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“What Makes You More Confident in Mathematics?”: Responses From Early Adolescents

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Introduction

- Self-efficacy, or the belief in one's ability to complete a given task, is influenced by individuals' experiences related to that domain. Bandura (1997) categorized these experiences into four sources: mastery experiences, vicarious experiences, social persuasions, and physiological states.
- The sources of self-efficacy have primarily been investigated with quantitative measures (see Usher & Pajares, 2008).
- Qualitative studies of the sources of mathematics self-efficacy have included interviews and thought-listing procedures, and have featured middle, high school, and college samples (e.g., Lent, Brown, Gover & Nijjer, 1996; Usher, 2009).
- Quantitative and qualitative methodologies reveal that mastery experiences have a powerful influence on mathematics self-efficacy. Qualitative techniques suggest that students rely on other sources as well.
- Sampling procedures, methodological shortcomings, or differences in self-efficacy criterion are all possible contributors to these different findings.
- Developmental changes and cultural differences in samples have also been shown to influence reported sources of self-efficacy (Usher & Pajares, 2008).

Purpose of the Study

We sought to examine how reported sources of self-efficacy differ across age groups and methods of inquiry. The two major aims were:

- Study 1:** To use a qualitative approach with a large sample of upper elementary and middle school students to determine what they report to be the most powerful source of their mathematics self-efficacy, and
- Study 2:** To examine whether response format (i.e., imposed categories or open-ended responses) yielded different results regarding the sources of self-efficacy.

Study 1

Method

Participants and Data Sources

Participants were 785 students enrolled in one middle school (Grades 6-8) in the southeastern United States during Spring 2006 (see Table 1). Participants were asked to “Write down something that has happened to make you feel MORE confident about yourself in math.”

Analyses

Twenty-one start codes were assigned using the NVivo software program. Fourteen final codes were used. A subset of students' responses was given to an external coder for a reliability check (Miles & Huberman, 1994). Students' gender, ethnicity, and mathematics ability level were also coded.

Results

- Three quarters of students reported mastery experiences as the factor responsible for raising and lowering their confidence in math.
- Students interpreted similar experiences differently, such that what one student listed as an efficacy-enhancing event, another listed as an efficacy-deflating one.

Table 1. Percentages Reflecting Students' Categorized Responses to Open-Ended Question in Study 1

Code Assigned	Full Sample (n = 785)	Boys (n = 388)	Girls (n = 397)	White (n = 531)	African American (n = 150)	Other Ethnicity (n = 104)	Above Level (n = 247)	On Level (n = 466)	Below Level (n = 72)
Mastery Experience	72	73	72	74	73	64	75	72	68
Vicarious Experience - Social Comparison	6	7	6	8	2	7	9	6	3
Vicarious Experience From Peers	1	1	1	1	2	1	2	1	0
Vicarious Experience From Adults	1	1	2	2	1	1	0	2	1
Cognitive Self-Modeling	1	1	1	0	1	1	0	1	1
Social Persuasions	4	5	4	5	3	5	5	4	7
Physiological State	0	0	0	0	0	0	0	0	0
Self-Regulated Learning	3	2	3	2	6	4	0	3	7
Help Availability	3	3	3	3	3	7	3	4	4
Teacher and Teaching Style	2	3	2	2	2	4	2	2	4
Course Placement	2	1	3	2	3	0	4	1	1
Future Outlook	0	1	0	1	0	0	0	1	0
Learning Structures and Environment	1	1	1	1	1	1	0	1	0
Public Embarrassment	0	0	0	0	0	0	0	0	0
Nothing	2	2	3	1	4	6	1	3	3

Note. Top three most frequently listed categories in each column appear in bold grayscale. A total of 1562 response segments were coded; 22 responses were left uncoded due to lack of clarity.

- Math performance was often intertwined with social comparative information, the second most frequent source listed.
- About 4% of students listed social persuasions as the source that most raised their self-efficacy.
- Few students mentioned physiological factors as responsible for altering their confidence in math.
- Some students listed factors other than those hypothesized such as their self-regulatory skills, perceived teacher support, or availability of help.

Study 2

Method

Participants and Data Sources

Participants were 328 students from two elementary schools (Grades 4-5) and one middle school (Grade 6) in the southeastern U.S.

Students completed two questionnaires in February and May of 2011. The first asked students to respond to the question, “What makes you feel most confident in math?” by selecting from five options that corresponded to the hypothesized sources of self-efficacy (see Table 2). An “Other” option invited a write-in response. On the second questionnaire, students were given the same open-ended prompt used in Study 1.

Analyses

Responses at both time points were coded according to the five response categories used on the first questionnaire (see Table 2). Microsoft Excel was used by two researchers to code open-ended responses. Multiple codes were assigned when warranted.

Results

- Mastery experience accounted for about half of the responses at each time point, followed by social persuasions and relative ability comparisons.
- One quarter of responses at Time 2 were coded as “other,” as they reflected additional sources, including teacher qualities, help availability, and self-regulated learning.

Results

Table 2. Categorized Responses to Forced-Choice and Open-Ended Questions Used in Study 2

	Time 1 N = 328 (choices provided with write-in option)	Time 2 N = 289 (open-ended prompt)
Mastery Experience “When I do well on math work.”	56% (n = 184)	49% (n = 152)
Vicarious Experience - Social Comparison “When I do better than other people.”	14% (n = 46)	6.5% (n = 20)
Vicarious Experience “When I see others do well.”	3% (n = 10)	1% (n = 4)
Social Persuasion “When other people tell me I'm good in math.”	17% (n = 56)	15% (n = 47)
Physiological Response “When I'm not worried about math.”	7% (n = 23)	2% (n = 7)
Other	3% (n = 9)	25% (n = 78)

Note. Responses that could not be coded into the five categories listed above were assigned a code of “Other.” Percentages were calculated out of total responses coded. Differences in number of participants from Time 1 to Time 2 is due to students who were present at Time 1 who were not present for the survey administration at Time 2.

- A comparison of intra-individual responses between time points indicated that 63% of students reported a different source of self-efficacy when provided with a list of sources versus given an open-ended prompt; 34% reported the same source across methods.

Key Findings

- Mastery experiences were the most commonly reported source regardless of students' age or the response format used. Students in both samples noted that social comparative information and social persuasions made them more confident in mathematics. Fewer mentioned physiological arousal or social modeling.
- Younger students were more likely than were older students to report social persuasions as a salient source of self-efficacy.
- Open-ended prompts seem best suited for determining the diverse influences on self-efficacy.

Discussion and Implications

- Quantitative measures might be altered to reflect additional categories emerging from this qualitative analysis. For example, researchers might consider including a measure of relative ability comparison to investigate how it compares to mastery experience as a predictor of self-efficacy.
- We did not consider Study 2 a longitudinal study. However, the considerable change in the categorized responses across waves in Study 2 could indicate instability in the salience of any given source of self-efficacy. This question merits further investigation.
- Researchers should acknowledge the role that different methodologies can play in determining study outcomes. Results from both studies suggest that sources of self-efficacy beyond those hypothesized may also be prominent and warrant attention.

References

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