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RICE UNIVERSITY SCHOOL MATHEMATICS PROJECT (RUSMP)

A Qualitative Study Examining the Barriers to Implementation of Constructivist Teaching Approaches among Mathematics Teachers in a High-Poverty Urban School District

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Outline

- Introduction
- Background
- Research Questions
- Method
- Results
- Conclusions

Purpose

- Purpose of this study:
  - Investigate conceptual, pedagogical, cultural, and political barriers that K-12 mathematics teachers in a high-poverty urban district encounter when trying to implement constructivist practices they learned through a rigorous professional development (PD) program
  - Identify facilitators that assist teachers to sustain constructivist practices

Constructivist Teaching

- Components of constructivist teaching (Cobb, 1994):
  - Active learning activities
  - Student interactions
  - Students' connecting new ideas with existing knowledge
- Correlates of constructivist teaching:
  - Greater student achievement in mathematics (Kim, 2005)
  - Enhanced algebraic procedural and conceptual understanding (Ross & Wilson, 2012)
  - More sophisticated epistemological conceptions of mathematics (Star & Hoffman, 2005)

Barriers

- Barriers to constructivist teaching in high-poverty, urban schools are due to (Crocco & Costigan, 2007):
  - scripted lessons
  - mandatory curriculum
  - accountability

Theoretical Framework

- Windschitl (2002) – "Constructivist in practice" model
- Four dimensions:
  - Conceptual dilemmas: Teachers' understanding of the underpinnings of constructivism
  - Pedagogical dilemmas: Teachers' ability to design curriculum and facilitate classroom activities that align with constructivist teaching
  - Cultural dilemmas: The necessary roles of teachers' and students' to create a constructivist classroom environment
  - Political dilemmas: School community stakeholders' resistance to constructivist teaching

Research Questions

- What types of barriers do teachers working in high-poverty schools encounter when transferring constructivist practices learned through PD into their classrooms?
- What types of facilitators assist teachers working in high-poverty schools to implement constructivist teaching learned through PD?

Participants

- A pool of 80 K-12 in-service mathematics teachers participated in 3-week rigorous summer PD program (summer 2015)
- Of the 80 teachers, 52 were selected from a high-poverty school district
- 2X2 categorization by
  - grade level (K-6 and 7-12)
  - teaching experience (experienced–6 or more years, novice–5 or less)
- Random selection of 2 teachers from each of the 4 categories

Interviews

- Structured interview protocol
  - 8 teachers interviewed in spring semester of 2015-16 academic year (40-60 mins each)
  - Transcription of the interviews by student RAs (Express Scribe)
- Framework for development of codes:
  - Identified specific manifestations of Windschitl's (2002) four constructivist dilemmas
  - Categorized the themes within the four dilemmas of constructivist teaching
  - Identified themes representing factors that helped or hindered constructivist teaching methods

Code Development

- Interview transcriptions were read by the 3 authors
- Codes were developed by authors during initial meeting
- Two interviews were selected at random to be coded by all 3 authors
- A second meeting was held to revise and finalize the codes and resolve discrepancies in codes to establish interrater reliability

Coding

- NVivo template was created with final theme codes
- All transcriptions were transferred to NVivo
- Each transcript was coded by two authors
- Authors assigned same transcripts resolved coding discrepancies

Conceptual Dilemmas

- Difficulties in understanding the constructivist approach to teaching
- Lack of knowledge or awareness of constructivist theories/philosophy
- Misconceptions about effective student learning

Conceptual Barriers

- Confusion about or lack of awareness of the term "constructivism"
- Belief that students learned math best via traditional methods

"I am old school in that I do like them to learn paper/ pencil first before we move on to the calculator."

Conceptual Facilitators

- Endorsing the implementation of instruction that consistent with a constructivist teaching approach

- Understanding that students learn math best through methods and activities consistent with constructivism

Conceptual Facilitators (cont.)

"So I like my kids to learn through play because I think that that works best for kids. Kids learn through each other and they learn through play and they learn through conversation (…) Numbers are just symbols, but if they don't understand what it means, they are not able to manipulate it (…) So I like to teach them to think deeper and dig deeper through hand-on interactions and conversations with each other."

Pedagogical Dilemmas

- Teachers' application of constructivist theory to the learning environment via tasks and activities
  - Shifting techniques ("lecture" → facilitating dialogue; problem sets →complex problems)

- Pedagogical dilemmas also refer to teacher attributes, such as deep background knowledge or interest in the material.

Pedagogical Barriers

- Difficulty in facilitating activities since students can use materials inappropriately
- Teacher attributes like poor motivation or lack of background knowledge

"It's about maintaining my motivation, cuz this is a burn-out industry, and I felt it. You know, I have felt it."

"And I'm not like a mathematician, like some people are. They get these concepts and they're real fast, and they get it, and their knowledge is real deep right away, and not so with me."

Pedagogical Facilitators

- Successful management of the different demands of a more constructivist classroom

- Implementation of many different types of activities, such as using manipulatives, technology, art, etc.

Pedag'l Facilitators (cont.)

"As an 8th grade teacher I always think that my kids are too old for manipulatives. And, there were some really good activities that we did over the summer that I don't know. And I did them in my classroom. And I don't know how I would've done them without the manipulatives. Um, you're never too old. As students you're never too old for manipulatives, it's just the process changes (…) We did a thing with my 8th grade kids, that one of my instructors did with bags for the real number system. And my kids, they got it. Because they had that visual there to see. So it was really fun. I enjoyed it."

Cultural Dilemmas

- Difficulties related to learning expectations that do not match constructivist theory

- Cultural background, expectations of students and beliefs of teacher colleagues may be inconsistent with a constructivist approach, creating difficulties in implementing the approach

Cultural Barriers

- Other teachers' attitudes as favoring status quo teaching approaches
- Difficulty implementing the constructivist techniques learned through the PD due to classroom management concerns
- Student poverty

Cultural Barriers (cont.)

"So the distractions, just the fact that outside of these walls, there's nothing to motivate them to do what we're doing here. You know, it's just, they're just, they're on survival mode out there."

"Some older teacher, I guess, veteran teachers are gung ho on having their kids memorize these facts, and I understand memorizing the facts once you know what they mean. But they are like no, I am going to drill and kill. 9 x 7 is what? 5x5 is what? And the kids don't understand the concept and it's mainly because I guess the teachers that they had before didn't do what they needed to do to develop the concept (…)"

Cultural Facilitators

- The attitudes and behavior of colleagues

"The other teachers in my immediate area, just around me, we're really amazing support system for each other, we keep an eye out for each other, we know the ins and outs of what's going on and what our deeds are, what students need help with in what periods, it's really about building that team around you."

Political Dilemmas

- Systemic barriers the impede the implementation of constructivist approaches
  - Barriers may stem from a variety of stakeholders, such as campus or district-level administrators, from parents or other community stakeholders

- Apt to produce controversy and tension amongst stakeholders

Political Barriers

- Teachers unable to access the instructional resources they needed in order to implement constructivist learning in their classrooms

- Teachers encounter overlapping barriers related to testing, timing, and flexibility

Political Barriers (cont.)

"Well as far as math is concerned, we don't have the manipulatives in order to teach the concepts."

"The other thing is that sometimes we're not free to teach the way the concept was brought across in the training here. And so we basically have to adapt to whatever the campus wants to do. Like, however the campus wants to teach the concept, you know, if it's not tested on the STAAR, we don't teach it in the classroom (...)"

Political Facilitators

- Some degree of administrative support such as providing instructional flexibility

"My principal just kinda lets us go teach, do what you need to do."

Conclusion

- This study applies and extends Windschitl's (2002) "constructivist in practice" dilemmas framework by elucidating how these dilemmas manifest for teachers working in high-poverty urban districts

- Most common dilemmas: conceptual and political

Recommendations

- Finding:
  - While teachers develop an understanding through PD of how students learn best that is consistent with constructivism, they still lack full awareness of their underlying teaching philosophy
- Recommendation:
  - Teacher educators explicitly convey the theoretical framework that informs the pedagogical approaches their programs endorse

Recommendations (cont.)

- Finding:
  - Prominent political dilemmas included lack of instructional resources and instructional time constraints due to high stakes testing

- Recommendation:
  - Additional consideration by district and school administration is necessary to support teachers so that they gain maximum benefit from their constructivism-informed PD experiences

THANK YOU !

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