Beginning Science Teachers' Subject Matter Knowledge, Misconceptions, and Emerging Inquiry-based Teaching Practices (Poster)

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Introduction & Rationale

- The landscape of teacher preparation is complex and from a research perspective presents itself as a multilevel, multivariable puzzle.
- For decades, federal and state policy-makers, teacher education institutions, educational researchers, school districts, administrators, and other stakeholders have tried to determine and measure the key, malleable factors that result in effective teaching.
- While all U.S. states regulate science teacher certification, science education researchers have not produced research that unequivocally sets a minimum amount of science coursework, or mastery levels, for teachers.
- Thus, problematically even when minimal SMK state certification requirements are met teachers may still hold persistent misconceptions.
- Determining teachers’ minimum amount of science SMK is challenging as science is multidisciplinary.
- A limitation of other studies is that only the number of subject area courses taken has been used to try to determine SMK mastery (NRC, 2010).
- Thus, we need studies that describe the relationship between: teachers’ subject matter knowledge and enacted reform-based teaching practices

Study Findings: Subject Matter Knowledge & Misconceptions

- Linear and logistic regression were used to predict MOSART chemistry (grades 9-12) test scores.
- For each 0.10 change in GNP, teachers were 1.22 times more likely to pass test at 80% (p = 2.747)
- Multiple variable regression and logistic regression were used to predict MOSART physics (grades 9-12) test scores.
- Relationship between mathematics GPA and physics credit hours is a function: likelihood of passing/failing MOSART physics test = β1 + β2 math GPA + β3 physics credit hours.

Study Findings: Connections to Inquiry-based Instruction

- Two-level hierarchical generalized linear models were built to investigate the relationship between proficiency in inquiry-oriented instruction and the predictor variables at both levels (Table 2).

Research Questions, Methodology, & Context

1. What is the performance of newly certified science teachers with a range of SMK on tests of science misconceptions?
2. To what degree are these teachers’ practices reform-based (i.e., inquiry-based)?

Approach & Methods

- Longitudinal (4 years), multi-method approach to investigating beginning science teachers’ SMK, science misconceptions, and instructional practices of undergraduate and master’s level science TPP graduates (Lewis, Rivero, Musson, & Lucas, 2016).
- Teachers’ SMK was examined through an analysis of Misconceptions-Oriented Standards-Based Assessment Resources for Teachers (MOSART) test scores and transcript analysis.
- We coded and analyzed science lessons using the EQUIP instrument (Marshall, Horton, Smart, & Llewellyn, 2008).

Conclusions & Future Research

Our research of our two teacher preparation programs contributes a reliable design for producing highly-qualified teachers who can provide active, engaging, constructivist learning opportunities for diverse students while addressing rigorous national science education standards.

Implications: Meeting the Need for High Quality Science Education

- Finding ways to transfer to other similar programs in terms of which science courses and at what level of mastery support strong SMK.
- Science teacher educators and professional development providers may find our results useful in considering teacher preparation priorities and induction phase teachers’ professional development needs.
- While strong science content knowledge ensures that teachers are able to recognize their students’ misconceptions, SMK is insufficient in itself to teach effectively using inquiry-based instruction.
- Other possible contributing factors include pedagogical knowledge, teaching self-efficacy, beliefs about reform-based science education.

Future Research: Comprehensive Model Building Fall 2017- Spring 2018 Activities

- We generated about 250 more classroom observations.
- Each with a week’s worth of lessons documented for a total of 2,150 class periods. (Follow-up interviews also served as coaching sessions for the teachers)

Acknowledgments & References

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Reference


Teacher Preparation Program

Noyce Project Overview

- Four-year NSF grant (September 2015 – August 2019)
- 60% of grant is required to be dedicated to the Noyce stipends (30 stipends at $16,000 each) in MAT program.
- Supporting diverse learners. Noyce recipients must complete 2 years of teaching at high-need school districts.
- Remainder of grant is used to investigate models of science teacher preparation.
- Our NSF Noyce Phase II grant has enabled us to add a comparison group to our previous study of MAT graduates started with our Noyce Track I, Phase I grant.