

Breaking Misconceptions with Model-Eliciting Activities: Fostering interest, motivation, and positive attitude in the high-School Level

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INTRODUCTION

Model-Eliciting Activities (MEAs) are a kind of **math classroom activity** that is **open-ended, yet structured enough** that students' explorations are often **rich learning opportunities** (Zawojewski et al., 2003). In MEAs students working in **small teams** are encouraged to develop and **generate** useful **solutions** to **real-world** problems by **repeatedly** communicating, testing, refining, and extending their thoughts. In addition, **students' interactions** are mediated by **tools** (e.g., math representations), **activity structure** (e.g., grouping of students), **community norms and values**. In this context we examined if the implementation of MEAs could potentially shift student's perception, motivation, and interest toward mathematics in the high school level. To this end we administered a pre/post instrument to measure the above.

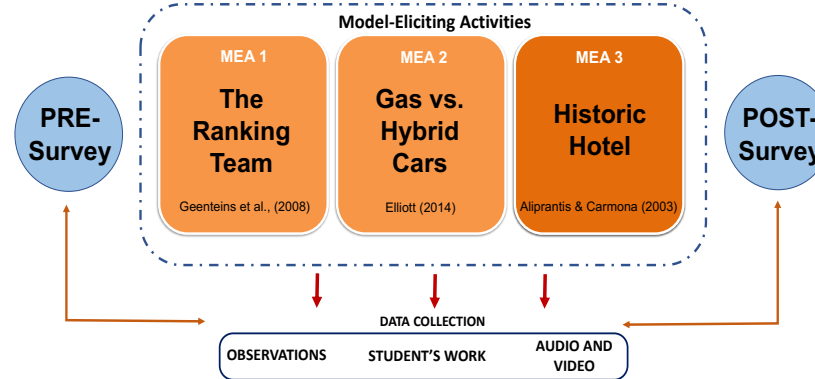
THEORETICAL PERSPECTIVES

Models are conceptual tools used to mathematize a real situation. **Modeling** is the *process* in which conceptual tools are *adapted or constructed* to provide a solution to a problem. The MM perspective supports and advocates **unstructured, collaborative learning**, since learning occurs in the **social context** of **students interaction** (Vygotsky, 1962), in which Team-members mutually negotiate goals, define problems, develop strategies, and produce socially constructed knowledge in small groups, and where face-to-face work on open-ended tasks—projects with several possible paths leading to multiple acceptable solutions—"facilitate cognitive growth" (Springer et al., 1999, p. 25).

When students collaborate in **small teams** in MEAs, they Construct their own and their community knowledge, Merge their knowledge to strengthen and broaden their skills, and **Escalates their Motivation and Engagement** toward an interest in problem-solving in mathematics. (Zawojewski, Lesh, & English, 2003)

METHODOLOGY

Participants were 75 high school students (65% male, 25% female) exposed to 3 MEAs. Students formed teams of 3 members, and in total there were 24 that agreed to participate in the study. Students were asked to answer a Pre/Post survey (a 5 liker-scale) to capture their motivations, attitude, and interest toward math before and after the MEA intervention. The instrument used was adapted from several prominent researchers (Chamberlin, 2002; Lesh et al, 2002, Showalter, 2008). It is composed of 51 items divided among four constructs (i.e., interest, self-perception, usefulness, and math interconnectivity). A descriptive and a T-Test analysis was conducted to analyze the survey-collected data.



FINDINGS

From all 51 question, 32 resulted to be statistically significant, in which the null hypothesis was rejected, meaning that there was a different from the pre to the post-survey implementation. Below, we are presenting an excerpt of the most important questions.

Measurement	N	Pre		Post		Paired			
		M	SD	M	SD	df	t	t-test	
Interest in mathematics	I enjoy math problems	75	2.91	0.841	3.33	1.143	74	2.61	0.011
	I like word problems.	75	2.75	0.824	3.6	0.93	74	5.589	0.000
	Math is fun.	75	2.73	0.741	3.52	0.95	74	5.677	0.000
	Math is boring	75	2.64	0.782	1.89	0.746	74	6.212	0.000
Self-perception on mathematics ability	I am good at math.	75	2.67	0.977	3.21	1.131	74	2.981	0.004
	Math makes sense to me.	75	2.95	1.102	3.48	1.083	74	2.956	0.004
	Math is confusing to me	75	3.35	0.993	2.6	0.959	74	4.732	0.000
	I feel confident when I am working on a mathematical Task	75	2.93	0.811	3.49	0.95	74	3.866	0.000
Perception on the usefulness of Mathematics	Math class seems useless.	75	2.05	0.82	1.59	0.639	74	3.971	0.000
	Math is very important for life success.	75	3.65	1.033	4.11	0.798	74	2.89	0.005
	Math is very important for success in college.	75	3.56	0.744	3.99	1.222	74	2.435	0.017
	Math is very important for success in school.	75	3.49	0.777	4.07	1.234	74	3.292	0.002
Perception of the interconnectivity of Mathematics	I often use other content areas to help solve math problems.	75	2.71	0.818	3.23	0.994	74	3.313	0.001
	often use my own background knowledge to solve math problems.	75	3.31	1.039	4.03	0.972	74	4.307	0.000
	Math is useful in all areas of education.	75	3.71	0.997	4.2	0.854	74	3.098	0.003
	Math is essential to every career.	75	3.68	1.105	4.27	0.92	74	3.801	0.000

CONCLUSIONS

- It is not uncommon for students to struggle when solving traditional textbook mathematical problems. However, with the right approach, motivation, and engagement, students can solve problem activities beyond their teachers or anybody else's expectations.
- Three MEAs were implemented with the intention of enhancing and motivating students to yield their negative attitudes and perceptions toward mathematics.
- We found evidence that indeed, MEAs have the potential to empower students, regardless of their achievement level, to engage in problem-solving and perceive mathematics as a subject they can actually understand, and at some point, enjoy.
- Unfortunately, more research and a longitudinal study is needed to generalize the benefits of implementing MEAs at the high school level.