

THE ROLE OF RHETORIC IN SOLVING AN ARITHMETIC WORD PROBLEM

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Work in discursive psychology has highlighted the role of rhetoric in social interaction, including in classroom discourse. Edwards and Potter (1992), for example, highlight a number of rhetorical strategies or 'devices' and show how they can be used to strengthen claims, accounts or descriptions of reality and undermine possible alternative versions. In this paper, I take a rhetorical perspective to analyse an extract from a Year 5 lesson, in which the teacher guides her class in solving an arithmetic word problem. The analysis reveals the emergence of two narratives, one relating to the word problem, the other to the solution process.

INTRODUCTION

Recent research in discursive psychology (Edwards, 1997; Edwards and Potter, 1992) has emphasised the primarily social nature of human interaction. In interacting, people are performing social actions: conducting relationships, persuading, agreeing and disagreeing and so on. These actions influence how interaction is organised. Consider, for example, possible responses to the question 'What did you do today?'. Both the content and form of any response will be related to the situation in which the question arises. Thus, variation will be observed between the responses of the same individual, according to whether she is asked by: her husband on returning home from work; a barrister in a court of law; or a television news reporter.

Edwards and Potter (1992) argue that any approach to the investigation of activities such as knowing, thinking or meaning, are mediated by interaction. Interviews, questionnaires or experiments all entail some form of interaction between researchers and participants. In order to investigate these ostensibly psychological topics, therefore, researchers need to include a theorisation of the interaction through which thinking, for example, is brought into the public world. Discursive psychology offers such a theorisation.

As part of my research, I have been exploring the nature of mathematics classroom interaction from a discursive psychology perspective. In this paper, I want to focus on a particular aspect of this discursive approach, that of rhetoric. In the next section, I will outline the role of rhetoric in interaction and describe a number of what Edwards and Potter call *rhetorical devices*. I will then use this framework to

examine a sequence from a Year 5 mathematics lesson in which a teacher works on solving an arithmetic word problem with her class.

RHETORIC

Rhetoric concerns how interaction is put together, particularly in relation to the *accountability* of the speaker (Edwards and Potter, 1992, pp. 165-166). The way in which an utterance is put together serves to account for the speaker's responsibility for any claims they make. Let me give a topical example: in a speech following the attacks of September 11, US President George Bush stated 'Either you are with us, or you are with the terrorists' [1]. In this statement, a contrast is set up between 'us' and 'the terrorists'. This contrast is presented as a fact. In terms of accountability, therefore, Bush diminishes his own role in the construction of the contrast. He did not say, for example, 'I think that...' or 'in my opinion...'

By designing their words in a particular way, speakers accomplish different outcomes, including the undermining of actual or potential alternative versions of what is being discussed (Edwards and Potter, 1992, p.154; Edwards, 1997, p. 78). To challenge Bush's statement, for example, it would be necessary to challenge the dichotomy between 'us' and 'the terrorists'. In examining how rhetoric works, then, the key question is 'what does this do?' What does a particular way of saying something achieve that another way would not? Thus, as well as examining how thinking, say, is publicly constructed, analysis considers how different constructions of thinking are used in different ways to suit different occasions and thereby accomplish different social actions (Edwards, 1997, p. 31). In this paper, I will focus on some of the rhetorical practices available in the English language, practices which Edwards and Potter (1992) refer to as rhetorical devices.

Rhetorical devices

Edwards and Potter (1992, pp. 160-163) highlight a number of rhetorical devices. These devices work by either supporting the reliability of the speaker or by distancing the speaker from their account or version of the world, which can then be portrayed as 'objective'. I will focus on four of them.

Narrative works by creating a coherent scenario for a particular situation, which constructs the reported circumstances as expectable or even inevitable (see Edwards and Middleton, 1986). Accounts which incorporate the roles of different participants, their motives and actions, and construct a connected set of happenings, appear as more reliable than an incoherent set of observations.

Category entitlements implicitly draw on particular identities which may be attributed to the speaker by a hearer and which are related to how reliable particular

claims they make about the world may be taken to be (see Antaki and Widdicombe, 1998).

Empiricist accounting entails the objectification of facts so that observers are removed or treated as recipients of information. The classic example of this style of rhetoric is found in scientific discourses in which scientists are portrayed as observing and recording objectively available facts about the world (Edwards and Potter, 1992, p. 162).

Logical argument or deduction draws on the idea that logical reasoning is objective and independent of the reasoner (see Edwards and Potter, 1992, p. 162, who use the term ‘rhetoric of argument’). An argument that occurrence A is a logical consequence of occurrence B is difficult to undermine. Whoever presents such an argument can claim that they have no personal interest and that the finding that B follows A is objective.

These different rhetorical devices are not exhaustive (see Edwards and Potter, 1992, pp. 160-163 for others); nor are they mutually exclusive. Talk continually involves the use of many such devices, often in combination. In the next section I explore the role of these devices in the solution of an arithmetic word problem.

RHETORIC IN THE MATHEMATICS CLASSROOM

To explore the role of rhetoric in the mathematics classroom, I have selected a sequence from a Year 5 mathematics lesson. The teacher has asked the class to solve a word problem which she has written on a flip chart. The word problem was written by some of the students on a previous occasion:

If Malik goes to the shop with £10 and spends his money on a drink 89p, some sweets (10 sweets costing 5p each) crisps (5 packets at 35p each) and pint of milk: 30p How much change will he have?

The sequence involves the teacher working on the problem with the whole class. An extract from near the beginning of the discussion is shown below (for transcription conventions, see [2]):

210	T	so let's see/ if we can just work through this/ and decide
211		what we've got to do/ to get the answer/ so we've got ten
212		pounds/ what does he buy S12? (<i>Writes £10</i>)
213	S12	um/ (he buys) a drink
214	T	which but hang on what does the drink cost/ S12
215	S12	um/ eighty nine p.
216	T	right/ stop there/ what else did he buy Joanne?
217	Joanne	um/ some (sweets)

- 218 T and how much did they cost
219 Joanne five pence
220 T right five pence each/ and how many did he buy/ Vicky?/ so
221 what's the first thing we've got to do with that information/
222 Cynthia?
223 Cynthia five times ten
224 T five times ten/ find out what the total cost of those sweets is/
225 five times ten is what S13
226 S13 forty p.
227 T (*rolls eyes*) S13/ five times ten is
228 S13 fifty
229 T so already (...)/ then what did he buy Cynthia
230 Cynthia um/ (*stands and reads*) he buy five packs of chips/
231 thirty five each/ (*the questions says 'crisps'*)
232 T right/ what do we do with **that** information S14/ you buy
233 five packets of crisps/ and they cost thirty five pence each/
234 what do you need to do with that information/

All four of the rhetorical devices described above are evident in the interaction between the teacher and students. First of all, the teacher sets up the task as 'working through' the problem and 'deciding what we've got to do to get the answer' (lines 210-211). What follows can therefore be seen as designed to carry out these tasks. The teacher constructs these activities in the form of a *narrative*; in fact she engineers two narratives, one relating to the content of the word problem, the other concerning the process of solving it. Thus, she uses questions which draw on the implicit scenario of the problem "what else did he buy", "how much did they cost". This narrativising rhetoric turns the abstract words of the problem into an event which the class can discuss. The narrative 'gives' sense to the problem. The 'facts' of the narrative, however, are derived from the problem which is written on a flip-chart. These facts are treated as objective, drawing on an *empiricist* rhetoric. The teacher is inviting the students to locate specific facts in the text and report them to her. One of the effects of this rhetoric is to transform a problem written by students in the class into a generic word problem. Although the information given in the problem was made up by some of the participants in the discussion, the agency of the authors is masked. There is no possibility, for example, of these students changing any aspects of their word problem. By objectifying their problem, the teacher freezes their ideas into something that can be solved but not altered. Treating word problems in this way is a recognisable aspect of the discourse of word problems (see Gerofsky, 1996).

As well as the narrative constructed from the word problem scenario, the teacher also creates a narrative of solving the problem. This narrative is at first implicit in the questions she asks the students concerning the content of the problem. It becomes explicit when the teacher asks “so what’s the first thing we’ve got to do with that information” (lines 220-221), and continues, “find out what the total cost of those sweets is” (line 224). This narrative continues throughout the sequence, with the teacher alternating the focus of her questions from the word problem scenario narrative and the narrative of the solution process. This narrative serves to present an explicit thought process on the part of the teacher. Making thought processes explicit in this way, often makes them accountable. Other participants can hear the moves proposed and can accept or challenge them and offer alternatives. In this case, however, there is also a rhetoric of *entitlement*. The teacher, for example, guides the construction of both narratives through the questions she asks. These questions and the resulting narratives are accepted by the students; as a teacher she is entitled to work in this way. The students cannot, therefore, easily challenge the reasoning that the teacher is offering through the narrative of solving. They can only respond to the questions she asks.

I have shown how the teacher uses questions to construct a narrative of solving for the word problem. This narrative also draws on the fourth rhetorical device, the *rhetoric of argument*. This device underpins most of the sequence. The teacher’s questions concerning how the different items of information extracted from the problem should be combined is predicated on the logic of arithmetic relationships and their relation to the sense constructed for the problem. It may, perhaps, seem strange to portray the mathematics of the interaction as a form of rhetoric. Mathematics is after all the purpose of the lesson. Alternatives are nevertheless possible. When the teacher asks “what do we do with **that** information” (line 232), her question implicitly draws on arithmetic logic. Students *could* respond that they would write down the information, ask the shopkeeper to work out the total, or just pay with a £10 note. By relying on the rhetoric of mathematical reasoning the teacher contributes to the construction of the discussion as part of a mathematics lesson. If her students are to make a wider sense of how mathematics relates to the word problem, alternative rhetorics may also need to be permitted.

DISCUSSION

The short analysis set out above describes how one teacher and her class work together on solving a single word problem and, implicitly, on solving word problems in general. I have illustrated how the four rhetorical devices described in this paper play a role in the sequence of interaction and have offered some indications of how these devices are used. In working on the word problem with her class, the teacher constructs two interwoven narratives, one concerning the

word-problem scenario, the other a narrative of solving. The use of these two narratives implicitly constructs a version of the process of solving word problems, involving first extracting information and then deciding what to do with it. Both narratives are largely constructed by the teacher, based on her entitlement as a teacher to ask questions and shape the construction of both problem and solution.

The different rhetorical devices which form part of the discursive practice of this class serve to manage the accountability of the participants, shaping, and perhaps limiting, the possible contribution of the students. By focusing on rhetoric as a basis for analysis, it becomes possible to ask how else accountability could be managed? One feature of the above sequence, for example, was the construction of some aspects of the word-problem task as objective. Would it be possible to construct these aspects in a different way, so that they are *not* seen as objective?

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NOTES

1. President George W. Bush, Address to a Joint Session of Congress and the American People, Washington, DC, USA, 20 September 2001. See www.whitehouse.gov/news/releases/ [active Oct. 2002].
2. Transcription conventions: Bold indicates emphasis. / is a pause < 2 secs. // is a pause > 2 secs. (...) indicates untranscribable. ? is for question intonation. () for where transcription is uncertain.

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