

A MATTER OF PERSPECTIVE: VIEWS OF COLLABORATIVE WORK IN DATA HANDLING

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Abstract: *This paper reports on a study of students' collaborative group work in a grade 5/6 classroom using an open-ended task from the chance and data part of the mathematics curriculum. It considers (a) students' beliefs about collaborative group work compared to their actions; (b) observations of student knowledge, learning, and outcomes during collaboration compared to understanding displayed in individual interviews after work was completed; (c) students' accounts of events that took place in their groups compared with what was recorded on videotape; and (d) students' perceptions of the task and their beliefs about the mathematics curriculum.*

Introduction

This study is one of a series examining students' collaborative work using an open-ended data handling activity. Earlier studies identified factors associated with small group collaboration in a near-classroom situation, examined the use of an open-ended mathematical task in that environment, and documented help asked for and provided during the collaborative sessions (Chick & Watson, 1998; Watson & Chick, 2000, in press). In the grade 5/6 class used for this research, the teacher claimed to employ collaborative work in mathematical problem solving. She also said that the students knew the expectations, which included that everyone in the group understood how the result was obtained. For the current study, students were video-taped working in groups, and were also interviewed after the collaborative activity about their beliefs and understanding. These two sources of data provided an opportunity to observe and compare students' actions, beliefs, and potential contradictions in behaviour. This allowed the investigation of four key themes.

Views on collaboration. With the use of collaborative activities in the mathematics classroom becoming more common, it is recognised that students need to appreciate the benefits, be willing to work with others, and (sometimes) be taught necessary skills. It is also acknowledged that whereas some students see the benefits of collaboration (e.g., Watson & Chick, in press), others would prefer to work alone (e.g., Barnes, 1998). Ross and Cousins (1994) observed that students' intentions to seek and give help were not necessarily associated with their behaviours when participating in group work.

Did students learn what it appeared they did? Decisions about what students have learned in classroom settings may be made based on output produced (e.g., Chick & Watson, 1998), test scores (e.g., Webb, Troper, & Fall, 1995), comments recorded on videotape (Cobb, 1999), questions asked or answered (e.g., Watson & Chick, 2000), or post class interviews (e.g., Clarke, 1998; Frid, 1994). In this study transcribed videotapes were used to examine understanding during

collaboration. This was compared to the understanding exhibited in individual follow-up interviews.

Recollection of events. During individual interviews students were not specifically quizzed about what happened in their groups, however they recounted what had occurred when asked to explain their group's poster and when asked if there was anything else that their group might have considered. Of interest were discrepancies in the accounts given by students and the actual events as recorded on videotape.

Is this maths? Students' negative views of mathematics and lack of confidence in the subject are well documented (e.g., Leder, Pearn, Brew, & Bishop, 1997). The introduction of chance and data to the curriculum had the potential to assist in softening the perceived profile of mathematics through the use of concrete materials, the inclusion of social applications, and the need for students to make personal judgements in decision-making. Of interest is what effect this has had on students' ideas of what mathematics is and its usefulness in everyday life.

Research Questions

In light of the above considerations, four questions were addressed. (i) Were students' beliefs about the value of collaboration as expressed during individual interviews consistent with their behaviour observed on the videotape? (ii) Were the observations of student knowledge, learning, and task outcomes consistent with that displayed in later individual interviews? (iii) Were students' accounts of events that occurred during their group work consistent with what was observed on videotape? (iv) To what extent did students question the mathematical nature of the task set?

Methodology

Procedure. Twenty-seven students in a combined grade 5/6 classroom in a suburban Australian primary (elementary) school took part in three 45-minute collaborative problem solving sessions involving an open-ended task from the chance and data part of the mathematics curriculum. The teacher assigned the students to groups of three, all with mixed gender. Seven groups had a mix of grades. Although the class had participated in group work on other occasions, the groups assigned for this activity were different from previous groups. The groups of three students were distributed around the classroom, half of the class at a time, with a video camera trained on each group. Except for a few initial instances of showing off for the cameras, the students ignored their presence. The task set for the students was to study a set of 16 data cards that contained the following information on each of 16 imaginary students: name, age, eye colour, favourite activity, weight, and number of fast food meals eaten per week. The students were asked to prepare a group poster displaying what they had learned about the 16 students. More details of the task are provided in Watson and Callingham (1997). After the three sessions, each group showed and explained its poster to the rest of the class, the two teacher/researchers who conducted the sessions (one of whom was the second author), and the classroom teacher. A week later the first author, who had not been previously involved with the class, interviewed all 27 students

individually with a sequence of questions related to what occurred during the collaborative sessions, what the students understood of the task, and their views of working in groups. All students were happy to talk about the activity and none appeared to show any nervousness.

Analysis. The research team that analysed the data included, at various times, the authors, the second teacher/researcher present in the classroom, the transcriber of the videotapes, and a research assistant. The analysis of the data from interviews and videotape of the group sessions was similar to that advocated by Clarke (1998), adapted to meet the aims of the research questions. His *complementary accounts methodology* combines various sources, includes the reflective voice of the student, and employs a multifaceted analysis by a team of researchers. He asserts that an individual's learning process is embedded in a complex social context, and is "an integration of not just the obvious social events that might be recorded on a videotape, but also the individual's construal of those events, the memories invoked, and the constructions that arise as a consequence" (p. 100). In Clarke's approach students viewed classroom videotape during their interviews. This was not done here because it was felt important to make comparisons of the students' memories and beliefs about what had happened in the collaborative setting.

Data. There were 15 boys and 12 girls in the class; 5 boys and 4 girls were in grade 5. The data that were collected for each student included: gender of student, grade of student, assigned group, statements made about the activity and mathematics itself, understanding exhibited during group work and during the interview, descriptions of events occurring during group work that differed from that observed on videotape, description of collaborative or non-collaborative actions observed on videotape, and stated beliefs on collaboration during the interview. Where subjective decisions had to be made, these were decided by three or four members of the research team.

Results

Contradictions of belief and action on collaboration. Students were classified according to (a) whether their behaviours during group sessions were collaborative (or non-disruptive) or non-collaborative, and (b) whether the beliefs expressed during the individual interview supported collaborative work or not. Eleven students displayed predominantly collaborative behaviour, whereas 15 were classified as non-collaborative. In interviews 12 students said that, in general, collaboration is good, 12 had a negative view of collaboration, and 3 expressed both views with justifications (see Table 1). Some students expressed mixed views: they usually liked working in groups but not in this one, or they did not mind this group but did not always like working in groups. Of the three who strongly expressed both views, one girl showed both types of behaviour. She gave the boy in the group a dig with her elbow and hid the group's work from him so he could not collaborate, but she also gave him a great deal of help drawing graphs. In her interview she said she liked working in this group but did not always enjoy group work. This student was not classified in Table 1.

Table 1. Association of expressed belief in collaboration with observed behaviour during group work (n = 26¹).

Belief expressed in individual interview	Observation of Individual's Group Work Behaviour						
	Positive	Collaborative			Non-collaborative		
		Male	Female	Total	Male ²	Female	Total
		4	4	8	3	3	6
	Negative	Male	Female	Total	Male ²	Female	Total
		1	2	3	9	2	11

¹One girl displayed both positive and negative beliefs, and collaborative and non-collaborative behaviour. She is not included in the table.

²Two boys expressed both positive and negative views of group work, with justification.

Two boys, judged to display non-collaborative behaviour, also expressed mixed beliefs in relation to group work. One, who hoarded cards and flicked pencils and rubber bands, said that although “sometimes some of the people in the group were a bit silly, a bit uncooperative,” the group worked quite well as “I got to know my partners better” and “[I’m] glad I worked with the group.” The other boy was not disruptive but was often non-collaborative, ignoring questions from the other boy in his group and making all group decisions himself. In the interview he said “Yeah, we cooperated ... and I learned ... I guess with a group you just have to cooperate,” but he also liked working alone because he could follow his own ideas. This boy was judged by the research team to be one of the brightest students in the class.

Four students who were judged to behave in a collaborative or non-disruptive fashion and who said that they liked to work in groups, were, in fact, observed to be ignored or abused by other group members. The other four students in the “collaborative-positive” cell of Table 1 were from the two most cooperative groups. The three students who generally behaved collaboratively but had negative views of group work were observed to be quiet students. In the case of one girl, one of the boys in her group was particularly disruptive. The third group member, a collaborative boy, noted that he would rather have worked on his own, as “sometimes when you needed the card another person had it, you couldn’t get the card when you needed it.”

Of students showing non-collaborative behaviour, 4 expressed positive views and 9 negative views, with, as noted above, 2 expressing both. Overall the groups from which these students came were judged among the least collaborative. There was a high representation of boys in the group displaying non-collaborative behaviour and having negative views of group work. Overall, about two-thirds of the class showed consistent behaviour and beliefs. No effect for students’ grade level was noted.

Discrepancies in understanding. When the responses from the individual interviews were compared with the understanding displayed during group work sessions and the poster presentation, 16 of the students appeared consistent in their understanding of the task and what they had done. However, explanations from 11 students appeared quite different from those originally observed. Of these

students, 6 (3 boys, 3 girls) had difficulty explaining what they had done in the group work sessions. One helped the others in her group construct their graphs during the group sessions but had trouble explaining her own graph during the interview. The other 5 students (of the 11) appeared to verbalise better understanding than they showed during group sessions. Three were girls, of whom one missed the final session and so did not contribute to her group's poster. One could state hypotheses about relationships among variables of which she appeared unaware during the group sessions, and one discussed a larger number of variables (for example differences between boys and girls) than during the group work where she appeared to consider only one, "hobbies". The two boys appeared to concentrate on the interview questions in contrast to their classroom behaviour, and provided better explanations than they had produced earlier.

Discrepancies in fact. In recounting events that occurred during group sessions, five students' descriptions differed markedly from events as recorded on videotape. One boy who hypothesised about the relationships among the variables claimed he did not graph any of these. He did graph at least one but due to the domineering attitude of the older girl in his group, he threw it away. He also claimed that all three had contributed to the group's graph, when in fact he and the other boy were only allowed to do "colouring in". Another boy explained why his graphs, rather than those of the other boy in the group, were used on the poster by saying a teacher/researcher told the group not to put "wrong data" on it; hence the other boy's graph was not used. Nothing said by the teacher/researcher on the videotape could be construed this way. The three girls with contradictory accounts of what happened were all dominant individuals in their groups. One said she wanted to graph eye colour, whereas during the group sessions she repeatedly stated that she did not like the idea at all. The second stated that her group had produced another graph that did not get on the final poster. Although a different graph was suggested by another group member, this was not even started. The third said her group discussed which graph to produce when in fact there was no discussion, she just demanded that her idea be carried out.

Is this maths? During group work 4 of the 27 students actively questioned whether the activity had anything to do with mathematics. Three boys and a girl asked variations on the theme: "What does this have to do with maths?" Another girl asked the second author in the course of the group work, "How can you *like* maths?" These five students' responses reflect some of the stereotypical views still present in the classroom. Students were not purposely questioned on these beliefs during their individual interviews, as the ideas were not part of the original research brief and because of the possibility of influencing responses to other interview questions.

Discussion

This class was not selected because it contained highly able students trained in a specific regime of collaborative behaviour. It was selected to observe what happens in a typical classroom in a typical school where collaboration is at least superficially known to be part of the teacher's program. The class was judged by

its teacher to be “average”, but she was confident students understood how to work collaboratively. The research team agreed with the teacher about the students’ ability level and considered that the cognitive outcomes did not reach the level of other grade 6 children using the same task (e.g., Watson & Callingham, 1997). This study provides information for those who wonder how collaboration works in the “real world”.

With some students indicating that sometimes they liked group work but not this time, or that they liked this group but not all group work, it may be that the specific make up of the group determines its success. It is interesting to note the differing experiences of the eight students who behaved collaboratively and expressed positive views about group work. Half were from groups judged to be the most disruptive and half were from the least disruptive groups. For the four students who had experienced abuse or been ignored, the contrast between views and experienced behaviour was not discussed in the interview. It is possible that they had experienced other more positive collaborative environments that compensated for this unpleasant experience or were reflecting a view they thought that the teacher wanted them to express. For the other four students, whose beliefs matched their behaviour, it might be expected that since their beliefs and behaviours coincided this contributed to relative harmony in their two groups. Whether these attitudes and actions were engendered by previous events in the classroom or the influence of the teacher is impossible to determine.

Of the 56% of students judged to have behaved in a non-collaborative fashion, a third were supportive of group work. Two of the girls in this category were among three dominant females who dictated terms within their groups. The research team suspected that some comments from students supporting collaboration—such as “It was easier to work together because you worked as a team”—closely resembled the opinions of their teacher. It is, however, impossible to determine if the students were speaking from genuine belief or from a “politically correct” position they had learned in the classroom. Of the two-thirds who were consistent in showing non-collaborative behaviour and negative beliefs most (9 of 11) were boys, including two whose views were equivocal. It is interesting that all members of one group were in this cell of Table 1, including the only two girls. This group comprised two grade 6 girls and a grade 5 boy and it appeared to the researchers that the grade and gender mix of this group, with a dominant but mathematically inept girl, was particularly unproductive.

The difference in understanding displayed at individual interviews from that observed during the group work sessions, particularly for the six students unable to explain the work done previously, is disturbing. Several possibilities exist to explain the apparent decline. Although all students appeared completely at ease during the individual interview with the first author, it may be that some were confused by the presence of the camera and a new researcher. It is also possible that in the intervening week students had forgotten what they had done. All appeared to remember the sequence of events but details may have been lost. Alternatively it is possible that students picked up comments and language from other members of their groups, which they utilised during group sessions and

quickly forgot. The research team felt confident in the attribution of understanding during these sessions, certainly in several cases where the students appeared able to help others in their groups. The five students whose understanding of relationships appeared better at the time of the individual interview may have gleaned further information from the poster presentations made after the group sessions but before individual interviews, and further digested comments made by other group members. The fact that 41% of students displayed discrepancies in two apparently reliable settings, points to the need to collect information on student understanding from several sources.

The five students who gave discrepant accounts of events that occurred during group work were all in the non-collaborative category in terms of observed behaviour on the videotape. Two of the girls' beliefs about group work contrasted with their behaviour and one boy was equivocal about group work. Although it is impossible to be certain, it may be that these students wanted to make their own positions look more positive by describing events differently from the way they actually occurred.

The observation of student comments on mathematics and its relationship to the task was a serendipitous outcome of comments captured on videotape. The comments may reflect the fact that these children had had no graphing or other data handling activities in this class. They point to a need to include data handling activities at all levels and to connect them to the goals of the mathematics curriculum.

Conclusion

Overall the results of this small study of students' behaviour, in what was claimed by the teacher to be a collaborative environment, were disappointing to the research team. Critics of this study would undoubtedly say that the students had not been properly trained in the techniques of cooperative group. Given the social conditions and time available in many schools, however, it is fair to ask what is realistic in terms of training time for cooperative group work. Good, Mulryan, and McCaslin (1992)—who considered the role of teachers in preparing students, classroom management, age of students, and the role of explanations—concluded, “It is doubtful that there is a common shared experience of small group learning ... Experiences ... are better thought of as probabilistic than as predictable” (p.190).

If collaborative group work is an aim for teachers, then it would appear that in “typical” classrooms such as the one studied, more preliminary work is required to create the proper expectations in students. It is also necessary to consider carefully the assignment of students to mixed-gender and mixed-aged groups. The teacher of the class in this study believed her students would work cooperatively in the groups she assigned, yet the groups appeared to display many shortcomings.

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