Science Education

Teaching Portfolio

Todd Campbell
Associate Professor of Science Education
School of Teacher Education and Leadership
Utah State University
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INTRODUCTION

Since 2004, I have taught pre-service science teacher education courses, first as a faculty member at the New York Institute of Technology (2004-2005) and then at Utah State University (2005-present). I was awarded promotion and tenure to Associate Professor at Utah State University in April 2011, effective July 1, 2011. Before this, I was a science teacher. It is my background as a science teacher that still greatly influences my stance as a teacher. It is as a science teacher that I found my 'niche' and passion and it is in science teacher education that I have continued this pursuit, but with a refocused vision.

As a science teacher, trained in an exemplary science education program, I developed a philosophy of science teaching, vetted in experience, reflections, and research literature in science education. This philosophy moves beyond science as content to science as concepts, science as process, nature of science, and communication in science, so that as one facet of science learning is connected to another, each is learned more deeply. I saw this as a more focused and informed approach to science education that had implications beyond the few who will become the next scientists and instead for all as the future collective citizenry. Additionally I recognized and reconciled this vision of a more holistic science education as more aligned with current theories of teaching and learning, namely **constructivism***.

> ***Constructivism** posits that student learning occurs actively as students are given time, space, and support to cultivate meanings of their experiences in the context of their current understandings and environments.

My focus as a science teacher educator naturally extends the four core priorities for science learning that grounded my philosophy as a science teacher, but with a new central focus of teacher professional development. Collectively, these five facets of science learning (emanating from the articulation of four strands of science learning in the 2007 & 2008 National Research Council documents) are represented in Figure 1.

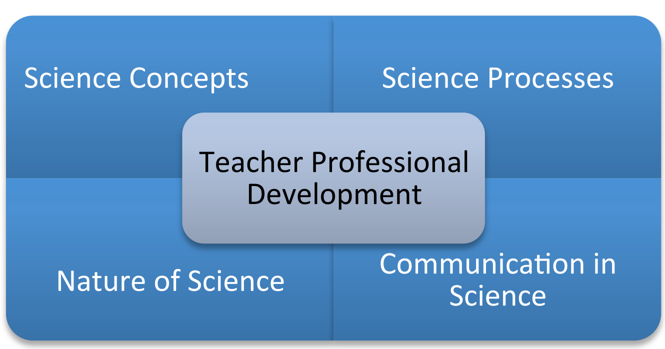


Figure 1. Five Inextricably Linked Facets of Science Teacher Education

TEACHING RESPONSIBILITIES

My teaching responsibilities include teaching courses and advising both masters and Ph.D. students. All of the courses taught are part of the secondary science teacher education program, except for TEAL 5820 and TEAL 6555 that are part of the science education focused graduate courses. All courses taught are listed in Table 1.

Table 1

Courses	Yrs. Taught	Enroll
SCED 3300 Clinical Experience I (Science)/SCED 3400 Science Teaching Methods I	2005-present	3-12
SCED 4300 Clinical Experience II (Science)/SCED 4400 Science Teaching Methods II	2005-present	2-3
TEAL 6555 Science Education and the Meaning of Science	Summer 2011	-
SCI 4300 Science in Society	2005-present	3-9

TEACHING PHILOSOPHY AND METHODOLOGIES

My teaching philosophy and methods are founded on **constructivist principles of learning**. As I consider situating **constructivist principles** in the discipline where my courses reside, I find myself focused on ***teaching science as inquiry***, a process that posits that teaching should be consistent with the nature and processes of science that scientist engage in as they learn about natural phenomenon. This stance holds science conceptual development, science process capacities and understandings, nature of science epistemological considerations, and communication within science as inextricably linked essential goals of science learning **(Four supporting strands of Five Strand framework in Figure 1)**. Because I believe ***teachers teach like they are taught***, I want to ensure that my students experience instruction aligned with the four strand teaching vision **(Figure 1)** as I focus them in self-reflection about the fifth strand (teacher professional development). I work to accomplish this through engaging students as science learners in scientific inquiry through mini-lessons in class and through more long-term semester scientific inquiry projects **(see Appendix C, Student Artifacts)**.

Because **constructivism** is at the heart of my teaching, this has implications for the teaching **methodologies** I leverage in facilitating student learning. The following are **methodologies** that can be seen cutting across all of my courses:

- **ELICITING STUDENT IDEAS:** *Understanding the role and influence students' prior knowledge has on learning is central to **constructivism**,*

    A. **Ensuring** students articulate goals for what they should know or be able to do based on learning in 6-12 science classrooms for science teaching methods students. Revising these throughout the semester and program in light of experiences and available standards and literature.

    B. **Facilitating** students articulation of their mental models of science and societal phenomenon in the Science in Society course before using the mental models as learning anchors to guide semester long class actions (see Appendix C, Student Artifacts).

    C. **Encouraging** students to share their early ideas about whether Intelligent Design and Evolution can be situated in a public science classroom, before these ideas are discussed and debated among peers and vetted through national and state standards documents and recent national court rulings regarding these discussions.

I believe learning really happens as it considers the 'footing' of the learner (i.e. where they are coming from, what they really think, and how they will react when challenged) and I believe that iteration, through multiple drafts of ideas, is the essence of what constructivist learning is about. Additionally, the vision of learning as iterative also 'fits' well with the **five strands of science teacher education** depicted in Figure 1.

- **ENGAGING IN DISCUSSION ABOUT IDEAS:** *I strongly believe that students need opportunities to discuss their ideas.* This requires appropriate prompts to bound or guide learning, so that class objectives are met. But, as importantly as bounding and guiding learning, it requires thought about when to interject, as the instructor, to ensure that students are learning from each other and developing ideas that they can truly call their own. An example of this can be seen as significant amounts of class time is spent in discussion where student-to-student interactions are common **(see Appendix F, Peer**

Observations and Letters). It is also through this process, of deciding how and when to bound learning that science concepts, process of science, nature of science, and communication in science are connected to visions and articulations of pre-service teachers as they reflect on and articulate their learning and understandings.

- **ENGAGING IN LEARNING AS INQUIRY:** *Inquiry, defined as students asking authentic questions, engaging in effective methods for answering questions, and carrying out methods to collect data to answer their questions is **essential*** **(See COURSE ASSIGNMENTS, p. 5)**. Through this process, students are learning by doing. This allows students to engage in very authentic ways both as individuals and with naturally occurring phenomenon that is both enticing and exciting to them as learners.

I truly love my profession and the challenges and experiences it brings daily and see my teaching as a fluid endeavor that will be continually revisited and improved throughout my career!

COURSE ASSIGNMENTS

The representative course assignments that follow from selected courses offer a vision for how my **five strands of science teacher education** philosophy (Figure 1) is grounded in student experiences:

- **Week Long Mini Modules** (SCED 3400 Science Teaching Methods I/SCED 3300 Clinical Experience I): *Students develop and enact two instructional modules with high school students.* Modules are developed in collaboration with the high school science teacher on the USU Innovation Campus, classmates, and myself. As students develop these modules, they are continually asked to focus on situating their instruction with the four strands of science learning.

- **Long-Term Science Inquiry Project Using Scientific Modeling** (SCED 3400 Science Teaching Methods I/SCED 3300 Clinical Experience I): *Students work alone or in groups to develop an inquiry project.* Students engage in a semester long inquiry project that is intended to help them better understand the complexities of doing scientific inquiry and facilitating science instruction focused on inquiry. This project is completed using a scientific modeling approach **(See Appendix E, National Scholars Syllabi Review-Windschitl).**

- **Class Action** (SCI 4300 Science in Society): *The class selects a science and societal issue to investigate more closely.* The class investigates the issue in-depth, through identifying and reading additional research and meeting with experts, the class decides on an action to take regarding the issue. The class takes the action and measures the impact of the action **(See Appendix B, Teaching Methodology Artifacts)**.

STRATEGIES FOR MOTIVATING STUDENTS

Students should be guided to see the beauty and excitement of science and teaching. Many strategies can be employed for this purpose, including 1) engaging students in rich and enticing explorations where they can bring creative ideas and notions to bear on real world challenges **(See Appendix B & C, Teaching Methodology and Student Artifacts)**, 2) offering students a vision for how creative, innovative, and challenging approaches to science teaching can occur so that they can try them on to help shape their identities as teachers, and 3) modeling intrinsically rewarding outcomes well aligned with admirable and needed visions of professionalism. Selected examples include the following:

Engaging Explorations for Students

- **Developing** bold outcomes through selecting topics that do not seem settled by public consensus to bring new insight to problems **(See Appendix C, Student Artifacts)**
- **Considering** individual emergent teaching stances through engaging in fours stranded science lessons as learners
- **Researching** as part of projects, publications, and teaching. Examples of this can be seen as I have co-authored with students, co-presented at national conferences, and engaged students in funded grant projects as participants and researchers **(See Appendix C, Student Artifacts)**

Vision for Student Science Teaching for Identity Development

- **Engaging** students in effective instruction to offer strong visions for teaching and aligned with science education literature and national standards documents. Students are mentored as they create instructional materials for engaging their own students **(See COURSE ASSIGNMENTS, p. 5)**

- **Challenging** students to continually articulate and refine their visions and identities as science teachers. This is done through the creation of 1) research based frameworks in the science teaching methods courses, 2) modules, and 3) reflections on teaching through video or reflective assignments **(See Appendix A, Representative Syllabus)**

Modeling Intrinsically Rewarding Outcomes of Professionalism

- **Supporting** students by showing compassion and empathy, but also holding students accountable and celebrating their victories.

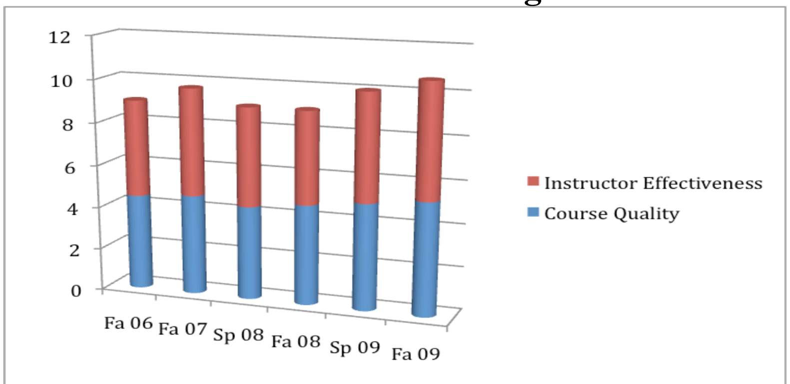
- **Modeling**, by ensuring students experience individual and authentic attention when they submit assignments. Through the experience of working through multiple drafts of assignments with feedback, students see learning as iterative. This allows students to witness their own improvements overtime in measurable ways.

- **Accomplishing** TALL things and not be bound by limits. Students see my professional efforts in publishing in leading journals, receiving state and nationally funded grants, leading colleagues and in-service teachers, it offers them a vision for the leaders they can be also.

STUDENT EVALUATION OF TEACHING

Figure 2 illustrates the two of the three courses that are central to my teaching course. While all evaluations I have received for all courses taught can be found in **Appendix D, Student Evaluations**, the trends shown in Figure 2 and Figure 3 are provided as evidence for how my teaching has continually improved with respect to the **Overall Quality of the Class** and **Instructor Effectiveness**. Throughout my tenure at USU, I have taken steps to continually improve my instruction **(See COURSE ASSIGMENTS, p. 5; EFFORTS TO IMPROVE TEACHING, p. 8; Appendix E, National Scholar Syllabi Review; & Appendix F, Peer Evaluations and Letters)**. Student evaluations provide evidence of my efforts to consistently improve.

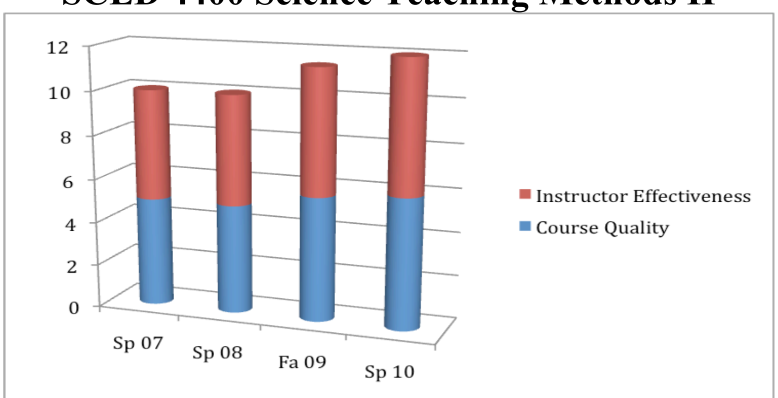
SCED 3400 Science Teaching Methods I



Semester	Course Quality	Instructor Effectiveness
Fa 06 (n=4)	4.5	4.5
Fa 07 (n=3)	4.7	5
Sp 08 (n=12)	4.4	4.6
Fa 08 (n=3)	4.7	4.3
Sp 09 (n=3)	5	5
Fa 09 (n=4)	5.3	5.3

Figure 2. Exemplary Trends in Student Evaluations, 1-6 Scale. (6 = Excellent & 1 = Very Poor)

SCED 4400 Science Teaching Methods II



Semester	Course Quality	Instructor Effectiveness
Sp 07 (n=4)	5	5
Sp 08 (n=1)	5	5
Fa 09 (n=2)	5.7	5.7
Sp 10 (n=3)	6.0	6.0

Figure 2. Exemplary Trends in Student Evaluations, 1-6 Scale. (6 = Excellent & 1 = Very Poor)

EFFORTS TO IMPROVE TEACHING

Ensuring continual professional growth as a high-quality teacher is lifelong process. I have supported this journey through 1) having national scholars in science education review and provide feedback to me course syllabi, 2) consistently requesting peers observe and provide feedback and guidance regarding my instructions, 3) working to develop and use formative assessments to inform my teaching, and 4) attending teacher workshops.

- ***National Scholars' Syllabi Review:*** During the 2007-2008 academic year, Dr. Mark Windschitl, University of Washington, and Dr. Jeffrey Weld, University of Northern Iowa, both secondary science educators completed reviews of my SCED 3400 & 4400 Science Teaching Methods I & II Course Syllabi **(See Appendix D, University Peer Observations)**. Through this review process, I was able to not only reflect on my practice and provide a rationale for the content of the courses, but I was also able to engage in discussion with these more senior science educators to consider possible ways to continually improve the courses. One example of the improvements emerging from this process is the modeling that students have began to do in concert with their long-term scientific inquiry projects **(See COURSE ASSIGNMENTS, p. 5)**.

  > *His [Todd's] approach to these courses is soundly based on state and national guidelines, along with Utah's core curriculum . . . Todd Campbell provides a first rate learning experience for his students.* Dr. Jeffrey Weld

- ***University Peer Observations:*** Throughout my tenure at USU, peers have consistently observed my teaching **(Appendix E, Peer Evaluations and Letters)**.

  > *In summary, it was clear from this observation that Dr. Campbell has created a classroom culture where active participation and student engagement are highly valued and encouraged. He is quite capable at using a variety of technology resources and highly effective in maximizing student participation and reflection.* Dr. Patricia Moyer-Packenham

- ***Formative Assessments:*** Through focusing on formative assessment in helping identify where students are in their understandings and capacities as science teachers, great potential exists for improving my instruction. The following are two examples of how I am developing and using formative assessments:

Learning Progressions for Pre-Service Science Teachers: I have begun to collaborate with colleagues in science education nationally to considering learning progressions for pre-service teachers (See Appendix B, Teaching Methodology Artifacts), so that as more is understood about where students are at, more can be done to focus on effective interventions to ensure continued student growth.

Creating Student and Class Pre- & Post- Learning Profiles: I have used research instruments to build profiles of students understandings of the nature of science at the beginning and end of semesters to helps guide instruction throughout the semester and to then assess the effectiveness of my instruction in meeting specific student and class learning needs.

- ***Teaching Workshops:*** Finally, I am continually and humbly focused on growing as a teacher by learning from experienced others. This teaching portfolio is one example important product that emerged from the Seldin, Miller, Seldin Portfolio Workshop during Summer 2011 (See Appendix F, Teaching Academy Attendance). As part of this workshop I spent focused time reflecting on and articulating my philosophy and methods of teaching and considering how to continually improve and document these improvements over time.

FUTURE TEACHING GOALS

Short Term Goals** (By the end of fall 2011)**: Identify a learning progression to use in the science teaching methods courses as a reflective tool for individualizing instruction to meet students where they are at and help them grow professionally as teachers.

***Long Term Goals** (Prior to being awarded tenure to Professor):* Provide evidence of the effectiveness of focusing on a learning progression in science teacher education and interventions informed by the progression, through documenting pre-service science teachers' growth as they move through the USU secondary science teacher education program.

APPENDICES

A. Representative Syllabus
B. Teaching Methodology Artifacts
C. Student Artifacts
D. Student Evaluations
E. National Scholars Syllabi Review
F. Peer Observations and Letters
G. Teaching Academy Attendance