Talk in the science classroom: using verbal behaviour analysis as a tool for group discussion

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ABSTRACT This article describes a pilot study following on from a curriculum development activity with teachers and children in primary school classrooms, using a framework for group discussion developed by Huthwaite International. The Centre for Science Education at Sheffield Hallam University and Huthwaite International worked with teachers from three schools to explore the hypothesis that verbal behaviour analysis (VBA) techniques could enhance children's talk within group discussion in science lessons. Questionnnaire responses from children are highlighted and teachers' perceptions of the value of the approach reviewed. The results indicate that teachers considered VBA a useful strategy to enhance classroom talk across the curriculum. Further study would be required to fully appreciate the effect of VBA on science learning.

Introduction

Educational researchers such as Lemke (1990) and Leach and Scott (1995) adopt a socio-cultural perspective on how students learn in science. There has been a common acknowledgement of the importance of discussion as the means through which students develop understanding of scientific concepts and learn reasoning skills appropriate for enquiry and investigation. Appreciation of the importance of language and social interaction within communities of learning stems back to Vygotsky's work (1978), which was followed up by others with reference to primary science education (Braund, 2009; Mercer *et al*. 2004; Mercer, Dawes and Kleine Staarman, 2009; Murphy *et al*., 2013; Rojas-Drummond and Mercer, 2003; Simon *et al*., 2008; Wertsch, 1991). Mercer *et al*. (2004: 373) indicated that, although no direct relationship had until then been demonstrated between encouraging children to engage in certain ways of using spoken language and improved understanding or attainment in science, they had found that teaching programmes could be designed to assist primary-age children to engage in explanatory talk. By engaging in this way, they work together more effectively, improve their language and reasoning skills, and reach higher levels of attainment in their study of science.

The need to help children understand and regularly use the routines of effective talk has also been emphasised in a range of curriculum development programmes in the UK (Alexander, 2003), with guidance provided to schools by the Department for Children, Schools and Families (2008), mainly in the context of enhancing attainment in literacy. National strategies for literacy focus heavily on speaking and listening skills, yet guidance specifically for science educators is limited.

Bianchi's research (2002) examined teachers' perceptions of the teaching and learning of verbal communication skills in the science curriculum, as part of a doctoral study that explored a range of personal capabilities and skills. This research suggested that children's personal capabilities were enhanced by the interaction of knowledge development, self-assessment, action planning, action and reflection. This research also showed that the science curriculum can provide opportunities for the development of generic personal skills and capabilities, best achieved through adaptation of teachers' pedagogy and consistency of use over time, using generic and embedded activities to support this process.

Science learning requires particular kinds of talk and discussion to take place, in order for children to work in ways that authenticate the

way scientists work; for example, proposing questions for investigation, deciding on and clarifying procedure, describing predictions and observations, explaining and justifying results, reasoning about cause and effect, summarising results, testing understanding and defending evidence. Such routines are endorsed in the 2013 National Curriculum for Science where spoken language is regarded as being of vital importance in a child's development:

The quality and variety of language that pupils hear and speak are key factors in developing their scientific vocabulary and articulating scientific concepts clearly and precisely. (Department for Education, 2013: 4)

However, once more, little guidance for teachers is given in terms of how to support such areas of development.

Background to the pilot study

A project had already been undertaken using the verbal behaviour analysis (VBA) framework (Box 1) in schools with the aim of increasing engagement and collaboration between the business sector, curriculum developers and partnership schools. This project resulted in the creation of a set of practical resources/models for schools to use in training teachers and children about VBA in science activities. Four Smart Science (www.smart-science.co.uk) activities were adapted so that each main behaviour category (initiating, reacting, clarifying and process control – see Box 1) could be explored in a primary science classroom setting. Teacher feedback suggested that exploring VBA more deeply in a primary setting was of interest and that it supported their existing work in developing children's personal skills and skills for learning in science.

Project aims

The research described in this article was designed as a pilot study to explore the influence of the VBA framework and teaching activities, adapted as described above, on children's awareness of and ability to use different types of language in the science curriculum at upper primary level (age 9–11). The purpose was to assess how this enhanced the effectiveness of group discussions. The research hypothesis was that, by teaching children about different types of language in group discussions and demonstrating the use of the categories of talk, they would respond to practice and in time better understand the impact that certain types of talk have in group situations. Specifically, the aim was to consider how VBA could enrich talk in the science classroom.

In doing this we aimed to address the need to develop effective talk in the science classroom and the continued emphasis on enhancing literacy across the primary school curriculum. It was understood that the project would not specifically target the development of science-specific skills but should help children to be more aware of how they interact and speak with others during science activities, thus assisting them in making their thinking clear both to themselves and

BOX 1 The VBA framework

Huthwaite International (www.huthwaite.co.uk) has researched the relationship between verbal skills and success across a wide sector of jobs. They developed verbal behaviour analysis (VBA), which assigns labels to different types of talk and uses categories to analyse the nature of interaction within groups. Their model is based on four talk processes – initiating, reacting, clarifying and process control – within which there are 11 categories (Table 1).

Table 1 VBA categories of talk; © Huthwaite International

Initiating	Reacting	Clarifying	Process control
Proposing (procedural and content)	Supporting	Testing understanding	Bringing in
Building	Disagreeing	Summarising	Shutting out
	Defend/attack	Seeking information	
		Giving information	

their peers – aspects valued in the new National Curriculum for Science. Huthwaite International is a company specialising in sales training for business employees, such as role play and the analysis of conversations. Their teaching activities encourage learners to become increasingly self-aware and lead to them taking increased personal responsibility and behaving in ways that help teams succeed. By using the categories of talk as identified by Huthwaite (Box 1), we sought to explore whether these methods encouraged improved communication skills and interactions between learners, using primary school science lessons as the context and the adapted materials as classroom activities.

The study methods

Six teachers from three schools were trained by Huthwaite International to recognise types of talk using VBA, involving role play and taped recordings. The teachers then used the adapted Smart Science activities within standard science curriculum time (approximately two hours) to introduce learners to the categories of talk and to give them the opportunity to practise and demonstrate the verbal behaviours within a primary science context. For further details on one such activity, see Box 2.

Data were collected in three strands:

1. Focus groups of teachers met in order to evaluate the use of the activities. Teachers were also interviewed and asked to write an evaluative commentary about the project. Focus groups and interviews were transcribed for analysis.
2. Children's perceptions of themselves in relation to the categories of verbal behaviour were explored through a self-assessment questionnaire (Box 3).
3. Teachers also provided teacher-assessment of a sample group of children from their classes using the same questionnaire.

Results

The main hypothesis was that the quality of interactions between children when learning science would improve if teachers helped them to understand the types of, and influence of, talk in group discussions. As such, the children would be more aware of what types of talk they and their group were using and adapt behaviour accordingly.

BOX 2 An example of an adapted activity; see Hedgehog Crime Scene in *Smart Science* (Bianchi and Barnett, 2006)

VBA focus: Clarifying behaviours (giving information, seeking information, testing understanding, and summarising)

Science focus: Make comparisons between pieces of evidence; draw conclusions that are consistent with evidence

Generic activity – focus on giving information: Children are asked to respond to a series of '*If… then*' statements, e.g. '*If there were no gravity then…*'; '*If we only ate carbohydrates then…*'; '*If rocks were flexible then…*'. They are required to acknowledge what type of behaviour they are using and why.

Embedded activity – focus on all behaviours: Children discuss and identify the possible causes of a hedgehog's injuries using a detailed drawing or a role-play setting. They work in teams of six and arrive at their view of what is the most likely scenario based on the evidence provided. Two children from the group observe and 'behaviour spot', and then give feedback on the range of behaviours used.

https://extra.shu.ac.uk/cse/pcs/

Teacher perceptions about the impact of VBA

Representative sections of lengthier interview transcripts are given below to illustrate teachers' perceptions of the use of VBA in the classroom, and specifically with regard to science language. These have been grouped into themes and mapped against having most, some or little impact. The themes are:

- impact on children's self-awareness;
- children's speaking and listening skills;
- teachers as professionals in the workplace;
- children's achievement in science.

VBA was perceived to have had most impact on children's self-awareness of the way they communicated with others:

Teacher A: *It's this idea of holding a mirror up to themselves, the children are able to say, '*Oh yes, I do do that*'. I really feel that teaching the VBA and doing the VBA with the children is actually teaching them life skills, so I think it's really making me think about how important life skills*

BOX 3 The self-assessment questionnaire

Smart Talking Pupil Questionnaire **Student No.** _____

Name: _____ School: _____

Date of Birth: _____ Class/Form: _____

Gender: Male ____ Female ____ Group: LA AA HA

What is your ethnic group? Tick the box that indicates your cultural background.

☐ White (British/Irish/other) ☐ Mixed (White & Black Caribbean/White & Black African/White & Asian/other)

☐ Asian (Indian/Pakistani/Bangladeshi/other) ☐ Black (Caribbean/African/other) ☐ Chinese (Chinese/other)

Think about yourself when you are working at school, and think about the sorts of things you may do everyday, in your schoolwork and when you are with others at school.

Tick (✓) the answer that best describes you most of the time.
Please try not to tick ACROSS two boxes.

There are no right or wrong answers, just truthful responses.
What you say will be used to help us find out about how children talk to each other. What you tell us is important and will be shared with other people to help us learn, but it will not be used with your name on it.

	Never	Sometimes	Often	Always
1. I give my ideas or suggestions	☐	☐	☐	☐
2. I add something to other people's ideas or suggestions	☐	☐	☐	☐
3. I make sure that I understand what other people mean	☐	☐	☐	☐
4. I find it hard to get someone involved in a discussion if they are getting left out	☐	☐	☐	☐
5. I say when I agree with other people's ideas or suggestions	☐	☐	☐	☐
6. I say when I support what other people suggest	☐	☐	☐	☐
7. I find it hard to answer questions that were asked to other people	☐	☐	☐	☐
8. If someone is being quiet in a group discussion I ask them what they think	☐	☐	☐	☐
9. I say when I disagree with other people's ideas or suggestions	☐	☐	☐	☐
10. I say negative things to other people	☐	☐	☐	☐
11. I stand up for myself	☐	☐	☐	☐
12. I butt in when other people are speaking	☐	☐	☐	☐
13. I find it hard to take action to include other people in group discussions	☐	☐	☐	☐
14. I say when I don't agree with someone's ideas or suggestions	☐	☐	☐	☐
15. I offer my ideas during a discussion	☐	☐	☐	☐
16. I tell people things, e.g. what I know, information etc.	☐	☐	☐	☐
17. I find it hard to interrupt people when I want to speak	☐	☐	☐	☐
18. I ask questions to try to find things out	☐	☐	☐	☐
19. I find it hard to summarise what has been said in my own words	☐	☐	☐	☐
20. I ask questions to get information from other people	☐	☐	☐	☐
21. I say horrible things to other people	☐	☐	☐	☐
22. I find it hard to add my ideas to other people's ideas or suggestions	☐	☐	☐	☐
23. I make an effort to get other people involved in group discussions	☐	☐	☐	☐
24. I offer my ideas during a discussion	☐	☐	☐	☐
25. I find it hard to give my ideas or suggestions	☐	☐	☐	☐
26. I find it hard to check that I understand what has been said	☐	☐	☐	☐
27. I go over the main points of what has been said	☐	☐	☐	☐
28. I find it hard to say when I disagree with someone's ideas or suggestions	☐	☐	☐	☐
29. I summarise what has been said in my own words	☐	☐	☐	☐
30. I interrupt people when I want to speak	☐	☐	☐	☐
31. I find it hard to ask questions to try to find things out	☐	☐	☐	☐
32. I reply to questions that someone else was asked	☐	☐	☐	☐
33. I find it hard to say when I agree with other people's ideas or suggestions	☐	☐	☐	☐
34. I answer questions that were asked to other people	☐	☐	☐	☐
35. I build on other people's ideas or suggestions	☐	☐	☐	☐
36. I find it hard to tell people things, e.g. what I think, what I know etc.	☐	☐	☐	☐
37. I take action to include other people in group discussions	☐	☐	☐	☐
38. I find it hard to add my ideas to other people's ideas or suggestions	☐	☐	☐	☐
39. If people say horrible things to me I do the same back	☐	☐	☐	☐
40. I give information to other people	☐	☐	☐	☐
41. I find it hard to say mean things to people if they say mean things to me	☐	☐	☐	☐

are to teach in the classroom rather than focusing on content which in the past, and possibly now it's coming back again, it has been the way things have been done.

Teacher B: *The analysis that was done allowed us to watch a group of my children… to have that information to show children 'This is actually how you are in a group' and for them to reflect on themselves rather than us telling them all the time… they'd see it for themselves or even hear it because we've been recording children's discussions as well so they can listen to themselves speaking.*

Teacher D: *I think through the VBA, children's awareness of those different behaviours has improved. I think that was really starting to happen, which then means the way they're starting to work in teams has had a direct knock-on. We've got our skills for learning; children know about collaborating and all the rest of it but this just sort of gives it a slightly different frame.*

One teacher in particular tracked and commented on children's attainment in speaking and listening, examining the changes in attainment levels as defined by the National Curriculum for English. These teacher assessments are regularly used by schools for reporting purposes and as such these levels were being collected outside the project. The teacher indicated, however, that the progress of between two and three sublevels was beyond that which she would otherwise expect in the timescale of the project, and therefore it could be considered that the VBA intervention caused such improvements.

She went on to explain in interview:

Teacher A: … *because I just think it has made them listen more carefully to what each other is saying because they are listening for behaviours. So it's kind of made them focus more on each other I think it's enabled quieter children who would normally sit out or not participate. VBA has made them join in partly because they're aware that they're not joining in more and partly because other children are trying to use bringing behaviour, to say 'OK, so what do you think, Tom?' and then Tom is… cajoled into joining in, whereas he might not be normally. It's the fact that the other children are aware.*

Further study would be required to investigate this teacher's observations of the impact of VBA on learners' progress. It is worth noting that she was the most proactive teacher who participated in this pilot study, therefore it is inevitable that her investment of time and effort in personally understanding the Huthwaite programmes of development and becoming personally adept at behaviour-spotting helped her in preparing and delivering teaching inputs to benefit the children. The impacts she recalls extended beyond the specific lessons described here.

Teachers involved in this work described impact that went beyond the children and the classroom, and into their own professional skills. Teachers explained how understanding the categories of behaviours led to their being increasingly aware of their own talk practices and resulted in changes in their own behaviour:

Teacher B: *It's making me stop and think about my practice more generally… We've been able to probe quite deeply into some of the thinking behind it. The different theories and thinking on how children learn and how teachers learn… you don't ever get time to do those things, which for me have been so powerful in my own practice.*

Teacher C: *The biggest impact has been on talk and initially it was on the way I talked to colleagues and the way I use the behaviours.*

Pupil self-assessment results

Questionnaire responses from 70 children aimed to help examine the differences children felt in their use of the four categories of behaviour. Children responded to the questions asking about their perception of the frequency with which they felt they demonstrated the different types of behaviour *most* of the time (see Box 3).

We have not reported the tests used and the detailed results here as the questionnaires were intended as a pilot. Additionally, the internal reliability of the questionnaire was not as good as would have been liked. Despite these limitations, however, the analysis of the questionnaires presents some interesting findings. For these analyses, the responses were examined by VBA category (i.e. initiating, reacting, clarifying and process control) rather than on a question-by-question basis. The results of the analyses showed that there was a statistically significant difference in the grouped mean values in the way in which the children responded to the four categories of question; that is, they responded more positively

to some than others. While the differences we saw in the mean values were small, they were still enough to produce a statistically significant result.

The set of questions which were responded to the most negatively were those in the process control category (see Box 1). There was a statistically significant difference in the way in which the children responded to these questions compared with those in the other three categories. The most positive responses were seen in the clarifying category.

The data were also analysed with regard to gender, using the categories of questions as before, and comparing the patterns of responses. This showed that there was only one behaviour category where the boys and girls answered with a statistically significant difference – reacting.

Discussion

This study explored the influence of the VBA framework and teaching activities on children's awareness of and ability to use different types of language in the science curriculum at upper primary level (age 9–11). The purpose was to enhance the effectiveness of group discussions.

The research hypothesis was that by teaching children about different types of language in group discussions, and demonstrating the use of the categories of talk, they would respond in practice and in time better understand the impact that certain types of talk have in group situations. Specifically, the aim was to consider how the VBA technique could enrich talk focused on learning in science.

This was a pilot study that involved a limited number of children and teachers, and which built on previous work that explicitly teaches communication skills within a mainstream curriculum context (Mercer *et al*., 2004; Bianchi, 2002). Despite the limitations of this work, the results are helpful in demonstrating the benefits of explicit teaching of talk within the upper primary setting and that this can lead to the improved self-awareness of children such that they feel they can adapt behaviour to positively influence the process of group discussions. The study used VBA as a tool, with science as the context in which VBA was introduced. To take this further in the science context would mean focusing explicitly on the talk and language associated with learning science, for example questioning, designing investigations and drawing conclusions from evidence.

Mercer *et al*. (2004) noted that providing children with 'rules' for talk may seem constraining yet found in their research that '*this can represent a kind of freedom*' (p. 375). Explaining that the social status of individuals can be neutralised by having ground rules for talk in place, Mercer *et al*. suggested that making routines for talk explicit creates an intellectual environment which is more equitable. As such, the more confident children have the opportunity to hear a wider range of views, and quieter children find that their contribution is sincerely requested and valued. This study supported the suggestions by Mercer *et al*. and also reported similar findings (albeit from a much smaller sample size) of teachers reporting that participating children find it easier to resolve conflict in situations outside the classroom, when explicitly taught routines of managing group discussion.

Analysis of the data supported the hypothesis to some degree, mainly illustrating how direct teaching through generic tasks could raise children's awareness of the types of talk taking place during a discussion. In this way, the children were increasingly able to practise and use different types of talk more readily.

The design of the pupil self-assessment questionnaire will require ongoing development as its internal reliability was not as good as we would have liked. However, we have included the questionnaire as it gives a starting point for future discussion and work in this area. We feel it would be of benefit to improve this questionnaire, as future development may result in our gaining insights from children as to their understanding and awareness of their communication skills.

The quantitative data results showing significant differences in reacting (supporting, disagreeing, attacking and defending) statements, especially between boys and girls, is of further interest. It is possible that children noted greater differences in their perceived use of this category of verbal behaviour as it carries implications of seemingly socially negative areas of behaviour. Although the children may use these behaviours appropriately in the contexts provided, it is possible that they may be perceived by the children as inappropriate. As the girls stated that they used these types of verbal behaviour less frequently, it might be that they are more reluctant to, for example, disagree with classmates or at least that they are less likely to state that this is

something that they do at all. Further analysis through focus group interviews, although outside the remit of this study, might lead to better understanding of the differences noted with regard to gender.

The project aimed to explore the impact of VBA on talk within the science classroom, and teachers were asked to comment on how successful it had been in terms of improving science learning, and ultimately children's achievement in science. Despite enthusiasm from teachers abou the potential for this to take place, it was evident from their responses that the timescale of the project inhibited the possibility of marked differences being noted in this area. Teachers felt they had not provided enough specific learning opportunities in science contexts for children to practise their verbal behaviours because they required a longer period than initially thought to learn about the talk behaviours in general classroom contexts and discussions. One teacher felt that VBA provided a way of talking and cooperating that could be applied to any subject and therefore felt that gains in achievement should be looked for beyond science. Further work would be required in order to establish the potential benefits of VBA in the classroom to learning in both science and elsewhere.

Conclusion

This study has provided insight into the strategies by which teachers can encourage the personal skill of verbal communication in a science setting. At a time when teachers are faced with the implementation of a new National Curriculum that places emphasis on spoken language in the classroom, this study has explored a means by which they might develop routines of spoken language so that children have secure foundations when engaged in discussion such that they can probe and remedy possible misconceptions (Department for Education, 2013).

The finding that dedicated time is essential to develop children's knowledge and understanding of specific types of behaviour correlates with that of Bianchi's (2002) study and further endorses the need to use generic activities to initially allow children to explore, practise and refine skills and behaviours. In this study into the development of personal capabilities, of which one is communication skills, it is suggested that there is a need to make explicit through talk and role play the types of talk or ways of working that are expected, prior to the children being asked to use them in a subject-specific context. Time within the curriculum needs to be found for this activity for most benefit to be gained.

In conclusion, this pilot study has been beneficial in allowing us to better understand the application of VBA as a tool for talk in the upper primary classroom. It has provided preliminary indications that it can have a positive impact on enhancing teacher and pupil self-awareness.

Moving this work forward beyond the pilot phase, it is not only of interest to explore further how teachers can use VBA to encourage children to understand how their talk impacts group discussions and interactions, but also to examine whether science achievement and attainment can benefit from the exploitation of the range of verbal behaviour in primary schools.

The outcomes detailed here also have potential implications for classroom practice and may provide a framework for reviewing how communication skills are taught in school. Teachers and curriculum developers should further appreciate, recognise and target the degree to which science teaching, and indeed the children's science learning, relies on good-quality talk, as well as consider the extent to which assisting the practice and refinement of communication skills is a goal in science teaching.

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