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GROUP COMPOSITION: INFLUENCES OF OPTIMISM AND LACK THEREOF

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Lesson video and video-stimulated post-lesson interviews were used to study the role of optimism in collaborative problem solving in a Grade 5/6 classroom for the purpose of informing group composition. This study focuses on the activity of two students who differed on the personal characteristic 'optimistic orientation'. It examines how the presence or absence of an optimistic orientation to failures (Seligman, 1995) contributed to these students' interactions with their groups and opportunities for collaborative creation of new knowledge. One group collaborated to develop mathematical knowledge that was new to each group member and the other group did not. These findings raise questions about how to group students who are not yet optimistic to enable collaborative activity, and how to build optimism.

INTRODUCTION

The composition of groups that are likely to support the 'collaborative' generation of knowledge that is new to the group is an area of study that needs attention now that research has raised our awareness of interaction as a crucial aspect of mathematics learning (e.g., Dreyfus, Hershkowitz, & Schwarz, 2001). This study uses previous research findings to inform the composition of groups in a Grade 5/6 classroom, and researcher observation of video data in that classroom, and reflection on interview data, to refine the groups formed to increase opportunities for collaboration. It draws attention to the nature of optimistic indicators that should assist teachers to identifying whether or not a student is optimistic and illuminates how differences in the personal characteristic 'optimism' can influence whether students learn groups.

THEORETICAL FRAMEWORK

The term 'collaboration' has been used to describe 'peer tutoring' situations (e.g., Wood & Yackel, 1991) involving an 'expert other' (Vygotsky, 1978) who is a peer who knows and explains. This term has also been used to describe group interactions in which new knowledge is developed without the continual presence of an expert other (Williams, 2002, 2007). In this paper, the second description of collaboration is used. The purposes associated with group formation differ depending on whether peer tutoring or the collaborative development of new knowledge is the goal. Group composition for peer tutoring requires an expert other as peer tutor (e.g., Webb, 1991). Group composition for collaboration requires all members of the group to be unfamiliar with the mathematics under focus. By working together outside their present understanding in overlapping Zones of Proximal Development (ZPD) (Vygotsky, 1978; Brown, 1994), these students can collaborate as long as their ZPDs continue to overlap. For ZPDs to continue to overlap, students need to be able to
think at a similar pace (Williams, 2005). One of the groups in this study shows what can occur when ZPDs do not overlap. Conditions for collaboration during mathematical problem solving include discovering a mathematical complexity that is unfamiliar to all group members and spontaneously deciding to explore it (Williams, 2002). It is accompanied by intense interest, and high positive affect (Brown, 1994; Kieran, & Guzmân, 2003; Williams, 2002) or ‘flow’ (Csikszentmihalyi, 1992). Conditions for flow during mathematical problem solving (Williams, 2002) include: a) discovery of a complexity that is unfamiliar to all group members; b) spontaneous interest in exploring it; and c) similar paces of thinking to maintaining overlapping ZPDs. Some students are inclined to take part in such activity and others are not. The two students whose activity is examined in this study illustrate these differences. Williams (2005) found that the personal characteristic ‘optimism’ (Seligman, 1995) was associated with this inclination when students were individually involved in creating new knowledge. This raised questions about the role of optimism during collaborative problem solving. This is the focus of the broader research study from which this data is drawn.

An optimistic child perceives failure as temporary, specific, and external, and success as permanent, pervasive, and personal. The inclination to explore unknown territory rather than remain within the confines of what is already known (i.e., the inclination to collaborate) is associated with optimism because exploring what is unknown (present failure) is consistent with the perception that ‘not knowing’ is temporary and ‘knowing’ can result from personal effort [Failure as Temporary; Success as Personal]. This involves identifying what can and cannot be changed and making decisions about changes that are likely to increase chances of future success [Failure as Specific]. The research question that focuses this paper is: Does optimism and/or absence of optimism influence opportunities for collaboration?

**RESEARCH DESIGN**

**Context**

The Fours Task is the final task in a series of three tasks undertaken over six lessons across the school year in a Grade 5/6 classroom in a government elementary school in Australia. The task spanned one eighty-minute lesson in which two cycles of five to ten minutes of small group activity were followed by whole class reporting sessions. Students were asked to improve their speed in generating numbers after they had: worked individually on a task for three minutes; shared their results; and checked each other’s answers. The task required students to make each of the whole numbers from one to twenty inclusive using four of the digit four and as many of the following operations and symbols as necessary “+ + - - * / +√( )²”. The researcher and teacher team-taught with the researcher as the primary implementer of the task. Groups were given tiles with fours, operations, and symbols on them. Transparent tiles were used by students, on an overhead projector during reporting.
sessions to enabled students to communicate in visual images and language (Ericsson & Simons, 1980). This also contributed to the data collected.

During the first reporting session, groups could focus on any of the following: two numbers they had generated; something they had found, something that was not working that other groups might be able to help with; a ‘big picture idea’ that helped generate numbers faster; or anything else they had found that they thought could be useful to other groups. The task was accessible to students with varying understandings of whole number operations because numbers could be generated with simple operations, or a wide variety of permutations and combinations could be used when students were familiar with many operations and symbols. Groups were expected to learn more about operations and symbols and how to use them from the reports of other groups and this was expected to increase their opportunities to create new sums. Trying to generate sums fast was also expected to elicit generalisations.

Focus Students

Patrick, a high performing student who displayed frequent indicators of optimism in his interviews, enacted optimism in his classroom activity. He reported learning by reflecting on the mistakes of others and on what had not been completed. He identified possible variables he could control, and adjusted them to increase the likelihood of success [Failure as Temporary; Failure as Specific; Success as Personal]. Patrick’s group was not altered, by the researcher throughout the tasks because this group collaborated well. One student was absent during this task.

Sam was the highest performing student on tests and was perceived as ‘very good at mathematics’ by class members and his teacher. He described the tasks in this study as boring and stated that he did not learn anything new. He described learning as listening to the teacher, reading books, and searching the internet [Success as External], not as self-generated knowledge [Success as Internal]. To the surprise of his teacher, Sam’s understandings in relation to the tasks were, and remained instrumental (Skemp, 1976).

Criteria for Group Composition

Criteria for group formation were informed by research literature. The teacher was provided with these criteria to form the original groups. These groups were refined from task to task after observation of group interactions in the lesson videos and interviews. In this way, there was opportunity to increase the collaborative nature of interactions, and test emerging ideas about the role of optimism in collaboration.

The criteria (with their purposes in brackets) are now provided: a) students thinking at the same pace grouped together (enable overlapping ZPDs); b) never less girls than boys in a group (increase likelihood of girls participating); c) every group to have a positive, encouraging member with more influence than any negative members of that group; d) separate behaviour problems to buffer against negative activity (to retain task focus); e) separate friendship groups (to decrease previously constructed
interactions that might not be intellectual in nature). An excerpt of an email from the researcher to the teacher prior to Task 2 illustrates the refining process:

Callum and Amit played around a lot. I think Amit would contribute if we added a serious eager boy ... [like] Jarrod. ... [and] Elsa might have more to contribute [in her group] if Jarrod were not dominating.

This excerpt addressed several criteria: participation of girls, and separating and focusing off task students. Adding Jarrod to the group was expected to provide conscientious participation from a boy sufficient to focus Amit, and transferring Jarrod from Elsa’s group was expected to increase her participation opportunities.

During The Fours Task, the criteria used to form Sam’s group were modified to try to give him further opportunities to create new mathematical ideas because the teacher was surprised he had not done so. He was placed in an all boys group in case he was uncomfortable working with girls, and two boys (Jarrod and Wesley) who had demonstrated they thought at a fast pace and were willing to collaborate were included in the group. Although the fourth boy, Donald had previously dominated activity in another group and taken it off track, it was considered that Jarrod would be focused enough and sufficiently dominant to keep this group on track.

Research Method
To enable study of group interactions, group reports to the class, and individual student learning resulting from these interactions, the Learners’ Perspective Study methodology (Clarke, 2006) was adapted to capture the private talk of at least three groups, the physical activity of all groups, interim reporting by groups, and student reconstruction of their thinking in video stimulated interviews. Four cameras were used and group written work was collected. Three cameras captured the groups and the fourth camera captured the reporting sessions at the blackboard and overhead. A mixed image was generated with a group at centre screen and the reporting sessions as an insert in the corner. Post-lesson video-stimulated individual interviews were undertaken with four students after each lesson. Students were selected from at least two groups each lesson based on the positioning of video cameras, and the interactions in that group. In these interviews, students controlled the video remote and found and discussed parts of the lesson they considered important. Indicators of optimism were captured through questions like: “How do you learn something like that?” and “How are you going in maths and how do you decide that?”

RESULTS AND ANALYSIS
This section reports the individual work undertaken by Patrick and Sam and the types of interactions they took part in during group work. These activities in combination show the effects of Patrick’s optimism and Sam’s lack of optimism on collaboration.

Initial Three Minutes Individual Work on the Fours Task
Patrick purposely chose to use operations and symbols that were more challenging for him: “I went looking for hard one's first like decimals and stuff and times”. He
generated more than half of his sums by retaining underlying structures and changing the positions of operations. He progressively increased the number of unfamiliar symbols and operations he used in a sum. Patrick was willing to move into unknown territory to develop new mathematical ideas. Table 1 shows the sums generated by Patrick [Column 2] and Sam [Column 3] in descending in the order matching the order they were generated in. The rows in Table 1 group these sums according to how they were generated, indicate their accuracy, and summarise the activity.

<table>
<thead>
<tr>
<th>Types of Sums and Answers Generated</th>
<th>Patrick</th>
<th>Sam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systematic Generation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$4^2 + 4 - 4/4 = 19$</td>
<td>$4/4 + 4 + 4 = 9$</td>
</tr>
<tr>
<td></td>
<td>$4^2 - 4 + 4/4 = 13$</td>
<td>$4/4 + 4 - 4 = 1$</td>
</tr>
<tr>
<td></td>
<td>$4^2 - 4 - 4/4 = 11$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$4 \times 4 + 4/4 = 17$</td>
<td>$\sqrt{4} + 4 + 4 - 4 = 6$</td>
</tr>
<tr>
<td></td>
<td>$4 \times 4 - 4/4 = 15$</td>
<td>$\sqrt{4} \times 4 + 4 + 4 = 20$</td>
</tr>
<tr>
<td>Other Sums Generated</td>
<td>$8$</td>
<td>$16$</td>
</tr>
<tr>
<td></td>
<td>$(4 + 4) - 4 \times 4 = 8$</td>
<td>$4 + 4 + 4 - 4 = 8$</td>
</tr>
<tr>
<td></td>
<td>$.4 \times 4 + 4 + 4 = 13.6$ (queried whether allowed)</td>
<td>$4/4 + \sqrt{4} + 4 = 7$</td>
</tr>
<tr>
<td>Incorrect Calculations</td>
<td>$(4 + 4) - 4 \times 4 = 8$</td>
<td>$4 \times 4 + 4 - 4 = 5$</td>
</tr>
<tr>
<td></td>
<td>$\sqrt{4} + 4 + 4 = 20$</td>
<td></td>
</tr>
<tr>
<td>Summary</td>
<td>7 Generated, 6 Correct 1 Incorrect calculation, Systems used more effectively</td>
<td>8 Generated, 6 Correct, 2 Incorrect calculations, Systems used to some extent</td>
</tr>
</tbody>
</table>

Table 1. Sums Generating Numbers in 3 Mins Individual Time on Fours Task

Sam generating eight sums quickly, stopped early, looked around, and appeared surprised that others were generating longer lists. He then covered his work but did not generate more sums. Although Sam’s number fact recall was faster than Patrick’s, the sums Sam generated, and his less sustained use of patterns to generate sums showed less evidence of experimentation. Unlike Patrick, Sam did not progressively increase the number of harder operations he used in the same sum, and did not try decimals or brackets. Sam was not inclined to explore. These findings support the indicators of lack of optimism Sam displayed in his interview.

**Group Interactions**

Patrick contributed to the development of new ideas in various ways. For example, when Gina generated a sum and Eliza queried it, Patrick looked at what could be changed thus eliminating the need to start again and demonstrating a strategy: “Put
something in the middle like a plus or something" [Failure as Specific]. He was the first to begin to package parts of sums together as mathematical objects (e.g., ‘4/4’: “Well four on four is just one whole!” and ‘- 4 + 4’: “We don’t really need these … they cancel each other out”). Subsequently, group members referred to -4 + 4 as ‘zero’. Patrick’s optimistic orientation to failure increased his group’s opportunities of recognising mathematical structure within the sums, and strategies to use.

After individual work and sharing time, Sam used ideas gained from Jarrod’s and Wesley’s more extensive lists to increase his own list instead of working with others as expected. New sums he generated included: ‘4\(^2\) - \sqrt{4} + 4 - 4 = 16; 4\sqrt{4} + 4 - 4 = 8; (4/4 + 4) \times 4 = 20’. Seeing the work of more expert others enabled Sam to use: the index 2, a product of a square root, and brackets. This showed Sam’s lack of inclination to move from what was known into unknown mathematical territory even though he wanted to generate a long list. It would appear that the indicator of lack of optimism ‘Success as External’ that Sam displayed in his interview contributed to his lack of inclination to create new ideas. Sam perceived learning as occurring through expert others and not through creating ideas when there was no expert, thus he was not inclined to collaborate as he did not see this as an option for learning.

When the group were meant to be exploring the task with the intention of finding fast ways to proceed, Sam used his own sheet, including his later generated sums, to focus discussion and refused Jarrod’s sheet that he offered in this discussion. Sam monopolised the group time in explaining to Donald how to get answers to sums and attempts at collaborative interactions were inhibited. For example, Wesley’s attempt to put forward an argument for why the decimal point could not be used was not ‘taken up’. This group did not create new knowledge around this idea but rather reported that it was not possible to make whole numbers with a decimal point in this sum without adequate justification. They gave one example containing additions and subtractions to support their argument even though Wesley and Jarrod had given stronger justifications for other arguments in previous tasks.

Patrick’s group developed several big ideas including: -4 + 4 could be used when wanting to obtain a small answer; brackets can change the size of the answer; and it may not matter whether multiplications or divisions are done first because the answers seem to be the same in these cases. Through collaboration, this group came to realise that the order of operations was important because different answers were achieved when these sums were calculated in different orders. Patrick’s optimistic activity was crucial to these outcomes.

DISCUSSION AND CONCLUSIONS

The composition of Sam’s group that did not fit with the optimal criteria formulated: Donald’s pace of understanding was slower than that of other group members, and the dominating influence was not a student who encouraged new ideas even though it was considered that such a student had been included (Jarrod). Peer tutoring took the time that could have been used for collaboration about potential uses of the decimal
point. Although Wesley made attempts to move the focus beyond the secure understanding of the group by focusing on this (Csikszentmihalyi, 1992; Williams, 2002), Sam and Donald inhibited these attempts. Jarrod was unable to fulfil a role of encouraging collaboration because Donald and Sam in combination used the time to focus within the present understanding of three group members. Donald worked in his ZPD with the assistance of an expert other (Sam) who willingly took on this role. Thus, the absence of overlapping ZPDs for group members was a contributing factor to inhibiting collaboration. In addition, Sam’s lack of optimism inhibited the usually collaborative interactions of Wesley and Jarrod. Because Sam was not inclined to challenge himself (as evidenced through his individual work), he decreased opportunities for the group to work outside his own understanding by using the time available for collaboration for other purposes and refusing to focus on more creative work than his own (included on Jarrod’s sheet). In comparison, in the other group, Patrick’s activity continually set up the conditions for flow that contributed his group’s frequent collaboration and the development of mathematical ideas. The optimism of other students in his group supported such interaction.

This study of the activity of two students in two groups is sufficient to raise issues for further study. The findings demonstrate that lack of optimism can inhibit collaborative activity and so further research is needed to find how to best compose groups when some students are not yet optimistic. This study also highlights the need to undertake research on developing optimism in our students to study the effects of such outcomes on problem solving capacity. Seligman’s (1995) findings that optimism building occurs by engineering flow situations provide a fruitful area for further study. Research presently being undertaken contributes to this area of study (see Williams, 2008).

References


