Professional Identity Development of Beginning Elementary Teachers of Science: A Comparative Case Study

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Summary

Project Nexus promotes quality science education by developing and testing an exemplary model that prepares supports and sustains *upper elementary and middle level* specialist science teachers. Project Nexus teachers will benefit from a baccalaureate program that features connecting transformative undergraduate science content courses with science method courses, supported internship experiences with adolescent students in informal education contexts, field placements in urban professional development schools and ongoing innovative educational experiences addressing the needs of minority and urban students, and continuous university, public school district, and informal education support during their induction years. Participants in the 5-year project include new specialist science teachers and practicing mentor teachers (formal and informal science education domains).

Rationale

Current need in science teacher preparation

- To increase the number of elementary teacher education majors who concentrate in science, particularly those typically underrepresented
- To increase the number of qualified upper elementary/ middle school science teachers, particularly those typically underrepresented

Builds on previous research

Maryland Collaborative for Teacher Preparation (MCTP), a National Science Foundation funded project in the CETP.

Central Research Question

To what extent of success (and for what reasons) can undergraduate elementary teacher education majors, particularly those from currently underrepresented groups, with demonstrated interest and performance in science be:

recruited, prepared and *supported*

to teach upper elementary/ middle science in a manner consistent with standards-based recommendations?

Theoretical Perspectives

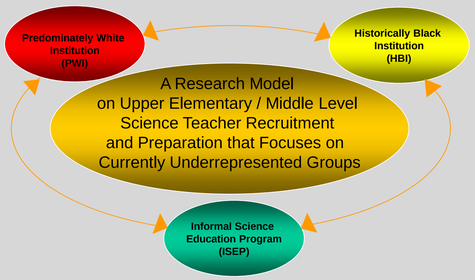
Identity theory

The ways individuals see themselves and are seen by others as "a certain kind of person" involves an interweaving of their natural identities (i.e., gender, race/ethnicity), institutional positionality (i.e., licensed teacher, student), engagement in dialogue with others, and shared experiences within groups (Gee, 2000)

Classroom Elementary Science Teacher Identity

Luehmann (2007) posited that developing professional identities that align with reform-based science teaching among educators is crucial for implementing transformative science teaching practices. Educators' personal histories and stories influence their identities as reform-oriented science educators.

Model



Collaborating Partners

- Coppin State University — Historically Black College/ University
- Florida A&M University — Historically Black College/ University
- Bowie State University — Historically Black College/ University
- Hands On Science Outreach Inc. — Informal Science Educational Program (Y1 & Y2)
- Prince George's County Public Schools — Professional Development Schools (PDS)
- University of Maryland — Research University, Very High

Objectives

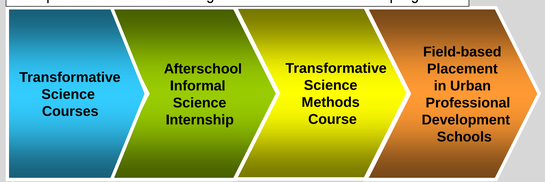
- To build a new teacher preparation continuum model for upper elementary/middle school science teachers with an undergraduate academic minor in science content who can pass standardized exams in their content field.
- To implement this model at the participating HBI and the PWI in partnership with an Informal Science Education Program (e.g., Hands on Science Outreach)
- To increase the number of elementary teacher education majors who concentrate in science, particularly those typically underrepresented.
- To increase the number of qualified upper elementary/middle school science teachers, particularly those typically underrepresented.
- To evaluate the model's effectiveness.
- To conduct research on the model.
- To disseminate the model locally and nationally.

Overarching Goal

Develop and Test a New Teacher Preparation Continuum Model
for Upper Elementary / Middle School Science Teachers
With a Focus on the Recruitment, Preparation, and Support of Underrepresented Groups

I. Implementing the Model

Components of the PN undergraduate teacher education program



II. Investigating the Model

Year One: HBI & PWI Baseline Data (Surveys & Interviews)

Years Two & Three: Transformative Science Course (PWI) & Informal Science Urban Field Placements

Year Four: Science Methods Course & Transformative Science Course (HBI)

Year Five: Induction Year

III. Disseminating the Model

- College/ university seminars
- Professional association conferences
- Journal articles/book chapters/ reports/curricular materials
- PDS interaction
- Website: www.projectnexus.umd.edu

Methods

Comparative Case Study of Beginning Teachers

Research Question: *How and in what ways did the Project Nexus innovations influence beginning teachers' elementary classroom science teaching identity development?*
Sample: 2009-2010 School Year: 2 Project Nexus graduates (Renee & Rachel) + 2 University of Maryland graduates for comparison (Michelle & Stacey)
Data Collection: *Drawing yourself teaching science/Draw your students learning science + Attitudes and Beliefs about the Nature of and the Teaching of Science* instrument + Individual and Focus Grou p Interviews + Email Survey + Artifact Collection + Discussion Thread on Facebook
Methodology: Complementary [Quantitative (Descriptive Statistics) + Qualitative (Identity Framework, Inductive Analyses)]
Analysis: To analyze the drawings, we examined them for evidence in regards to the 6 strands explicated in two recent NRC documents [*Taking Science to Schools: Learning and Teaching Science in Grades K-8* (2007) & *Learning Science in Informal Environments: People, Places, and Pursuits* (2009)]. We developed a detailed rubric and used an inter-rater reliability check.

Findings

Rachel (Treatment, African American Female)

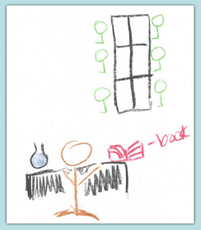
➢ Over the course of Project Nexus, Rachel develops in terms of her confidence to teach science but still sees room for further progress.

Pre-HOSO "*Draw yourself teaching science*" drawing

"I think just, in general, / personally have a fear of science I guess, because it's not my strongest subject" (August 2008).

"I know we've talked about this a lot in education… that teachers are lifelong learners and we want our students to be lifelong learners, so I feel like I'm at the beginning of my learning stage and I'm really excited, especially after this year. To know that science is not so scary I guess and going to the conference and everything that it really can be what you make it and I really want a kind of run with it and stuff…" (July 2010).

➢Rachel shifts from teacher-centered to student-centered science teaching and learning practices.



Post-HOSO "*Draw yourself teaching science*" drawing

End of induction year "*Draw yourself teaching science*" drawing

➢Rachel identifies as a teacher that teaches all subjects, not necessarily just science.

"I would probably say not really, honestly. I would say that I *do* teach science, but I wouldn't call myself a reading teacher or a math teacher either. I just kind of blanket everything. As a general education teacher I do teach science, but I'm not at the point where I feel comfortable saying I'm a science teacher" (March 2010).

➢She views herself on a continuum and reflects on her progress.

"…I know we've talked about this a lot in education too, that teachers are lifelong learners and we want our students to be lifelong learners, so I feel like I'm at the beginning of my learning stage and I'm really excited, especially after this year" (July 2010).

Stacey (Comparison, African American Female)

➢Stacey previously disliked science but came to see herself as a teacher that enjoyed science teaching and learning.

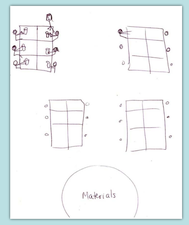
"I was not a fan of science growing up. I actually despised science quite frankly" (July 2010).

"I've always had such a negative view of science, so it's very hard for me to-- I've learned that it's not what I used to think it was. You know what I mean? Just terminology and things like that. It's not as boring as it used to be, because there are things that kids can explore and can figure out and relate to actual, their actual life, whereas before I didn't learn it that way " (March 2010).

"I have a new found love for science I think. I can appreciate it and yeah, and I enjoy it so I think that-- last year when I was teaching it, especially at the beginning of the year, I wanted to make it fun for my students so it was more of like trying to make them enjoy it, but as the year went on we both enjoyed it. So I think that the fact that I enjoyed it and learned as much as they did then it kind of came full circle"(July 2010).

➢Stacey shifts from teacher-centered to student-centered science teaching and learning practices.

Pre-science methods course "*Draw yourself teaching science*" drawing



Post-science methods course "*Draw yourself teaching science*" drawing

➢At the end of her first year of teaching, Stacey expresses enthusiasm for her science teaching, seeing herself as capable of making a change on her students' futures.

"'Mrs. [Harris], I want to become a scientist!'… And I said, "Oh, that's cool, you can definitely do that!" So, I was really excited about that…" (July 2010).

"…my goal is to make sure my students don't have the same outlook on science as I did" (July 2010).

➢Stacey reflected on her science teaching and identified areas for growth.

"I think I need to learn scientific investigation a little better. You know, I know generically speaking… I know how to …create a science fair board, but I want to be able to teach it so that it rolls off my tongue and is just second nature, so that it comes off to the kids as something easy for them to do and it makes it that way for them as well" (July 2010).

Survey data (Selective)

Survey Item		Rachel Treatment	Renee Treatment	Michelle Comparison	Stacey Comparison
I like science	Initial Survey Response	Strongly disagree	Strongly agree	Not sure	Strongly disagree
	Final Survey Response	Sort of agree	Sort of agree	Sort of agree	Strongly agree
The idea of teaching science scares	Initial Survey Response	Sort of agree	Sort of agree	Not sure	Strongly agree
	Final Survey Response	Sort of disagree	Strongly disagree	Sort of disagree	Sort of disagree
I am looking forward to taking more science courses.	Initial Survey Response	Sort of disagree	Sort of agree	Not sure	Sort of disagree
	Final Survey Response	Sort of agree	Strongly agree	Strongly agree	Sort of agree
Students should have opportunities to experience manipulating materials in the science classroom before teachers introduce scientific vocabulary	Initial Survey Response	Strongly agree	Sort of disagree	Strongly agree	Sort of disagree
	Final Survey Response	Strongly agree	Strongly agree	Strongly agree	Sort of agree
Small group activity should be a regular part of the science classroom.	Initial Survey Response	Sort of agree	Strongly agree	Strongly agree	Strongly agree
	Final Survey Response	Strongly agree	Strongly agree	Strongly agree	Strongly agree
Getting the correct answer to a problem in the science classroom is more important than investigating the problem in a scientific manner	Initial Survey Response	Strongly disagree	Sort of disagree	Strongly disagree	Strongly disagree
	Final Survey Response	Strongly disagree	Strongly agree	Strongly disagree	Strongly disagree

Attitudes and Beliefs Survey, Table 1. Case participants' responses to the *Attitudes and Beliefs about the Nature of and the Teaching of Science* survey.

Strand		Rachel Treatment	Renee Treatment	Michelle Comparison	Stacey Comparison
Strand 1: *Experience excitement, interest, and motivation to learn about phenomena in the natural and physical world.*	Initial Combined Teaching and Learning Score	7	6	7	6
	Final Combined Teaching and Learning Score	3	8	6	6
	Difference	-4	2	-1	0
Strand 2: *Come to generate, understand, remember, and use concepts, explanations, arguments, models, and facts related to science.*	Initial Combined Teaching and Learning Score	0	0	2	1
	Final Combined Teaching and Learning Score	1	5	1	0
	Difference	1	5	-1	-1
Strand 3: *Manipulate, test, explore, predict, question, observe, and make sense of the natural and physical world.*	Initial Combined Teaching and Learning Score	4	5	8	2
	Final Combined Teaching and Learning Score	8	7	7	6
	Difference	4	2	-1	4
Strand 5: *Participate in scientific activities and learning practices with others, using scientific language and tools.*	Initial Combined Teaching and Learning Score	5	5	6	5
	Final Combined Teaching and Learning Score	8	6	7	6
	Difference	3	1	1	1

Drawing Analysis, Table 2. Analysis of changes on case participants' initial and final drawings by strand.

Poster Design by: Kelly Riedinger, Emily Hestness & Amy Dai