Is There Design Potential to Examine Overlaps Between Confidence, Persistence, and Optimism?

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The methodological potential of a research design employed to examine the role of optimism in collaborative problemsolving is explored for its potential to study overlaps between confidence, persistence, and optimism. Crucial design features found included: a) multiple video capture each lesson to identify optimistic enactment occurring for any student; b) capture of student interview responses and in-class talk to identify indicators of optimism; c) video-stimulated nature of interviews informed simultaneous analysis of reconstructed student thinking in interviews and optimistic or non-optimistic problemsolving activity in class; and d) longitudinal data enabling retrospective analyses of changes in enactment.

Introduction

For more than thirty years, mathematics education researchers have recognized that problemsolving activity can lead to deep mathematical understandings (Skemp, 1976; Cobb, Wood, Yackel, & McNeal, 1992; Williams, 2005). But, many students do not engage in this activity and may actively fight against it: demanding to be 'told' (Anthony, 1996). The Australian Mathematics Curriculum (see <http://www.australiancurriculum.edu.au/Mathematics/Rationale> framed by the Melbourne Declaration of Educational Goals for Young Australians < http://www.mceecdya.edu.au/mceecdya/melbourne_declaration,25979.html> intends the development of creative, innovative and resourceful problem solvers. We need to find out more about how to build these characteristics. My research (Williams, 2005) identified 'optimism' (Seligman, 1995), a form of resilience, as a characteristic of creative mathematical problem solvers, and later elaborated the nature of a pedagogical approach that theory suggests should build optimism (Williams, 2009). My present research examines whether it does build when such pedagogy is employed. I am frequently asked how confidence and persistence relate to optimism. This question focuses the research question for this paper: "Is this video-stimulated post-lesson interview research design sufficient to identify the nature of overlaps between these three constructs (confidence, persistence, and optimism)?"

Theoretically Framing This Study

Optimism is an orientation to successes and failures (Seligman, 1995). Optimistic children perceive failure as 'temporary' (able to be overcome), and 'specific' (to the situation at hand so able to be overcome by varying situation elements). They perceive successes as permanent (able to be achieved again), personal (achieved through own effort), and pervasive (internalized as a characteristic of self: 'I did this,

I am good at this'). For the purposes of this study, failures and successes during mathematical problemsolving are taken to be 'not knowing' and 'finding out' respectively. 'Persistence' is "how much students keep trying to work out an answer or to understand a problem even when that problem is difficult or is challenging … 'If I can't understand my schoolwork at first, I keep going over it until I understand it'" (Martin, 2003, p. 46). Thus, a persistent student continues to make personal effort because they perceive 'not knowing' is temporary. 'Confidence' is the "degree to which a person feels certain of her or his ability to learn and perform well in mathematics" (Hart, 1999, p. 243). Previous successes have been taken on as characteristics of self thus the perception that they will be able to undertake such activity in the future [Success as pervasive, thus success as permanent].

Research Design

Three problemsolving tasks were undertaken each year (for three years) in six eighty-minute sessions in three classes (in two schools) as students progressed through upper elementary school. The RT (researcher as teacher) implemented the tasks and the T (classroom teacher) and RT team taught with T taking over more parts of the teaching and learning approach (Engaged to Learn, Williams, 2009), as they felt more comfortable to do so. Students worked in small groups and gave brief reports to the class at 5-10 minute intervals. RT and T did not affirm pathways taken nor ideas presented but rather asked questions to stimulate further thinking. Students selected for the present study (this paper) displayed a variety of different indicators on dimensions of optimism. After that, preference was given to those students in the pilot or main study whose activity could be illustrated concisely.

Four video cameras captured the activity, including student talk, in the 5-7 problemsolving groups in each class, and their progressive reports to the class. After each session, the RT undertook four individual post-lesson video-stimulated interviews with students and an interview with the teacher. Video-stimulated interviews increase the validity of student reconstructive reports through focus on memory traces related to specific activity that occurred, and decrease the likelihood of the student talking more generally without relating this talk to what has previously occurred (Ericsson & Simon, 1980). Students had simultaneous access to video of their group and the reporting sessions. They identified and discussed parts of the lesson that were important to them and answered some general questions. The pilot study was a one-year study using tasks from the main study, and the same research design (except that only one audio lead was available from each camera).

Ways Design Elements Supported Analyses

Table 1 displays indicators or enactments on dimensions of optimism for each student, and Figure 2 clusters students by the characteristics (confidence, persistence, optimism) represented as combinations of optimistic indicators. Below, illustrations of how the research design supported the analysis are included using part of the activity of each student. 'F' denotes 'not knowing'/failure and 'S' denotes 'finding out'/success. Text in square brackets elaborates data interpretations.

Interview Reconstruction Led to Retrospective Lesson Video Analysis

Lenny was perceived by his teachers to be an average performer in mathematics. After two years in the study, he reflected on changes to his problemsolving activity:

"Instead of just going 'I don't know', I [now] sit there and I really really think about it- …". Lenny had shifted from 'giving up' [F as permanent] to knowing if he persisted he could 'find out' more [F as temporary; S as personal]. He recognized he had developed this new characteristic (persistence) [S as pervasive] and that by 'really thinking' he would work out more [S as permanent]. Subsequent retrospective analysis of Lenny's group interactions at the start of the study showed he participated with interest early in the task when work focused on previously learned procedures, and began to playful poke his neighbor when his group began to creatively combine ideas to think about something unfamiliar [F 'not knowing' was permanent; S 'finding out' through personal effort did not occur]. When asked how this change happened, Lenny replied reflectively: "I don't really know … it just made me think more. It was probably actually doing the tasks …". Lenny identified successes in working with the tasks (finding out more) as developing his persistence.

Questions in Interview Protocol and Probes 'On the Run'

Sam was a high performing student in tests in class. Sam's responses to questions in the interview protocol, and spontaneous probes generated non-optimistic indicators. When asked "And what's learning something for you?" Sam answered: '… gaining knowledge [pause] sometimes I read … somebody teaches … I go on the Internet". Sam perceived S was attained through input from 'expert others' (Vygotsky, 1978) [S as external], rather than by developing ideas himself. He perceived he was able to learn fast [S as pervasive] when 'told'. Although Sam displayed confidence [S as permanent, S as pervasive] he did not persist when working with unfamiliar ideas. When students were required to work individually on a task requiring creative manipulation of whole numbers and operations, Sam stopped after a third of the time with less than a third of the possibilities found. Other students with lower performances in usual class tests continued to work and generated a greater diversity of possibilities. Sam then quickly wrote down and began to use the ideas of others [F as permanent without help from an external source: S through external means]. In his interview, Sam volunteered that he had not succeeded on the test for entry to a prestigious school. The interviewer (RT) probed what he would do differently (when he did the test again that year) to increase his likelihood of success. Sam was unable to identify anything [enactment of F as specific not displayed].

Classroom Observations Stimulated Simultaneous Lesson and Interview Analysis

In problemsolving tasks during the research period, Bethany (a high performing student on classroom tests) was conscientious, stayed on task, and encouraged her group to do so. She listened carefully to what was expected, listened to group members, and asked them for explanations when she did not understand. She also explicitly worked to make sure the interactions in her group fitted with the RT's classroom expectations. She valued what she achieved according to how it was valued by others. For example, she: a) displayed pleasure with an instantaneous broad smile when RT valued an aspect of her report in class; and b) stated in interview that she liked group work because when something was wrong 'the whole group took the fall'. Bethany thus perceived F as temporary and able to be overcome through personal effort but the analysis so far indicates that personal effort was more related to careful listening and asking and working out how to follow given procedures than to

developing new ideas herself: "[I]f I don't really get it I really really try and listen- and sometimes I try and make ways that … [it] sort of makes sense and use different numbers in the same ways as he was." She will also: "… look around and see what … everyone else is doing and … when he says like this is the answer to it then I sort of work it out and then I get it." S in this case 'I get it' is working out how to get to the answer by consulting external sources [Success as External]. Simultaneous analysis of Bethany's group activity and interviews across the three-year period are ongoing. So far, no indicators or enactment of F as specific (varying something within a problemsolving activity to increase the likelihood of success) have been identified, even though each group Bethany was in developed complex new knowledge. In the three out of nine tasks in which Bethany's group activity has already been analyzed in detail she has displayed only the types of activity described previously. There is some evidence of F as pervasive: she perceives others will generalize 'being wrong' as a characteristic of the person who was wrong, thus perceives it better if 'the whole group took the fall'.

Simultaneous Analysis of Interview and Lesson Video

In her interview, Eliza reconstructed her classroom activity when her group were trying to work out possible dimensions for a cuboid made from 32 whole one cm cubes: "When I try to do things *in my mind* it is hard for me to figure it out till I really know how so the blocks help me to learn how to figure it out in my mind". Eliza's response indicates that trying to work out what is unfamiliar ('not known') is something she does and she expects to be able to gain some success with [S as pervasive; F as temporary]. She perceived that personal effort in using her mind while using the blocks would help her [S as personal]. Patrick (in the same group) developed a way to proceed when another group member found they did not yet have a calculation matching what was required: "Put something in the middle like a plus or something" [F temporary and specific to the situation]. He varied an aspect of the calculation, to increase the likelihood of success, rather than starting again. Patrick also explained that he learns by thinking about other group reports (how to do something they were unable to do; why a group came up with a particular incorrect answer) [F as temporary, S through personal effort]. By talking generally about the way he learns and using his classroom activity to illustrate, he has shown he perceives himself as having characteristics that enable him to find out more about something 'not yet known'.

Interpreting Table 1 and Figure 1

Indicators of optimism or lack thereof that students displayed (Table 1) were used to identify student characteristics (confidence, persistence, optimism) in Figure 1. For example, Bethany is persistent [F temporary, S requires personal effort (Table 1)], but not confident [S not pervasive because she does not perceive herself as coping without consulting others: S external]. Lenny in 2009 did not display indicators for confidence or persistence, but by the end of 2010, he was displaying all six indicators of optimism. He perceived himself as able to find out more if he kept thinking [S through personal effort], and he looked carefully at what was not working to find what he might be able to change to bring about success [F specific: focused on what could be changed to increase likelihood of success; F external: differentiated between

what could and could not be changed)]. Figure 1 also contains a space with no student illustrations (see arrow in Figure 1). This raises questions about whether there are possible students that can be represented in this space.

Table 1: Optimistic/non-optimistic indicators displayed

	Not Optimistic		Optimistic		Characteristic
	Success	**Failure**	**Success**	**Failure**	
Eliza Patrick			Permanent ✔ Pervasive ✔ Personal ✔	Temporary ✔ Specific ✔ External ✔	Confident Persistent Optimistic
Sam	External ✔		Permanent ✔ Pervasive ✔ Personal X not known	Temporary Specific X External X	Confident
Bethany 2009	External ✔	Pervasive ✔	Personal ✔	Temporary ✔	Persistent
Lenny 2009		Permanent ✔	Pervasive X Personal X		No optimistic characteristics displayed
Lenny end 2010			Permanent ✔ Pervasive ✔ Personal ✔	Temporary ✔ Specific ✔ External ✔	Changed to Optimistic

Key to Figure 1: Students displaying Confidence: Green; Students displaying Persistence: Grey; Students displaying optimism: Yellow region
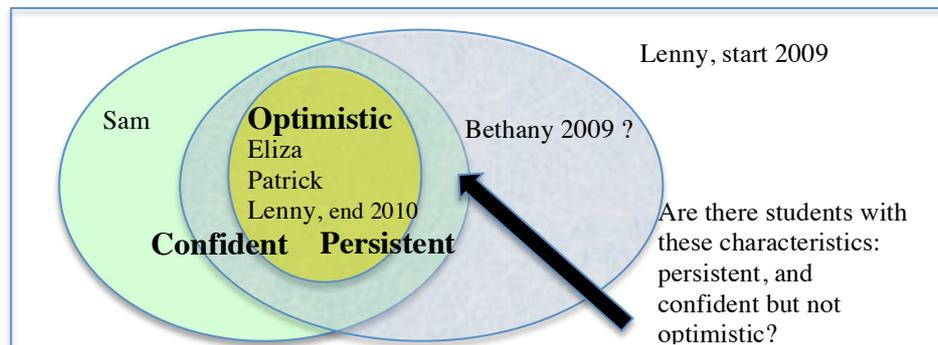

Figure 1. Student characteristics possessed (confidence, persistence, optimism)

Discussion and Conclusions

This preliminary analysis of student activity using this multi-camera video-stimulated interview design illustrates the multiple purposes for which these multiple data sources were employed was sufficient to provide illustrative cases to demonstrate a partial, not complete, overlap between the constructs: confidence, persistence, and optimism. It raised questions about possible combinations of optimistic indicators not illustrated, so pointed to an area for further study. Aspects of the research design that contributed to the quality of the data for the purpose of this study were: a) the configuration of cameras to maximize the visibility of highly relevant group activity; b) developing rapport in interviews to increase the likelihood of eliciting rich data; and c) flexible probing where opportunities arose to generate further indicators of optimism or lack thereof. Without taking such factors into consideration, the data generated may not be sufficiently rich to support such a study.

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