The Influence of Research Experience on Teachers' Beliefs and Instruction: Piloting a Survey

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PURPOSE

Discovery learning: teachers create situations so that the students can explore and learn themselves (Kistian, Armanto, & Sudrajat, 2017).

- Widely used in advanced schools (Kistian et al.,2017).
- many benefits (Herdiana, Wahyudin, & Sispiyati, 2017).
- teachers should have the ability to effectively guide students in the discovery learning (Kalathaki, 2015).
  - Professional Development (PD)

- Mathematics PD influence teachers' beliefs (Polly, Neale, & Pugalee, 2013), which affect their instruction (Hart, 2002; Stipek, Givvin, Salmon, & Macgyvers, 2001).

Purpose: Explore the influence of the RE program on teachers' beliefs and future mathematics instruction.

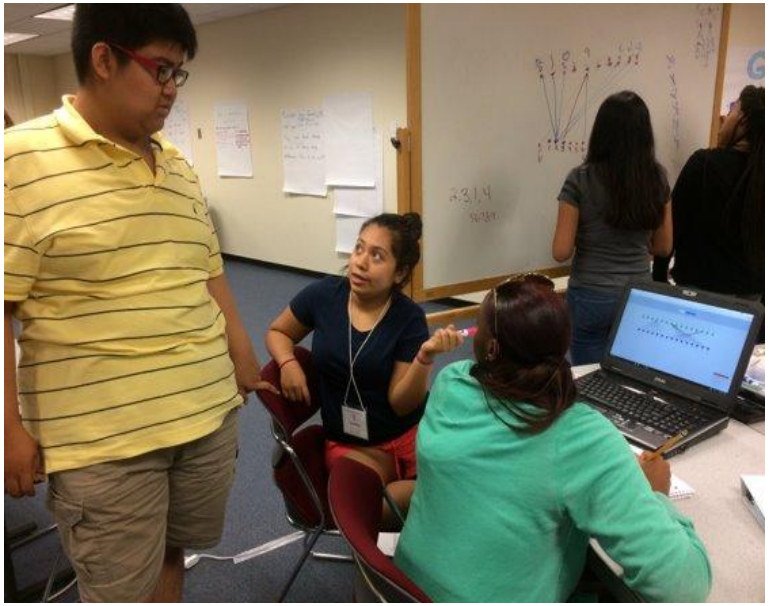
REU PROGRAM

- 120 preservice and in-service mathematics teacher participated in the RE program. For each cohort, there were 12 teachers including four in-service and eight preservice teachers.
- **The first few days :** immersion problems, a review of the fundamental ideas of discrete mathematics, and an introduction to proof techniques. Then they get-together in groups and start exploring research questions.
- **Typical week:** Over the next several weeks, participants work in teams to generate examples, explore questions, and generate new questions and periodically present their research and progress.
    - Clear precise report of their project describing their investigations
    - Presentation of the results in national conferences.
- **Math education sections:** Tuesdays and Thursdays
    - Translate research experience to school classrooms.
- **Math camp**
    - Students from public schools.

MATH CAMP

RE

MATH CAMP



RE

RESEARCH QUESTIONS

In this study we seek to answer three research questions:

1) **How did participating in the RE program affect teachers' beliefs?**

   How did participating in RE program affect teachers' beliefs about the nature of mathematics?

   How did participating in the RE program affect teachers' beliefs about teaching mathematics?

   How did participating in the RE program affect teachers' expectation of students in mathematics class?

2) **How participating in RE program affect teachers' instruction and teaching methods?**

   How many times do they typically use mathematical explorations in their classroom?

3) **If you participated in a math camp, how beneficial was this experience?**

   What did you learn from the math camp experience?

How did participating in the RE program affect teachers' confidence?

METHODS

Participants

14 volunteer in-service and pre-service mathematics teachers responded the survey: 2006-2018.

- 3 Current student
- 11 Current mathematics teacher
  - Teaching experience: [0-2] 4 teachers, [3-6] 4 teachers, more than 6 years 2 teachers (do we need to include this information? We have not used them).

METHODS

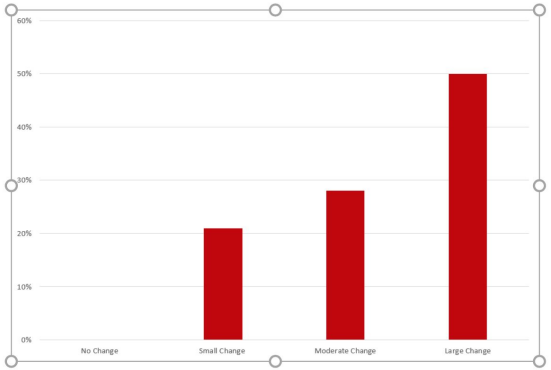
An online survey was used to ask participants to reflect on how their participation in the RE program had influenced their beliefs and classroom instruction.

The online survey consisted of **16 items**, which included demographic information, questions about participants' beliefs, teaching methods, math camp, and teachers' confidence.

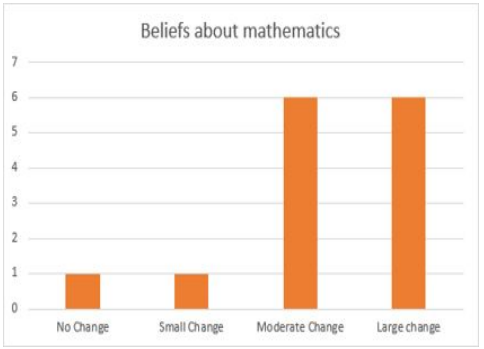
Open coding, categorization, comparing an discussion

PILOT RESULTS: CHANGE IN TEACHERS' BELIEFS

Q9	%
No Change	7%
Small Change	7%
Moderate Change	28%
Large change	50%



Q9	%
No Change	7%
Small Change	7%
Moderate Change	42%
Large change	42%



Q5-To what extent did the RE change your beliefs about teaching?

Q9- To what extent did the RE change your beliefs about doing mathematics?

- 78% of the participants believed that RE had moderate or large changed in their beliefs about teaching mathematics .
- 84% of the participants believed that RE had moderate or large change in their beliefs about doing mathematics and

We did not have any open-ended question about teachers' beliefs about teaching mathematics, we find some quotes from their answers to other questions that we could code them in the belief's category. For the future study we need to add some open-end questions about the beliefs.

Beliefs

PILOT RESULTS: CHANGE IN TEACHERS' BELIEFS

Q8-How if any, RE program changed your expectation from students?

Statements	Themes
give students more of a chance to explore and play with the math	exploration
see that all students can recognize patterns all students have the ability to perform at a high level all students can learn math, all students are capable of high-level mathematics. all learned that they were able to do higher order mathematics that everyone can learn math math is accessible to all students then any high school student should be able to do any high school math. my expectations of how much students can do. have higher standards	all students can learn math

Question eight was very narrow and it contains responses about both beliefs and teaching methods; some quotes about students' ability could be categories as teachers' beliefs and quotes about their us e of exploration could represent their teaching methods.

Beliefs

PILOT RESULTS: CHANGE IN TEACHING METHODS

Q6-How has the RE experience contributed to your teaching methods? What aspects of the RE influenced these changes?

Statements (Part One)	**Themes**
Not all questions will have a solution Highlight the need for alternate strategies I use more open-ended questions I now try to get as much Problem Solving Showed me the power of exploring and discovering mathematics! Giving my students chances to play with the math, experiment with it, and discover Chances for more creativity in their problem solving Math camp and emphasis on exploration and justification motivated me to be more active in looking for those spots	Exploration Discovery learning Problem solving
Shifted my views on the teachers' role in the classroom, to let students take the lead.	Teachers' role
Made me explain mathematics differently to my students	Explain mathematics differently
Made me higher my expectations of what my students are capable of. be more rigorous in my expectations	Higher my expectations

Topics that needs further exploration:
We need to add some questions about the effect of RE program on the following topics to further clarify what they mean by the role of teacher and explaining mathematics differently.
Teachers' role and students' role in the classroom (quote form question six).
How they explain mathematics differently to the students (quote form question six).

Instruction

PILOT RESULTS: CHANGE IN TEACHING METHODS

Q7 - How many times per week do you typically use mathematical explorations in your classroom? Please describe how the RE has influenced your utilization of mathematical explorations.

- ➢ 77 % of the participants who answered this question mentioned that they use exploration at least 1-2 times

Statements	Number of participants
1-2/week	7
3 or more	2
N/A	4

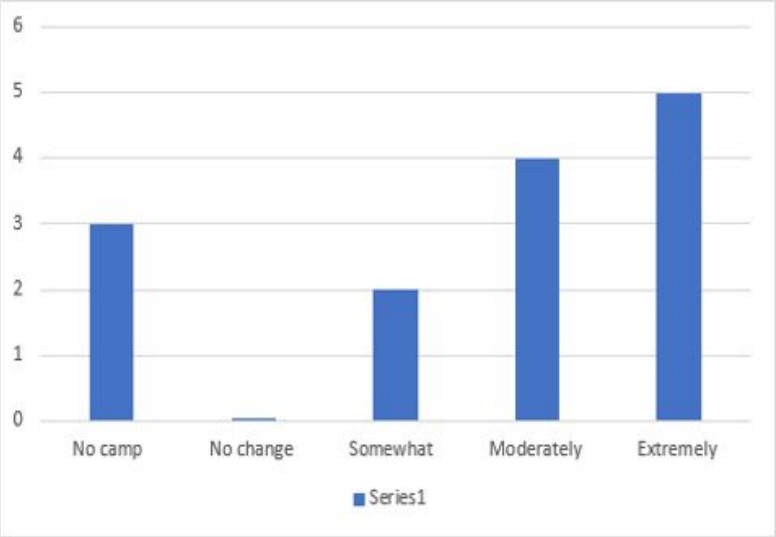
Statements	Themes
It is a great way to introduce new topics and increase student engagement	student engagement
I realize that a lack of a solution to the explorations is sometimes a good thing.	explorations
RE allowed me to see and experience how taking ownership for discoveries can enhance and deepen student understanding	discoveries
exploration can make math more accessible for all students.	all students can learn
Problems: time constraints, not all material can be taught and understood with teaching through exploration.	

We need to ask this question from a group of random teachers to know how many times other teachers use exploration in their classrooms

Instruction

PILOT RESULTS: MATH CAMP

Q13- If you participated in math camp, how beneficial was this experience to your growth as a teacher?



PRIMARY RESULTS: MATH CAMP

Q14- If you participated in a Math Camp, what did you learn from the experience? What benefited you the most?

Statements	Themes
what student are capable of. I learned that research is not only for college students changed my perspective on what a group of high schoolers might be interested in and capable of we do not hold students back with our own expectations	All students can learn mathematics
High school students should be asking questions and exploring keep providing my students with opportunities to discover and explore.	Exploration
classroom management skills during math camp!	Classroom management

PRIMARY RESULTS: TEACHERS' CONFIDENCE

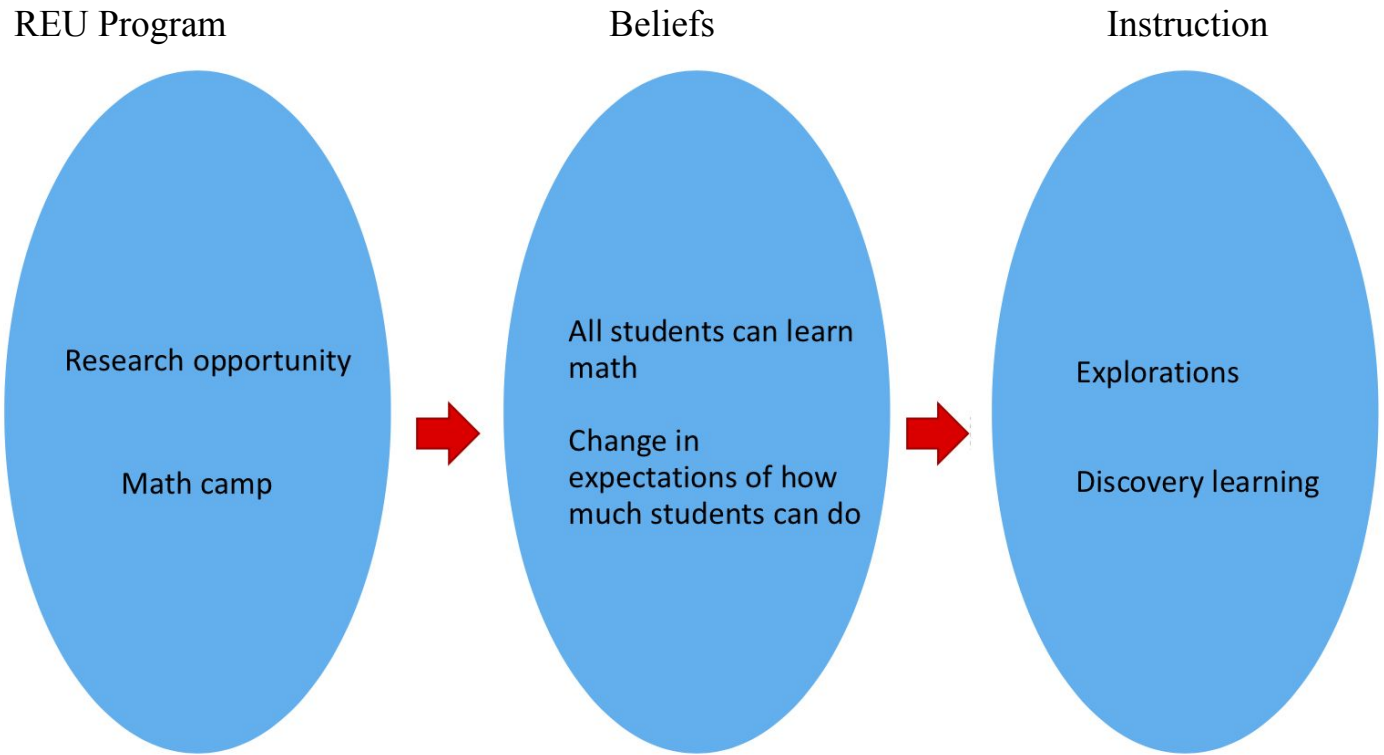
Q11- To what extent has the REU influenced your confidence to do mathematics?

Q11	Number of participants
No change	1
Somewhat increased	3
Greatly increased	10

Q12- To what extent has the REU influenced your confidence to teach?

Q12	Number of participants
No change	2
Somewhat increased	8
Greatly increased	4

RESULTS:


REU Program
Beliefs
Instruction
Research opportunity
Math camp
All students can learn math
Change in expectations of how much students can do
Explorations
Discovery learning

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Thanks

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