



A methodological approach to exploring the rhythm of classroom discourse in a cumulative frame in science teaching



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ABSTRACT

The purpose of this study was to characterise the nature and purpose of different types of classroom discourse and to explore how the rhythm of classroom discourse provides a cumulative frame for the teaching of science. The overall data consisted of a teaching sequence of eight lessons on the moment of force as taught to physiotherapy students at a Finnish University of Applied Sciences. Our in-depth multiple timescale analysis of two episodes illustrated in this study shows examples how cumulation was instantiated by the different types of classroom discourse. The methodology and findings of this study have implications both for teacher education and further research.

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1. Introduction

The sociocultural perspective (e.g., Leach & Scott, 2003; Mercer & Littleton, 2007; Vygotsky, 1978) emphasises the importance of social interaction and language for constructing knowledge and understanding. Accordingly, science education is constituted as a discursive process, whereby novices are inducted into specific ways of representing and understanding phenomena by those more expert in the field (Mercer, 2004; Mercer, Daves, Wegerif, & Sams, 2004). Acting as a mediator of “the scientific view,” the teacher has to ensure that the classroom discussion is conducted at an appropriate level and in a way suited to the learning aims (Mortimer & Scott, 2003; Scott, Mortimer, & Aguiar, 2006).

Classroom discussion, which supports students' learning and is suited to the aims of learning, has certain properties that cohere through the concept of “dialogic teaching” (Alexander, 2004). Central to Alexander's dialogic teaching is the cumulative nature of teaching, whereby teachers and students build on their own and each other's ideas and chain them into coherent lines of thinking and enquiry. Research considering the cumulative nature and quality of teaching from the perspective of classroom discourse is needed because cumulation is arguably (Alexander, 2004) the most difficult (and perhaps the most important) criterion of dialogic teaching to achieve.

Many studies provide important insights that enable us to understand the role of discourse in science teaching, the meaning of cumulation in dialogic teaching and different characterisations of classroom discourse (e.g., Aguiar, Mortimer, & Scott, 2010; Alexander, 2004; Furtak & Shavelson, 2009; Mortimer & Machado, 2000; Mortimer & Scott, 2003; Scott et al., 2006; Viiri & Saari, 2006). They do not, however, investigate the relation of rhythm and cumulation of discourse in different time-scales. This study also extends existing research by examining classroom discourse—particularly with respect to the cumulation of teaching—from

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the perspective of temporality by addressing how talk develops in time through visual illustrations. This issue is limitedly addressed in previous studies on classroom discourse, which mostly provide information in tables and charts (Nassaji & Wells, 2000; Polman, 2004). In this study, the temporal consideration is utilised by using multiple timescales in analysis and visual presentation of classroom discourse.

There is a pressing need for studies using different timescales as units of analysis, since, as Klette (2009) has shown, using different time scales may offer different interpretations and conclusions regarding the same lesson. In relation to this study, different time scales may also increase the insights into different presentations of classroom interactions.

Our purpose in this study is to give examples of a new method to analyse classroom discourse. With this method, it is possible to characterise the types and the purposes of the classroom discourse and to explore how the rhythm of classroom discourse affords a cumulative frame for the teaching of science. Before introducing the methods of the study, an overview is provided to the theoretical background.

2. Theoretical background

In dialogic teaching, purposefulness means that teacher plans and steers classroom talk with specific educational goals in mind. Cumulation must be used to steer the talk toward specific purposes. (Alexander, 2004.) Even if students are immersed in classroom discourse, coherent knowledge and purposeful understanding will not emerge naturally: they have to be actively pursued as pedagogic goals, through the use of carefully chosen, appropriate teaching strategies with which possibilities of continuities in the students' experience can be exploited (Mercer & Littleton, 2007).

The cumulative quality of teaching, as discussed here, not only emphasises continuity (the teacher explicitly points out connections between new knowledge and concepts or topics learned earlier) but also deepens, expands or highlights the concept or topic to be learned. In our study, cumulation is also examined from the perspective of various types of classroom discourse. By the cumulation of types of classroom discourse, we mean that when the same concept is reviewed, another type of classroom discourse may be used.

The cumulation of teaching can be related to continuity of teaching. In some studies (e.g., Ryder, Hind, & Leach, 2003; Tiberghien, Buty, & Le Maréchal, 2004), continuity is taken to mean that the teacher explicitly makes connections between new knowledge and concepts or topics learned earlier in the same lesson or in previous lessons. In cumulative teaching, a teacher consciously and actively makes connections between the contents of lessons and builds coherent lines in students' thinking and enquiry (Alexander, 2004). By using talk, the teacher provides a cumulative, continuing and contextual frame to enable students' involvement and engagement with new ideas and knowledge (Mercer & Littleton, 2007, p. 42). In this study, we aimed to seek how cumulation is depicted in a variety of specific discourse types. Within the cumulative variation of discourse types, students' ideas must explicitly be taken account.

In several studies of classroom interaction (e.g., Cazden, 1986; Sinclair & Coulthard, 1975; Wells, 1999), one very common finding is that such interaction typically follows a three-part exchange structure. In this triadic IRF pattern, "I" corresponds to the initiative of the dialogue by the teacher, normally with a question, "R" stands for the student's response and "F" refers to the feedback given by the teacher to the student's response. In the IRF pattern, the teacher maintains control in interactions with students (Mercer, Littleton, & Wegerif, 2004). In the IRF pattern, the third move from the teacher can have different functions and could more generally be understood as a follow-up move rather merely as feedback (Cullen, 2002). In some contexts, it has a dominant, evaluative function, but it can also be "an opportunity to extend the student's answer, to draw out its significance, or make connections with the student's experience" (Wells, 1999, p. 200). In line with this idea, Mortimer and Machado (2000) have aligned the IRF pattern with pedagogical aims by classifying the classroom discourse structure on the basis of the form of the third move action in the dialogue. The IRF pattern can be considered "authoritative" as long as the feedback from the teacher is an evaluation—this can also be expressed by "IRE," where "E" stands for evaluation. In the case where the feedback (or the follow-up) supplies elements for a further extension of the response by the students or elicits new ideas and contributions from them, the IRF pattern corresponds to a dialogic function.

In relation to more recent derivatives from classical interaction forms, student initiatives have also been recognised as having a role in shaping the forms of classroom discourses (Aguilar et al., 2010). Besides their potentiality to shape ongoing discussions, the teacher follow-up to student initiatives could give insights into the prevailing nature of discussions.

Based on actual classroom discourse analysis in Finnish physics lessons, Viiri and Saari (2006) extended the characterisation by Mortimer and Machado, dividing classroom discourse into five categories: teacher presentation (TP), teacher-guided authoritative discussion (AD), teacher-guided dialogic discussion (DD), peer discussion (PD) and other (O). The different types of classroom discourse do not represent "better" or "worse" teaching strategies, as these different types of discourse can serve complementary functions.

The characterisation of Viiri and Saari resembles the concept of communicative approach developed by Mortimer and Scott (2003). Yet, whereas in Mortimer and Scott's categorisation system the identification of dialogic and authoritative approaches is based on evaluating sequential interaction patterns, Viiri and Saari describe different types of discourse in more micro-level. For example, in this categorisation, system one talk pattern IRE could be considered as AD. In Mortimer and Scott's categorisation, one pattern could be, for example, considered as authoritative passage within a dialogic episode, or vice versa, dialogic moment within authoritative episode. In this study, we apply the Viiri and Saari system since the interest on any changes in discourse types forming a rhythm of discourse.

Because of the different purposes of the types of classroom discourse, any teaching sequence should include variation in discourse types (Mortimer & Scott, 2003; Scott et al., 2006), and a teacher should also be able to change pre-planned classroom discourse types if and when necessary (Leach & Scott, 2003). According to Mortimer and Machado (2000), this varying of the

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