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Primary mathematics teachers' responses to students' offers: An 'elaboration' framework

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ABSTRACT

Responding constructively 'in-the moment' to student offers is described as a critical, and yet difficult, aspect of skilful and responsive teaching. South African evidence points to limited evaluation of student offers in schools serving poor communities. In this paper, we present and discuss an 'elaboration' framework emerging from a grounded analysis of data drawn from video recordings of 18 mathematics lessons prepared and conducted by four in-service primary school teachers in South Africa. This analysis led to a categorization of the situations in which teacher responses to student offers occurred, and the nature and range of these responses. Three response situations are identified within the framework: breakdown, sophistication, and individuation/collectivization, with a range of response (and non-response) categories in each situation. Literature on responsive feedback is drawn in to explore hierarchies and relationships between the emergent categories within situations of elaboration. The elaboration framework provides a tool for lesson observation, and a model for thinking about developments in responsive teaching.

1. Introduction

There is wide acknowledgement that responding to students' offers with awareness of how to act appropriately in-the-moment is a difficult task of teaching (Son, 2016). Solutions need to be constructed immediately, in the classroom in front of the students (Lampert, 2001). Successful teachers have the capacity to both apply and develop their knowledge base in the context of responsive teaching. This development of the knowledge base is particularly important, with Chick (1996) noting that teacher preparation is inevitably incomplete and in-service professional training can never cover all the issues that teachers will encounter in their actual teaching.

Situations involving teachers' interpretations of, and responses to, students' offers provide the empirical base for responsive teaching. The South African evidence base on primary mathematics teaching tends though, to stand at some distance from the international literature base on what responsive teaching involves. There is evidence of lack of coherence within teaching, and some evidence, in schools serving more disadvantaged learner populations, of complete absences of evaluation at all of student offers. In the international literature, responsive teaching has been particularly considered in the context of unexpected events, which necessitate attention to contingent and creative responses. Given the South African evidence of lack of response in some contexts to learner offers that can be described as predictable based on common errors and misconceptions, a grounded re-consideration of the ways in which 'in-the-moment' elaboration needed to be considered in a South African context was undertaken, and forms the crux of this paper. Centrally, in order to provide both 'fit' and 'fitness for purpose', looking at responsive teaching in this context required

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extension beyond what might be termed 'unexpected' offers to look simply at the nature of teacher responses to any and all student offers. This re-consideration through grounded analysis produced a framework that encompassed key situations in which responsive teaching was offered in our dataset, and a categorization of the nature of teachers' responses in these situations. Our focus in this paper is on the presentation and discussion of this framework.

In 'developed' country contexts, Rowland, Thwaites, and Jared (2015) have classified situations in which contingent teacher responses are presented in classrooms. They propose three origin situations that 'trigger' these responses: (i) students' ideas during the teaching/learning situation (ii) teacher insights through reflection on his/her own planned actions (i.e. teacher's in-the-moment evaluation of the lesson planning and development); and (iii) the pedagogical tools and resources that are brought to bear on the instruction, when the teacher is responding to the availability (or the unavailability) of resources. In response to these contingency triggers, Rowland et al. (2015) further proposed a typology of common teacher responses: (i) to ignore; (ii) to acknowledge and put aside; and (iii) to acknowledge and incorporate.

Our analysis of four primary school teachers' responses to learner offers pointed to the need to focus on the first trigger (arising from students' offers during classroom interactions). We use the notion of elaboration to refine Rowland et al's (2015) typology of responses with reference to the specificities of the South African context. Within this, we use teacher elaborations in response to triggers resulting from student offers (correct and incorrect) as a metaphoric lens to examine responsive teaching. While the word 'elaboration' – in the literature and in everyday usage – can refer to providing a more detailed explanation without reference to response to student offers, we work with a more restricted notion of elaboration referring to teachers' responses to student offers in the course of classroom interactions. These elaborations form the substance of responsive teaching actions, and provide a means to bring some of the ways of thinking about responsive teaching noted in the international literature as important into dialogue with the specificities of the South African context.

We view the notion of elaboration from two key bases: a psychological constructivist view of the individual cognizing teacher, drawing from an underpinning knowledge base; and an interactionist view on collective classroom practice (Bauersfeld, 1995) in which the teacher participates in and contributes to the development of collective processes through renegotiation of meaning. Cobb (1989) refers to the intersectionality of these two perspectives as an 'emergent approach', set within an interpretivist framework.

We begin this paper with a review of literature relating to responsive teaching: how it is described and related to teachers' mathematical knowledge for teaching, and why it is seen as important. We then move on to discuss some of the problems associated with possibilities for responsive teaching in the South African context, pointing – as noted already – to the need for grounded re-consideration of how responsive teaching could be usefully thought about in a landscape marked by extensive gaps in teachers' mathematical knowledge, some incoherent mathematical talk, and lack of evaluation of students' offers. Empirical analysis of instances of teacher response to student offers in our dataset (drawn from the first author's doctoral study – Abdulhamid, 2016) led to the development of an 'elaboration framework'. The data sources and methodological approaches used for this development are detailed prior to the central sections of this paper, where we present and illustrate the dimensions, codes, categories and hierarchies that constitute this framework, and discuss the hierarchies.

2. Responsive teaching: an overview of literature

2.1. How is responsive teaching described and how is it related to knowledge?

Responsive teaching is considered in the context of classroom interaction with a view to increasing teachers' awareness of the need to provide appropriate follow-up to students' offers (answers or contributions) in ways that extend or expand possibilities for mathematics learning. Classroom interaction has been the focus of a variety of studies over the last forty years. Initiation-response-evaluation/feedback (IRE/F) interactions (Mehan, 1979; Sinclair & Coulthard, 1975) have been widely studied to analyse how teachers react to and evaluate students' responses or give feedback to students (e.g. Brodie, 2008; Edwards & Mercer, 1987; Wells, 1999). Findings from this body of writing can be classified into two groups: 'deficit' approaches and 'affordance' approaches to the use of IRE/F. In the first group, the authors draw linkages between a teacher's lack of mathematical awareness and feedback or evaluation in their mathematics teaching. In the latter, the authors highlight the affordances created for genuine student participation. We review each group separately.

On the deficit side, research has shown that the IRE/F model is often used by teachers in what Bauersfeld (1980) has described as 'funnelling' moves. Funnelling involves reducing the cognitive demand of the task. Here, the teacher initiates a classroom discourse by asking a challenging question, but, if students can't give the answer, the teacher asks follow-up questions which get easier and easier until the only option open to students is the specific answer to the question. This results in a situation where students eventually answer questions far below the level of the initial task (Brodie, 2007; Forman & Ansell, 2002). Brodie (2007) provides empirical examples where she illustrates that merely engaging students in question-and-answer exchanges does not guarantee genuine student participation in the lesson and need not move students' mathematical thinking forward. This pattern of classroom interaction points to teaching that fails to provide follow-up to students' responses in ways that extend or expand possibilities for learning.

The affordances approach focuses on feedback that is contingent on students' responses during classroom interaction (Forman & Ansell, 2002; Nystrand & Gamoran, 1990), and which supports genuine student participation in the classroom (Brodie, 2007; Edwards & Mercer, 1987; Mercer, 1995). For instance, Nystrand and Gamoran (1990) developed the notion of 'uptake' to argue that productive work with IRE/F patterns of discourse involved feedback based on what immediately precedes in the student's response. Here, the teacher incorporates students' ideas into the subsequent discussion, and therefore, the teacher's next question or