Primary Students' Perceptions of their Mathematics Learning

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A survey was given to 87 primary students in Years 3 and 4 at a school participating in the *Encouraging Persistence Maintaining Challenge* project. Its purpose was to give an overview of students' attitudes and beliefs about learning mathematics, their motivation, and their self-awareness. Findings indicate that most students believe mathematics is important, they feel confident and capable of learning mathematics. Students were also self-aware and identified their motivations to try hard at mathematics as: an interest in mathematics, wanting to please their parents, and feeling capable of being successful. Their learning appeared to be less influenced by peer pressure and classroom culture.

Background

The *Encouraging Persistence Maintaining Challenge* project[1] (EPMC) researched a range of issues including the kinds of teacher practice which might encourage students to persist when working on challenging tasks in mathematics (Sullivan et al., 2011). It was a complex project with many important elements that are not included in this paper, including teacher interviews, student observations, and different survey instruments completed by teachers and students. The particular research question addressed in this paper is: What are primary students' views of their mathematics, their motivation to learn and their willingness to persist?

Motivation to persist with mathematics is a key to students' ongoing success yet students' perceptions of themselves, their learning, and their teachers appear infrequently in the literature. The way an individual perceives their ability to perform will affect their motivation (Caraway, Tucker, Reinke, & Hall, 2003). According to Seligman (2007), optimism may be considered a resilient trait amongst students and when students believe they can do well, they are more likely to persist with a task when it becomes challenging.

It is known that students' beliefs affect their goals and the way they operate in the classroom (Cobb, 1986). Further, Marsh (1984) hypothesised that students' self-concept was affected by how they saw themselves academically and in comparison to their peers. In addition students' perceptions of their ability to perform tasks (self-efficacy) are known to affect their motivation (Bandura, 1982). Bandura (1986) also wrote about the ways in which self-efficacy and goal orientation work in unison to increase motivation. The influence of families, schooling and peers all contribute to a student's performance (Zimmerman & Cleary, 2002).

Goals affect student performance (Locke & Latham, 2002) and persistence. Therefore, goal setting may be an effective self-regulatory device if used consistently in the classroom. Bronson (2000) noted the connections between motivation and self-regulation arguing:

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"Self-directed learning, problem solving, and action can occur only when the ability to control thinking or behaviour is accompanied by the wish to do so." (p. 55). The literature shows strong connections between academic resilience, motivation, self-efficacy and goal setting (Bronson, 2000).

Methodology

A written survey was administered to 87 Year 3 and 4 students in an EPMC school. The students surveyed were 9 years old (36%), 10 years old (62%) and 11 years old (2%) and almost equally male (45) and female (42).

Survey design

The purpose of the survey was to establish students' attitudes and beliefs about learning mathematics. Particular items were framed to identify students' beliefs in regard to mathematics; for example, in Table 1 the statement *"Learning mathematics is important."* Another example is found in Table 2 "*Most of what I learn at school will be useful to me one day".* This statement provides insight into whether students see links between what they learned at school and their future goals. Each of the scale questions was written with a specific purpose linking it to the literature underpinning the research.

The survey asked 28 questions. It was designed to be easy to read and short, taking approximately 10 minutes to complete. Individual students who needed support were read to by a teacher or teacher's aide. Before completing the survey students rehearsed its three different formats by working through the front page with their teacher. The scale format is shown in Figure 1 where the first four of 24 such survey questions are reproduced. The scale from 1 to 7 was explained as being from Disagree Strongly as a "NO!" and Agree Strongly as a "YES!" showing how strongly you feel.

PLEASE CIRCLE ONE NUMBER FOR EACH STATEMENT		Disagree Strongly						Agree Strongly
1.	I like to learn	1	2	3	4	5	6	7
2.	In school, I try my hardest no matter what the other students say	1	2	3	4	5	6	7
3.	I feel very pleased with myself when I understand mathematics	1	2	3	4	5	6	7
4.	Often the main reason I work at mathematics is because I want people to think that I'm smart	1	2	3	4	5	6	7

Figure 1. The first four survey questions showing the response format.

An open response format was used for four questions (e.g., Do you remember a difficult mathematics task? How did you go about tackling it?) The survey was piloted with 14 Year 3/4 non-project students and refined as a result of feedback, discussion, and analysis of the responses. Numerical data were entered into SPSS for analysis and open response data were categorised and summarised for reporting.

Results

Findings of the survey are reported briefly to give an overview of responses. Quantitative data results are given as statements based on the distribution of responses on a 7 point scale but specifically with regard to 6 and 7 on the scale where 7 is "Agree

Strongly". An example of the raw survey data and its summary is given to illustrate the treatment of these data then the complete set of summary findings is shown.

Quantitative data: An example of the process

The quantitative results shown in Table 1 are for the students' views of the importance of mathematics.

Table 1.
Learning Mathematics is Important

Response scale	Frequency	Percentage
1 Strongly Disagree	2	3
2	0	0
3	0	0
4	7	8
5	4	5
6	9	10
7 Strongly Agree	64	74
Total	86	100

Summarised data are reported under headings which tap into similar thinking or associated views. For example, Table 2 shows raw data designed to be paired with the question in Table 1 to indicate students' views of the importance and relevance of mathematics.

Table 2.
Most of What I Learn at School Will be Useful to Me One Day

Response scale	Frequency	Percent
1 Strongly Disagree	0	0
2	0	0
3	0	0
4	6	7
5	7	8
6	12	14
7 Strongly Agree	62	71
Total	87	100

The summary statement for these two questions focussing on categories 6 and 7 as highlighted by boxes in Tables 1 and 2 is: These students think learning mathematics is important (84%) and believe that most of what they learn at school will be useful to them one day (85%).

Quantitative data: Summary statements

Using the process described above was used for each of the questions in the survey. The following statements summarise student responses. Data have been clustered according to the purpose for which the question was designed.

Students and the affective domain:

- Feel pleased with themselves when they learn new mathematics at school (64%).
- Feel very pleased with themselves when they understand mathematics (63%).
- Are confident that they can learn most things in mathematics (67%).
- Enjoy mathematics at school (66%).

Students view themselves as:

- Capable of being successful at mathematics (55%).
- Confident that with effort they can do mathematics well (85%).
- Confident that they can learn most things in mathematics (77%).

Students believe:

- Anyone can be good at mathematics if they put their mind to it (79%).

Students' motivation to try hard:

- Because they want people to think that they're smart (16%).
- To please their parents (56%).
- That the mathematics interests them (40%).
- The personal encouragement of teachers (39%).
- The feeling that I am capable of doing it successfully (55%).
- Depends on what most of the class think or do (13%).
- I put more effort into my schoolwork than most students in my class (28%).

Students views about hard work:

- If they work or study hard they will achieve their goals (94%).
- If they work hard they can do mathematics well (77%).

Students views about their effort:

- Trying hard in mathematics will give them more future job opportunities (75%).
- In school, they try their hardest no matter what the other students say (61%).

Student optimism:

- "If I try hard, I can do most of my mathematics well" (77%).

Student persistence:

- When I'm taught some mathematics that doesn't make sense, I spend time to try to understand it (47%).
- Some students don't try hard because they are afraid of what other students might think of them (38%).
- My friends would say that I keep on trying when the mathematics gets hard (38%).

Open response data

Table 3 shows the summarised data from the open format questions on the survey. Students wrote a total of 182 responses of which 51 (28%) could be considered as negative

words to describe "trying hard in mathematics". It is clear from these responses that the students identified some of the emotions we would associate with struggling in mathematics. They listed words such as "sad", "upset", "frustrated", "confused", "stressed" or "worried".

Table 3
*What Words Would You Use to Describe Yourself When You are **Trying Hard** in Mathematics?*

Negative	Worried/concerned/nervous/scared/stressed/sad/upset/angry	22	(12%)
	Tired/lazy/bored	12	(7%)
	Confused /frustrated/ slow/ feel I can't work it out/need help	17	(9%)
Positive	Good/great/happy/excited/confident/hopeful	50	(27%)
	Working well/ using my brain/ understanding	29	(16%)
	Smart/ outstanding/awesome/proud	25	(14%)
	Concentrating/writing/listening	15	(8%)
	Persistent/determined/focused	12	(7%)
Total responses		182	

The other 131 (72%) responses were positive. Students mostly mentioned how good they felt when they were trying hard, working well and using their brains to understand mathematics. They recognised that they were concentrating and were persistent, determined and focused. They also said that trying hard made them feel confident and proud. Some students recognised there were extremes of emotion involved with trying and they felt "tired" thereby acknowledging the effort required to complete challenging mathematical tasks.

As Table 4 shows, some of the responses were evocative of the joy children find in "learning mathematics well". For example, "mouth-watering", "like I want to do more mathematics" and "I love to learn what I don't know". Most of the responses could be categorised as dealing with the sense of satisfaction gained from learning mathematics well. Students said they felt "happy", "great" and "excited" (32%). They were aware that they needed to try to learn mathematics well and to be focused and persistent (18%) and their responses showed they were conscious of their improved understanding as a result (22%). They reported feeling "successful", "confident" and "proud" of themselves (18%).

Table 4
*What Words Would You Use to Describe Yourself When You are **Learning Mathematics Well**?*

Happy/good/great/excited/enjoying it/okay	51	(32%)
Improving/learning/understanding/ Smart/becoming smarter	34	(22%)
Trying to do my best/focused/hard working/persistent/concentrating	29	(18%)
Successful/outstanding/"I can do it"/doing well/confident/proud	29	(18%)
Willing to learn/listening/want to do more/not nervous/calm	10	(6%)
Confused/ Worried/ "nerd"	4	(2%)
Total responses	157	

Table 5 shows the interesting responses to a question about tackling a difficult mathematics task. Three of the categories of response, try harder, persist through initial difficulties, and figure it out by thinking it through comprise 50% of the total responses.

Table 5
Do You Remember a Difficult Mathematics Task? How Did You Go About Tackling it?

Use a skill or strategy	27	(24%)
Apply myself/try harder	25	(22%)
Awareness of some initial difficulties/persist/spend time	19	(16%)
Figure it out/thinking it through	14	(12%)
Ask for help/get information	12	(11%)
Positive attitude	8	(7%)
Move on to the next thing/give up	7	(6%)
No idea/use a distraction	2	(2%)
Total responses	114	

Responses also indicate that students are able to use skills or strategies they have already learned to help them to tackle difficult tasks (24%) and they know to access help as well (11%).

Discussion

The results indicate that about two-thirds of the students feel confident that they can learn and are pleased when they do learn new mathematics; they like understanding mathematics and enjoy mathematics at school. These beliefs relate to the work of Ames (1992) who described a positive orientation to learning when students connect effort to success. When students feel positively disposed to learning they are more likely to persist and they could be considered more academically resilient (Mornane, 2009).

The students surveyed view themselves as capable and confident, and they have positive views of their self-efficacy. The findings show that students' motivations to try hard are related to their feelings of self-confidence and self-efficacy and their interest in mathematics. Many students are self-aware and have the ability to self-regulate their responses and processes in response to challenging mathematics.

The desire to make their parents proud of them is a strong motivational force for the surveyed students (56%). Similarly the pilot group reported that their parents wanted them to work hard in mathematics. However, pilot students did not seem to feel pressure to work hard to make their parents proud of them. They remarked that their "parents are proud of them anyway." This speaks to shared values between parent and child of working hard to succeed but also to students working hard due to the intrinsic motivation they have for learning mathematics.

Interestingly, the survey students are not motivated by the wish to be seen as smart or by what others in their class think of them. What became very clear in the discussion and feedback session with the pilot group was their feeling that friendship had nothing to do with doing mathematics at school. These pilot students said that they did not know what their friends thought about mathematics or care about how good they were at doing mathematics in school. This is in contrast to the findings in the literature from studies of

secondary students who were found to be more influenced by classroom culture and the views of their peers (Sullivan, Tobias, & McDonough, 2006). In secondary school students connect peer pressure and performance in mathematics. It is a potential point of difference between primary and secondary students and the motivation to persist with mathematics tasks.

Survey students are optimistic (Seligman, 2007; Seligman, Reivich, Jaycox, & Gillham, 1995) believing that if they try hard they can do mathematics well (77%). They also see the connection between effort and achievement, reporting that if they work hard they can succeed. This view is seen as adaptive, persistent, and "mastery oriented" – as opposed to "helpless" (Dweck, 2000). Interestingly the proportion of responses by the students surveyed to "Some students don't try hard because they are afraid of what other students might think of them" (38%) is approximately the proportion of grade school students that Dweck described as having a view of intelligence as fixed, and being afraid of being judged by others as lacking in ability. This observation needs further study.

The questions shown in Table 3, "*What words would you use to describe yourself when you are **trying hard** in mathematics?"* and Table 4, "*What words would you use to describe yourself when you are **learning mathematics well**?"* were designed to draw responses from students that would indicate their self-understanding, awareness and ability to self-regulate. What can be seen from these data is that students of 9-11 years of age understand the negative feelings evoked by struggling with challenging mathematics and the joy they find in learning mathematics. These responses show real self-awareness.

The question shown in Table 5, *"Do you remember a difficult mathematics task? How did you go about tackling it?"* addressed the students' experience of participating in challenging mathematical tasks and the processes they experienced along the way. What can be seen from these data is that students are very aware of themselves and the difficulties they face when they meet mathematical challenges. They describe using their knowledge and skills, trying harder, persisting through initial difficulties and figuring it out by thinking it through (50%). These students show an awareness that mathematics problems can be difficult initially and that time is needed to solve them. These responses indicate an ability to self-regulate their behaviours by expecting to feel confused, take time, and persist if a solution is to be found to the problem. It is worth noting, however, that a small proportion of students (8%) recognised that they disengage with the mathematics when they find it difficult.

Conclusion

Motivation to persist with mathematics is a key to students' ongoing success and we have provided some evidence of students' perceptions of themselves and their learning. While the results reported here are of a relatively small number of students surveyed in a single school, they provide some insights into the motivation of 9–11 year olds for learning mathematics. We have shown that:

- Parents are important but they are not the only reason students work well at school.
- Students are more inclined to work well because they are interested in mathematics rather than because of the encouragement of teachers.
- Students do not depend on what most of the class think or do as they are largely unaffected by what others say about them.

Many students show confidence and view themselves as competent learners of mathematics which, in turn, creates persistence with challenging mathematics. This is an important finding because "persistent students remain truly challenge-seeking" (Dweck, 2000, p. 218).

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