WHY SOME GROUPS WORK AND SOME DO NOT

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Some teachers have found group work useful, and others have not. Many have observed that it works sometimes, and other times it is not as effective. In particular, they say that in the same lesson some groups are effective and others are not. This paper explores the compositions of groups and factors that can influence their likelihood of promoting learning. In particular, this paper looks at how resilience (optimistic, Seligman, 1995) or lack thereof can change learning opportunities for groups.

Introduction

As a teacher, I developed a group work approach to the learning of maths over a 15-year period. I found students became more engaged in their learning and reported learning more through this approach. As both a teacher and a researcher, I have observed and listened to students undertaking group work in classes from Early Years through to Year 12 Specialist Maths. This has helped me to reflect on group composition strategies I developed, and learn more about why they tend to work. Group composition is only one factor that can alter opportunities for learning. For example, the task, the classroom culture, teacher 'moves', and the physical set up of the classroom, also contribute to the social and intellectual outcomes for groups and the individuals within them. This paper is focused on group composition because this is one influence I consider has not received enough attention. In particular I focus on composing groups to optimize the creating of mathematical ideas whilst solving unfamiliar problems.

Intended Purpose and Group Composition

The purposes for which I have found teachers often use group work include to:

- Give students a support network during individual work;
- Consolidate previously learned knowledge;
- Increase student ability to cooperate in team situations and
- Enable students to collaboratively develop new knowledge.

The reasons teachers have given for letting students select groups include that they:

- Didn't realize group composition could be a significant influence;
- Wanted students to be comfortable with friends while problem solving in maths and
- Did not want to contend with the fuss students will otherwise make.

This paper is intended to stimulate some rethinking about group composition and the role it can play in enabling teachers to implement group work sessions that might better fit their intended purposes. It describes group work for the purposes of: supporting individual work; consolidating new knowledge; or building new knowledge, and considers types of group compositions that might be useful for each.

1. Groups Supporting Individual Task Completion

This is when students are seated together in pairs or larger groups to complete their own work, but allowed to cooperate to do so. Peer tutoring occurs, and sometimes critical evaluation of the solutions of others. To achieve the intended purpose, knowledge required to do the task is held by one or various group members, and a willingness to explain is required. Mixed ability grouping has been found useful for this purpose.

2. Group Work for Revision / Consolidation

This involves students working together in pairs or small groups on a task at the end of a topic. These tasks are generally set in a context different to ones used in the teaching of the topic. They generally involve the application of rules and procedures that have just been taught, and sometimes recognizing which maths in the topic to use. Task wording often 'gives this away'.

In general, when using group work for revision or consolidation, the purposes include to:

- Consolidate new learning;
- Allow teachers to see what students do not yet understanding and
- Give students opportunity to do maths other than exercises.

Composition of these groups can include a student or several students who 'know', and 'don't know' much about the rules and procedures just taught. It is also helpful to include students willing to explain, or encourage others to explain, and a willingness to ask for help. Mixed ability groups can be useful.

3. Groupings for Creating New Maths Understandings

In some instances, teachers want students to work together to develop an understanding of the mathematical ideas that underpin a new topic before it is formally taught. Through this approach, students can build understandings of maths they often have difficulty understanding if formally taught. This is my area of teaching and research expertise. The composition of such groups is the focus of the rest of the paper.

Tasks that promote creative thinking or 'big idea' development (Williams, 2007) are integral to this learning approach. Many of my MAV papers (1991-2007) describe a variety of such tasks (e.g., Williams, 2005a). The creating of 'big ideas' relies upon tasks with certain features which include:

- Presented before relevant maths has been formally taught;
- Accessible to students with varying maths backgrounds;
- Relevant maths is not identified but left for students to identify;
- Variety of pathways and representations can be used and
- Unexpected findings stimulate further exploration.

How should we group to promote creative thinking or 'big idea' development?

To keep up with each other as new ideas develop, group members need 'similar paces of thinking'. When tasks are set at the start of the topic, and students have not been taught an appropriate procedure, they have to struggle to develop 'big ideas'. In other words, they need to overcome adversities associated with many possible 'failures' before finding productive ways to progress. My research (Williams, 2005b) shows that students who are willing to try to create new ideas individually are resilient (optimistic, Seligman, 1995). This made me wonder how optimism might affect group activity. To find out more, I analyzed the interactions of groups that had all optimistic members, and those that contained some non-optimistic students.

An optimistic student sees:

- Not knowing as temporary; overcome through personal effort;
- That looking into situations to find what could be changed can increase chances of success;

- That external factors may not be able to be changed;
- Success as pervasive or due to a characteristic of self: "I succeeded, I am good at this".

Students who are not yet optimistic are missing some or all of these characteristics. They see failures as pervasive: "I will never be able to do this, I am too dumb".

During my years as a teacher, I found the following criteria were useful for composing groups for the creative development of new knowledge:

- Preferably groups of four, but three if this is not possible;
- Gender balance if possible, but at least no less girls than boys;
- In general, separate friends unless productive intellectual outcomes; that are not of a peer tutoring type are evident;
- Include 'positive personalities' to overcome any negative influence;
- Include student with the same pace of thinking (not same level of performance).

Here, I discuss only the 'positive personality'. I did not realize that these 'positive' students were optimistic and that the 'negative' students were not when I formulated these criteria as a teacher. This occurred many years later during my research. Sometimes three positive personalities are needed to buffer against one negative personality, and with a limited number of positive students, a dysfunctional group may be formed and need additional support to encourage positive interactions. More information on how to recognize optimistic students can be found in Williams (2003).

The Role of Optimism in Group Composition

Across Year 12 Specialist classes and Grade 5/6 classes, I found commonalities in group interactions for groups that were homogeneous and heterogeneous with regard to optimism. I have included below some examples of the interactions in differently composed groups.

Interaction 1: All Group Members Optimistic

Year 12 Group: Talei, William, and Gerard, were all optimistic. (More information on the task they undertook can be found in Williams (2000).) William and Talei willingly stepped 'into unknown territory' to explore mathematical complexities and Gerard willingly participated too. During the creative thinking necessary to unravel each complexity, the pace of thinking finally became too fast for Gerard and he stopped participating and listened intently.

Instead of interrupting to ask questions, Gerard waited until Talei and William's creative activity subsided, then asked Talei several questions. During that time, William

generally studied the task sheet but sometimes added to explanations. When Gerard had caught up, William had begun to identify the next complexity and the group moved into another cycle of creative activity.

The Grade 5/6 group contained Patrick, Gemma, Eliza, and Eriz who were all optimistic. Like the Year 12 group, one student (Eriz) participated early, then listened intently when the pace of thinking became too fast. He then discussed what he did not know with Patrick before the next creative cycle commenced with all participating.

These creative cycles lasted for 2-3 minutes with the catch-up time taking less than 30 seconds. As shown in Figure 1, all students were inclined to consider ideas outside their present understanding during the initial period of creative thinking. The student in each group who was unable to sustain the pace of thinking, possessed characteristics that helped to sustain the creative group process, and enabled that student to continue to take part in later creative thinking cycles. When they 'did not know', they listened carefully and worked out what they did not understand so they could ask more about it. In terms of optimistic dimensions, they enacted failure to know as temporary, and able to be overcome through personal effort by looking into the situation to identify where they needed to know more. They displayed persistence in the face of adversity.

Interaction 2: Groups With a Non-Optimistic Member

These Year 12 and Grade 5/6 groups both included students who were inclined to work outside their present understandings. In each group, there was one student who monopolized group time by continually interjecting about or explaining work that was within the present understanding of other group members. There is enough evidence to show the Grade 5/6 student was not optimistic, so not inclined to 'move into unfamiliar territory'. He showed in his interview that he perceived 'success as external'; learning for him only occurred through the teacher telling, reading textbooks and the Internet. This contrasted to optimistic students who identified learning as struggling to make meaning (that is, they see success as personal).

Figure 2 represents interactions that inhibited the creative development of new knowledge. In at least the Grade 5/6 case, this was because a non-optimistic student monopolizing the discussion time and retained the discussion within his present understanding. It would appear that the Year 12 student might also have been non-optimistic at that stage in the year but there is insufficient evidence to tell.

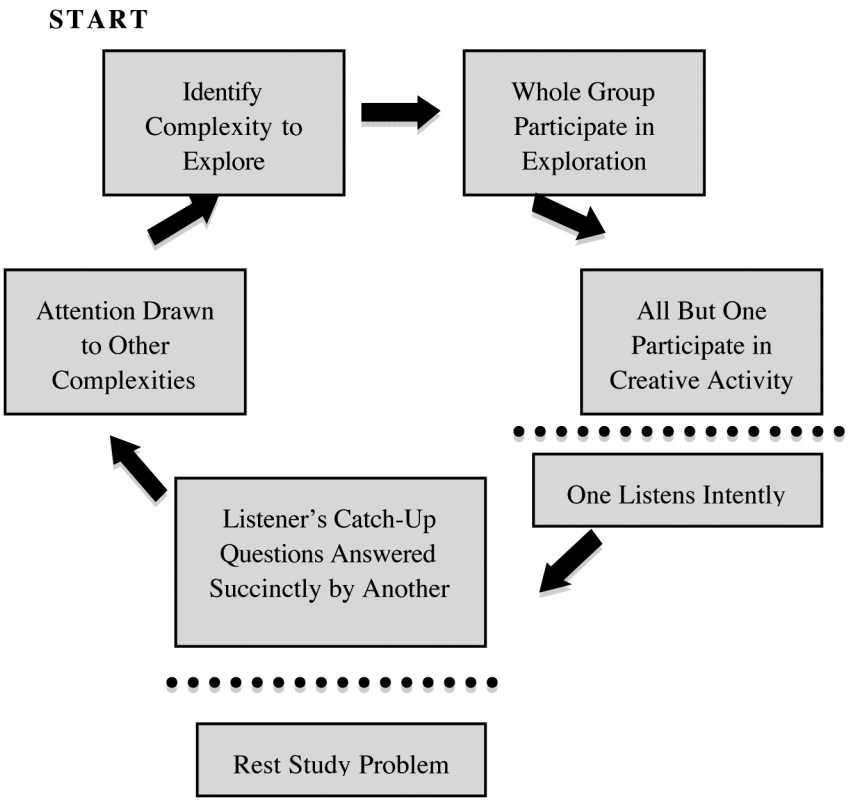

Figure 1. Optimistic students sustain creative activity

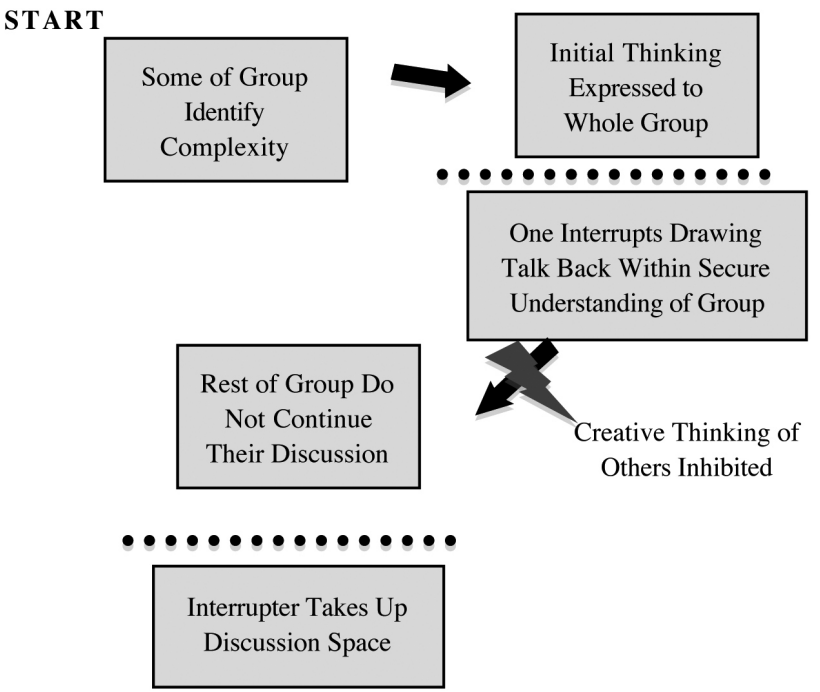

Figure 2. Creative thinking inhibited by non-optimistic student

Conclusions and Implications for Teaching

This paper shows that the relative optimism of group members can influence chances of developing deep understandings. It raises questions about whether student self-selection of groups may be creating group compositions that are not appropriate for the intended learning purpose of the teacher. It also alerts us to the importance of developing approaches to the teaching and learning of maths that simultaneously build optimism in our students.

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