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Optimizing small group discourse in classrooms: Effective practices and theoretical constraints

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ABSTRACT

Acknowledging that small group activities are prominent features of science classrooms, this article addresses two questions about the discourse that occurs while such activities are in progress. The first is whether small group discourse actually matters as regards student learning, in other words whether there are forms of discourse that, if they occur in small groups, promote knowledge gain. With reference to the author's past research, this question receives a clear, affirmative answer. The second question relates to the prevalence of productive forms of small group discourse in science classrooms, and here the focus is a systematic review of research that others have conducted. Although a sizeable body of material is identified that describes relevant discourse, virtually none of it takes productive forms as the yardstick and addresses their prevalence. This state of affairs is attributed to tacit theories of learning, which locate key processes within whole-class discourse orchestrated by teachers and physical activities (not discourse) that occur at the small group level. Moreover, these theories are likely to be held by practitioners as well as researchers. The implication is that if classroom-based discourse is to be improved in small group settings, it is not, for science, fundamentally a question of establishing relevant strategies. Rather it is acceptance that, far from being tangential to the teaching and learning process, small group discourse is a resource that should be harnessed appropriately. It is suggested that this message might apply beyond the science context.

1. Introduction

While the whole class is the basic organizational unit for purposes of teaching, classes are often divided into smaller groups for specific activities. The frequency with which small groups are used depends upon numerous factors, of which culture is probably fundamental (Alexander, 2001; Osborn, 2001): at present group work appears to be particularly prevalent in North America, Northern Europe, and Australasia, although there is evidence for growing interest in other parts of the world. Within cultures, one of the key sources of variation is school subject area, for small group activity seems to play an especially significant role in science. For instance, based on a survey of 331 English primary schools and 248 English secondary schools, Baines, Blatchford, and Kutnick (2003) report that 46% of science teaching takes place in small group contexts compared with only 15% of mathematics teaching and 24% of language teaching. This extensive use of group work within science is almost certainly a consequence of the emphasis on practical work: schools do not typically have the resources to provide apparatus on a one-to-one basis, and the need to share necessitates group work. However, practical

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work in science typically involves using apparatus to create effects or to examine causes, and it is inconceivable that such activities could be conducted within small group contexts without social interaction (and therefore discourse) amongst students. Occupying nearly half of the total teaching time and involving discourse, small group activity in science is therefore a key forum for classroom-based discourse. As a consequence, it was selected as the focus for the material to follow.

Specifically, two questions are addressed relating to science. The first is whether the discourse that occurs during group work actually matters, in other words whether there are forms of discourse that, if they occur, support student learning. This question has been the focus of my own research for over 20 years, with learning interpreted as both conceptual mastery and procedural skill. Therefore the first of the two sections that follow is structured around a review of my previous research. The second question relates to the prevalence of productive forms amongst the small group discourse that occurs routinely in science classrooms. Here the focus, which occupies the second of the sections to follow, is a systematic review of research that others have conducted. The basic conclusion is that whilst a definitive answer can be given to the first question, the second question remains unresolved. Moreover, this lack of progress does not reflect failure to sample the small group discourse that occurs in science classrooms: numerous studies have analyzed such samples. Rather, it is a consequence of analyses that typically by-pass conceptions of productivity. The explanation that is offered for this seemingly curious state of affairs implies a need for significant theoretical change. Furthermore, the need is not simply to permit research gaps to be filled, but also (and crucially) to support optimal practices in classrooms. It is suggested that this is a message that might apply beyond the science context.

2. Productive discourse during group work in science

Analyses of pedagogic discourse are traceable to classical Greece, in particular via Plato to Socrates. Moreover one theme that occurs repeatedly in such analyses is the power of discourse that involves contrasting ideas. Appearing initially in Greek texts, it is detectable in the pedagogical writings of, for instance, Rousseau, Mill, Dewey and Piaget. While Bakhtin seldom addressed education explicitly (and application of his ideas to classrooms is perilous, Matusov, 2004), the theme is unmistakable in such claims as 'The importance of struggling with another's discourse, its influence in the history of an individual's coming to ideological consciousness, is enormous' (Bakhtin, 1981, p. 348). By the 1980s, benefits from contrasting ideas during peer interaction were receiving empirical support, primarily from research with Piagetian conservation and perspective taking tasks (e.g. Doise & Mugny, 1984; Perret-Clermont, 1980) and with tasks requiring the resolution of ethical or legal dilemmas (e.g. Damon & Killen, 1982; Roy & Howe, 1990). This led me to wonder about group work in science, especially given the close association that Piagetians theorize between the knowledge underpinning conservation and perspective taking and conceptions of physical and biological reality. Certainly, evidence was emerging in the 1980s that students approach science education with a wide range of preconceptions about the phenomena they are studying (e.g. Driver, Guesne, & Tiberghien, 1985), suggesting that contrasting ideas within small groups were highly probable. However, these preconceptions were often found to diverge markedly from the target science, in extreme cases proving contradictory. Even if the goal is merely progress towards targets rather than complete mastery, it seemed implausible that discussion alone would turn out to be beneficial. Nevertheless, together with colleagues, I resolved to examine the issue, and the paragraphs to follow summarize what we found.[1] In other words, the first of the two questions flagged above is addressed through ascertaining the relevance to learning of small group discourse around contrasting ideas.

Reflecting the emphasis on preconceptions within background research, the majority of my studies address the conceptual dimension of science, e.g. students' understanding of the properties of objects relevant to floating and sinking (Howe, Rodgers, & Tolmie, 1990; Tolmie, Howe, Mackenzie, & Greer, 1993), the direction and speed of object motion (Howe, Tolmie, Anderson, & Mackenzie, 1992; Howe, Tolmie, & Rodgers, 1992; Howe, Tolmie, & Mackenzie, 1995), and the characteristics of containers that determine the rate at which hot water cools (Howe & Tolmie, 2003; Howe, Tolmie, Greer, & Mackenzie, 1995). Jointly, the studies cover the age range from late primary school (8–12 years) to undergraduate level. In all studies, groups (dyads, triads, or foursomes) worked on tasks that required them to formulate joint predictions about outcomes. For instance, groups made predictions about whether an empty metal box or a solid rubber ring would float or sink in a tank of water, and whether a heavy lorry rolling down a slope with a rough surface and then onto the floor would travel a greater, similar or lesser distance along the floor than a light car rolling down a smooth surface. Having agreed predictions, groups were invited to test these using apparatus that was provided, and to formulate joint interpretations of why things turned out as they did. Tasks were designed to optimize the expression and discussion of student ideas, e.g. through requiring each student to write personal predictions on cards before formulating joint predictions (so that nobody could 'hide') and repeatedly instructing groups to 'make sure everybody says what they think'. Sometimes task instructions were presented via computers, but usually they were presented via workbooks, which group members took turns to read out loud. After a brief introduction, groups worked through the tasks on their own with minimal intervention from teachers or researchers, and typically took about 1 h to reach completion.

In all studies, participating students were individually pre-tested to establish their preconceptions prior to the group tasks, sometimes by responding orally in one-to-one interviews, and sometimes by completing written tests in whole-class

[1] While this is the first time that all of the studies reviewed here have been brought together, the studies described in the first two paragraphs have been summarized previously (Howe, 2010). The text of these two paragraphs is substantially the same as the earlier summary.