I can't do maths, yet! The impact of process praise on maths mindset and effort

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Introduction

Carol Dweck's 'theories of intelligence' proposes that different core beliefs about intelligence can set up different patterns of response to challenge and setbacks.

Fixed mindset ⟷ Growth mindset

Previous research has shown that even when pupils on both ends of the continuum show equal intellectual ability, their theories of intelligence shape their response to academic challenge (Aronson, Fried and Good, 2002).

Furthermore, a person's theory of intelligence appears to be unrelated to the value they place on a particular skill set e.g. mathematics. Rattan et al (2012) analysed undergraduates' sense of belonging, enjoyment and usefulness of maths and revealed maths was equally valued by participants with different theories of maths intelligence.

Impact of praise

According to Haimovitz and Corpus (2011) teachers who use praise which focuses on traits and abilities reinforce intelligence as fixed and unchanging (entity theory). This in turn leads to decreased motivation, engagement and effort. The effects of praise on pupils' effort and attainment is therefore greater in subjects where pupils regularly experience difficulties and failures such as maths.

Research questions

RQ1 - Do pupils in Year 4, 5, and 6 who are exposed to daily process praise show a higher growth mindset in maths when compared with a waitlist control?

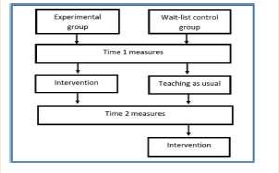
RQ2 - Do pupils in Year 4, 5, and 6 who are exposed to daily process praise achieve a higher effort grade in maths when compared with a waitlist control?

RQ3 - For pupils in Year 4, 5 and 6 is there a positive relationship between theories of intelligence, as measured by maths mindset scale, and the value placed on maths, as measured by belonging and usefulness scales?

Methods

Design

Figure 3.3: Experimental design



Participants

522 pupils from year 4, 5, 6 across three primary schools in the Local Authority. 280 pupils in the experimental Group and 242 in the control group. There were no significant differences between the groups except for EAL.

Random allocation was at school level.

Pre and post measures

Maths mindset

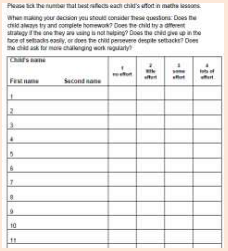
Table 3.3: The individual survey statements mapped onto constructs

Survey no.	Maths survey statements	Scoring	Construct
2	I have a certain amount of maths intelligence and I can't really do much to change it	Total scored = mean mindset score The higher the score the more growth mindset the response	Maths mindset scale
5	Maths intelligence is something you can't change very much		
11	You can learn new things but you can't really change your basic maths intelligence		
13	You can't really change how intelligent you are in maths		

Table 3.4: Scoring the vignette questions

Survey no	Survey question	Pie-chart	Percentage	Score
21	How much of Mimi's test score is because of a lack of hard work?	Not coloured in	0%	1
		¼ coloured in	25%	2
		½	50%	3
		¾	75%	4
		Completely coloured in	100%	5
22	How much do you believe Mimi got 65% on the test because she is not clever enough in maths?	I believe very much		1
		I believe quite a lot		2
		I sort of believe		3
		I sort of don't believe		4
		I don't believe quite a lot		5
		I don't believe very much		6

Effort



Please tick the number that best reflects each child's effort in maths lessons.

When making your decision you should consider these questions: Does the child always try and complete homework? Does the child try a different strategy if the one they are using is not helping? Does the child give up in the face of setbacks easily; or does the child persevere despite setbacks? Does the child ask for more challenging work regularly?

Child's name		1 no effort	2 little effort	3 some effort	4 lots of effort
First name	Second name				
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					

Value of maths

Procedure and fidelity

Table 3.2: Stages of the intervention

Phase	Description
Planning	The teacher decides at the start of the day which part of the maths lesson they will count process praise statements.
Equipment	The teacher has a golf counter given to them, which is set to 000.
Active	For 15 minutes the teacher presses the golf counter every time they give a process praise statements.
Recording	At the end of the school day, the teacher follows the link sent by email to a Google form, where they input their email and daily praise count (from the golf counter).
Self-Monitoring	The teacher receives a bar graph showing their daily praise counts against their personal goal.
Peer observation	Once during the 4 week intervention the teacher completes their praise count while being observed by a peer and they compare the praise counts and discuss good examples. The teachers then swap roles.

The fidelity check involved the researcher agreeing with the teacher to come into the maths lesson and complete the process praise count at the same time as the teacher. Further fidelity checks involved the researcher receiving daily praise count data through the Google form for each participating teacher.

Results

For research questions 1 an 2 a mixed analysis of variance (ANOVA) was conducted to assess the impact of the process praise intervention on Mindset and Effort. The between subjects variable was group (experimental and control) and the within subject variable was time (pre and post intervention).

For research question 3 the relationship between mindset and value of maths was investigated using Pearson product-moment correlation coefficient.

RQ1 Mindset

There was no significant interaction between group and time on the mindset scale total score, Wilks' Lambda = 1.0, F (1, 452) = .02, p = .89, partial eta squared = .00.

There was a significant interaction between group and time for the piechart, Wilks' Lambda = .99, F (1, 451) = 4.1, p < .05, partial eta squared = .01 (small effect).

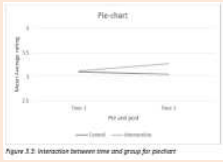
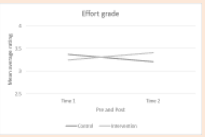


Figure 3.2: Interaction between time and group for piechart

RQ2 Effort

There was a significant interaction between group and time, Wilks' Lambda = .94, F (1, 510), p< .001, partial eta squared = .06 (medium effect).



RQ3 Value of maths

Only 2% of the variance in both the belonging scores and usefulness scores can be explained by the maths Mindset score.

Table 3.11: Pearson product-moment correlations between measures of maths mindset and belonging to maths and usefulness of maths

Scale	1	2	3
1 Total Mindset	-		
2 Total Belonging	.14*	-	.5*
3 Total Usefulness	.20*	.5*	-

* $p < .01$ (2-tailed)

Discussion

- Pupils who where exposed to the process praise intervention saw (on average) an increase in effort over time, whereas pupils in the control group saw a small decrease in effort over the same time period.
- Pupils in the experimental group were (on average) also more likely to attribute a higher percentage of a fictitious pupil's score to hard work following the intervention than the control group.
- The difference in means for the mindset statements between the experimental and control group were not significant, suggesting the intervention did not impact on the maths mindset of pupils.
- Younger pupils' implicit theories of maths intelligence are not related to their beliefs about the value of maths (as measured by usefulness and belonging), consistent with previous research findings on older pupils.

Take home message

- Using process praise statements in maths can lead to pupils making more effort in maths.
- Reinforcing the value of numerical literacy is unlikely to improve pupils effort in maths.
- Increasing the use of process praise by teachers is not necessarily enough to alter the maths mindsets of pupils, suggesting further changes to the structure and organisation of learning are required e.g. directly teaching children about neuroplasticity.

References: Aronson, J., Fried, C. B., & Good, C. (2002). Reducing the effects of stereotype threat on African American college students by shaping theories of intelligence. Journal of Experimental Social Psychology, 38, 113–125. *Haimovitz, K., & Henderlong Corpus, J. (2011). Effects of person versus process praise on student motivation: stability and change in emerging adulthood. Educational Psychology, 31(June 2015), 595–609.* Rattan, A., Good, C., & Dweck, C. S. (2012). "It's ok — Not everyone can be good at math": Instructors with an entity theory comfort (and demotivate) students. *Journal of Experimental Social Psychology, 48*(3), 731-737.