2.

Table 2

Ok, what is your opinion Abdullah? What is the result?	Open question
Excellent…how did you calculate it?	How question

Ahmad also used questions that required the students to provide explanations and descriptions for their answers – not only for the sake of Ahmad, but also for the benefit of the students, so as not to have repeated answers among students. The most prominent change in his questioning was the manner in which he bypassed the IRF in order to obtain more responses from the students prior to providing feedback. An example is illustrated below in Table 3.

Table 3

Teacher	We took time units, including minutes and seconds. The question is as follows: how many seconds are in three minutes, and how do you calculate this?	Inquiry
Teacher	Ok, what is your opinion Abdullah? What is the answer?	Inquiry
Abdullah	One hundred and eighty seconds.	Response
Teacher	Excellent…how did you calculate it?	Inquiry following a question
Abdullah	I added the minutes.	Response
Teacher	Added the minutes…how?	Inquiry following a question
Teacher	Excellent…teach us…we want to add with you. (The teacher then walked to the board to write how Abdullah added the seconds.)	Inquiry

Discussion and Conclusion

It is clear that Ahmad's teaching method was close to a lecture as students rarely contributed and some of his questions were used to repeat what he had already said. Based on the analysis of Ahmad's lessons and pre-study interview, it is clear that there is a contradiction between Ahmad's espoused belief about the active role of students and the enacted classroom practice that shows the absence of his students' participation and engagement. This initial analysis of Ahmad's first and final lessons shows significant development and improvement in Ahmad's classroom practice based on his developed understanding of dialogic teaching. For example, Ahmad no longer used the short IRF method but instead elicited more responses from the students prior to providing feedback. Such a variety of questions was effective for the development of classroom discussion as well as turning the talk in the classroom into a tool for improving students' learning and enhancing Ahmad's teaching practice.

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