



Improving and Assessing an Elementary Science Field Experience: Lessons Learned

Cody Sandifer and Beth Renwick

Who We Are

Cody Sandifer

Assist. Professor of Science Education
Dept. of Physics, Astronomy, and
Geosciences
Towson University

Beth Renwick

Teacher-in-Residence, Towson University
3rd grade teacher
Sinclair Lane Elementary, Baltimore City

Project Support

Our project is funded by
**PhysTEC (Physics Teacher
Education Coalition)**

PhysTEC:

- **National project: Improving K-12 science teacher preparation**
- **Towson's focus: Elementary science teaching**

Session Overview

- **Session Introduction**
- **Project Background and Context:**
Elementary science education at Towson
- **Project Motivation and Goals:**
Problems with our field experience course, and specific improvement goals
- **Project Activity:** What we did to improve the field experience course
- **Demonstration of Observation Protocol:**
Using a standards-based observation protocol to assess science instruction

Related Discussions

- **How should a “field experience” (early teaching) course be structured?**
- **What do we mean by “Inquiry”?**
- **What is the best way to provide professional development for mentor teachers and instructors?**

Project Background and Context

Towson University

- **Public university and member of the Maryland state system**
- **Second largest university in the state**
- **Top producer of teachers in the state (200 elementary teachers per year)**

**The focus of our
elementary education
science courses?**

Inquiry!

Program Coherence: A Focus on Inquiry

Physical Science 1: ELED majors learn concepts through guided inquiry

Earth-Space Science: ELED majors learn concepts through guided inquiry, and learn inquiry-oriented teaching methods

Elementary Science Field

Experience: ELED majors teach science using inquiry methods

Math-Science Semester

MATH 323 Math teaching methods

MATH 324 Math field experience

BIOL 303 Life Sciences

PHSC 303 Earth-Space Science
(content/methods)

SCIE 376 Science field experience

ITSC 301 Instructional Media

*(This occurs **before** student teaching)*

TU's Elementary Science Field Experience

- **Interns learn teaching methods**
- **Interns practice teaching at elementary school sites**
- **Interns become exposed to science standards**
- **Interns engage in self-reflection and improvement**

TU's Elementary Science Field Experience: Basic Structure

- 6-7 sections per semester
- Course meets once per week for 4 hours
- Course is front-loaded with methods (on TU campus)
- After first few weeks, class is held at elementary sites
- Number of interns per classroom is variable

Basic Structure Cont.

- Lesson planning done in small groups, by classroom
- Interns teach students, mentor teacher helps with management
- Lesson debriefing and methods activities conducted when interns not teaching
- Self-reflection through weekly journals

Group Discussion

**What are other ways to
structure a field
experience course?**

Lessons Learned

- **It is important to have have ELED undergrads enroll in content and field experience courses concurrently**
- **The cohort system has its benefits**

Lessons Cont.

- **The “small group” model for teaching (each intern teaches to her own small group) works well**
- **The “small group” model for lesson planning (interns plan in groups) works well**
- **Interns appreciate being able to teach science every week**

Lessons Cont.

- **Coordination across sections is important for multiple-section courses**
- **Providing a “course syllabus” for part-time instructors is not sufficient instructional support**

Project Motivation and Goals

Motivation for the Project

- **In recent years, there have been numerous student and instructor complaints about SCIE 376**
- **SCIE 376 is the last real opportunity for ELED majors to teach a significant amount of science before graduation**
 - **25% teach no science at all during student teaching**
 - **40% teach science infrequently during student teaching**

Problems with SCIE 376

- **Course not uniform from section to section**
- **Interns often observing instead of teaching**
- **When teaching, interns use traditional methods rather than inquiry-oriented methods**

Why?

- **Lack of coordination between sections**
- **Lack of communication about course goals between instructors, mentor teachers, and interns**
- **Lack of shared understanding of inquiry**

Project Goal: *To improve our elementary science field experience course*

- **More uniformity from section to section (6-7 sections per semester)**
- **Help interns and part-time faculty develop a better understanding of inquiry-based science teaching**
- **Increase the amount and quality of inquiry in the interns' science lessons at the practicum school sites**

Inquiry

What is inquiry-based science teaching?

“In an inquiry-based lesson, students learn science by engaging in the scientific process.”

Sounds harmless...

Group Discussion

What is meant by the phrase “engaging in the scientific process”?

Lessons Learned

- **Mentor teachers may contradict your inquiry-oriented teaching advice**
- **Having interns conduct formal assessments of student learning can be detrimental**

Lessons Cont.

- **Providing quality feedback on interns' lesson plans and teaching is time-consuming**
- **Due to philosophical differences, it can be impossible for people to agree completely on a definition of "inquiry"**

Project Activities

Activity Overview

- **Re-establishing course goals**
- **Developing core principles of inquiry**
- **Standards-based curricular reform (NSES)**
- **Mentor teacher workshops**
- **Instructor meetings and workshops**

Re-establishing course goals

- **Interns will understand and apply inquiry-focused theories of science teaching and learning**
- **Interns will become exposed to local, state, and national content and teaching standards**
- **Interns will observe their mentor teacher infrequently (0-2 times)**

Goals cont.

- **Interns will teach science as often as possible (9+ times for each intern)**
- **4-6 interns per classroom, with each intern in charge of teaching science to a small group of students**
- **The interns' science units/lessons will generally consist of modified, inquiry-oriented versions of the official school units/lessons**

Goals cont.

- **Interns will receive in-depth feedback on their teaching from mentor teachers and university instructors**
- **Interns will engage in self-reflection and improvement**

Defining Inquiry

- **First attempt:** NSES
“emphasis” documents --
Content and teaching
standards
- **Next attempt:** Shortening and
reorganizing the emphasis
documents
- **Finally:** Developing our own
core principles of inquiry

Principles of Inquiry: Summary

Principle 1: Figuring Out. Students are figuring out science concepts and underlying scientific mechanisms *on their own* whenever possible.

Principle 2: Active Learning. Lessons are activity- and discussion-based, rather than lecture- and reading-based.

Principle 3: Ideas and Good Reasoning/Making Sense. Lessons focus on ideas and evidence-based reasoning rather than memorization of right answers, facts, and vocabulary words.

Curricular Reform

Resource CD for part-time instructors:

- Course overview
- Forms and documents
- Methods activities

Instructor Workshop

Two-day workshop on:

- **Course goals and structure**
- **Inquiry and the scientific process**
- **How to support inquiry**
- **The roles and responsibilities of the university instructors and mentor teachers**
- **SCIE 376 resource CD and course equipment**

Mentor teacher workshop

Half-day workshop on:

- **Course goals and structure**
- **Inquiry and the scientific process**
- **The roles and responsibilities of the university instructors and mentor teachers**

Group Discussion

**What are other ways to
provide professional
development for part-time
instructors?**

Group Discussion

**What are other ways to
provide professional
development for mentor
teachers?**

The Role of our Elementary Teacher-in-Residence

- **Planned science lessons with instructors and interns**
- **Helped plan and implement instructor and mentor teacher workshops**
- **Helped develop surveys and teaching observation protocol**
- **Data collection and analysis**
- **Helped create resource CD-rom for SCIE 376 instructors**

Lessons Learned

- **Interns' self-reflections need to be heavily guided and focused**
- **Interns have a tough time modifying official science lessons**
- **Observations of mentor teachers by interns can be a mixed bag**

Lessons Cont.

- **A lack of familiarity with technology can be a significant barrier to reform**
- **A little payment goes a long way**
- **“Inquiry” and “active learning” are not synonyms**

Lessons Cont.

- **Don't expect brief workshops to have long-lasting effects**
- **When providing professional development, *telling* should always be accompanied by *showing* and *doing***

Lessons Cont.

- **People interpret your statements according to their current worldview (example: # of interns per classroom)**
- **Ongoing support is necessary to achieve long-term impact**

Assessing the Project Activities

Project Successes: Practicum Course

*After instructor and mentor
teacher workshops...*

- **Course more uniform from section to section: Less observing, more teaching**
- **More inquiry-based science teaching at school sites**
- **Interns have greater appreciation for inquiry**

Project Assessments

- **Pre/post surveys:**
attitudes, understanding
of inquiry, course
activities
- **Observations of the
interns' science lessons**
- **End-of-semester
reflections and “advice”
documents**

Survey Data: Course Activity and Attitudes

	Fall 04 (89 interns)	Spring 05 (108 interns)	Fall 05 (75 interns)
Interns who observed their mentor teacher teaching 4 or more times	19%	18%	9%
Interns who taught less than 4 times	28%	11%	0%
Interns who indicated that their lessons were mostly official school activities implemented as written (with no modifications)	20%	10%	20%

Statement	Pre (80 students)			Post (75 students)			Pre vs. post Chi-square
	Agree	Neutral	Disagree	Agree	Neutral	Disagree	
Some students have a natural talent for science, and some do not	47%	40%	13%	40%	28%	32%	7.8, $p < 0.05$
The idea of teaching science scares me.	19%	26%	55%	8%	20%	72%	5.7, $p > 0.05$
I like science.	61%	21%	18%	77%	17%	5%	6.7, $p < 0.05$

Survey Data: Understanding of Inquiry

	Fall 05 pre (80 interns)	Fall 05 post (75 interns)
Interns who indicate that a top priority is to give students experiences with experimentation and data	46%	45%
Interns who indicate that a top priority is to help students develop argumentation and reasoning skills	19%	24%
Interns who indicate that the top two activities that they would try to incorporate into every science class are (1) discussions in which students generate a variety of scientific ideas and (2) experiments in which students generate a variety of ideas.	56%	51%
Interns who indicate that one of the two primary roles of the teacher is to guide whole-class and small group discussions	45%	45%

No change!

Observational Data: Interns' Science Teaching

Lesson Characteristic: Traditional Vs. Inquiry			Lesson Focus							
			Fall 2004				Spring 2005			
Traditional	Vs.	Inquiry	NA	Trad	Mix	Inq	NA	Trad	Mix	Inq
Verifying science content	Vs.	Investigating and analyze science content	0	9	0	2	0	4	5	5
Getting an answer	Vs.	Using evidence to develop or revise an explanation	0	8	1	2	0	5	0	9
Providing answers to questions	Vs.	Communicating science explanations	0	8	1	2	1	3	5	5
Rigidly following curriculum	Vs.	Selecting and adapting curriculum	0	5	4	2	0	5	5	4
Focusing on acquisition of information	Vs.	Focusing on understanding and use of scientific ideas and inquiry processes	0	7	2	2	0	5	4	5
Lecture, text, and demonstration	Vs.	Guiding students in active and extensive scientific inquiry	0	8	1	2	0	5	6	3
Asking for recitation of acquired knowledge	Vs.	Providing opportunities for discussion and debate	0	9	0	2	0	5	6	3

Note: 11 lessons were observed in Fa04; 14 lessons were observed in Sp05.

Lessons Learned

- **Surveys are not enough; teaching observations are also needed.**
 - What preservice teachers say and what preservice teachers do are often two different things.

Barriers to Sustainability?

- **Instructor and mentor teacher turnover**
- **Standardized testing in Maryland**
- **Course coordination**

Assessment Demonstration

**Using the standards-
based observation
protocol**

For More Information...

[http://wwwnew.towson.edu/
physics/scienceeducation/](http://wwwnew.towson.edu/physics/scienceeducation/)

Cody Sandifer:

csandifer@towson.edu

Laura Lising:

llising@towson.edu

Beth Renwick:

erenwick@towson.edu

Group Discussion

**What else is on your
mind?**