

IS THE BEST WE HAVE TO OFFER ONLY IDEAS? A PROPOSAL FOR REFORMING SCIENCE TEACHER PREPARATION

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Vexation

In an era of reform and change (not to sound too political), what does science education research tell a secondary science teacher to do? How can I leave a teacher education program with more than just ideas? Can one accelerate the process to help teachers become effective in the first years or will it always be a time based system where some gradually become effective teachers, others leave and even worse others just survive for 30 years and then take retirement, never having developed tools to teach with that effectively help students to understand.

In 1985 after graduating from college with a degree in teaching math and physics I was lost when I finally was given my own classroom of students. I have reflected back to those first years often and wondered if I did anything to help the students I taught understand some math and physics. I left college with ideas, but that was about it. I liken my experience in education courses as being one of the only math and science teachers and that made me an anomaly in the education classes I was enrolled in. The education courses gave me wonderful ideas but almost no concrete tangible things to take with me when I entered my own classroom. It seems that the courses were building a foundation that can be thought of as the quiver for your arrows. I had the normal courses, adolescent psychology, classroom management, math and science for teachers, measurement and evaluation, student practicums and student teaching. When I received my license to be a teacher and stood in front of 30 students a period, 6 periods a day for 180 days the quiver of ideas was not even close to being able to meet the needs of my students let alone my needs as a teacher. All of a sudden teaching became, "Let's all read section 4.1 to 4.4 today and do the odd numbered problems on page 77-79", that was the reality.

Now I look back on those first years and wonder what could have happened in my education courses that perhaps would have helped me to be able to do more than to have my students read a section of the book and work on the chapter end problems. Could there be a way to not only build a nice pedagogically sound set of ideas, (the quiver) and also put some arrows in the quiver, arrows that become the tools to make the ideas help students learn. These arrows would help a new teacher move from ideas to the reality of being the teacher. Or what is lacking in today's preparation of teachers that would help them to have tools to use when they get in the classroom not just a quiver of ideas!

One can study Bloom's Taxonomy, Gardner's Multiple intelligences, Karplus Learning Cycle, the 5 E's of Instruction, the Moral Dimensions of Teaching, Direct Teaching techniques, Inquiry based learning and a myriad of techniques but without any tools how far can these ideas take you?

25 years after leaving the College of Education in the University that I attended I don't see much different of an approach to the preparation of Secondary Teachers. Same names to the classes, same bunch of ideas, and still very little in arrows that can be put in this quiver. My vexation is how to design science teacher preparation programs that not only build a strong quiver for my students' ideas but gives students arrows that will work in the first year a new teacher walks into that classroom with 30 students 6 periods a day for 180 days.

As for my efforts as a first year teacher I worked hard but fell back into the read section 4.1 through 4.4 and do the odd numbered problems because the ideas were great but the application had not been emphasized, just the idea. Hence an empty quiver! I always wonder if I should contact all of those students that I taught in the first few years and see if they think of the classes that I taught the way I saw myself struggling being ready to be a teacher everyday. Maybe someday I can offer them a refund for the experiment they became for me.

Venture

The basic course work to receive teacher Utah Teacher License through BYU consists of: PhySci 276, Exploration of teaching physical science (40 hr practicum in schools); PhySci 377, Teaching Methods and Instruction secondary physical science; PhySci 378, Practicum in Secondary Education (32 Hours in schools); PhySci 476, Secondary Student-Teaching Internship (15 weeks). In addition, students take: CPSE 402 , Teaching students with disabilities; IP&T 286, Technology in Education; Sc Ed 350, Adolescent Development in an Education Context; Sc Ed 353, Multicultural Education; and, Sc Ed 379, Classroom Management. The course work that is in a physical science teachers' field of focus is taught in the College of Physical and Mathematical Science. Yet during the second year when following student teachers I found that they fell back to practices that even they would have weeks before said were not effective, just to survive. Back to the read section 4.2 - 4.5 and do the problems on page 87-88, kind of teaching.

My venture began to find away to help the students have some tools to go with the framework of ideas that they had been given. I wondered if engaging students using inquiry techniques was a feasible way to change the core

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fibers of the young teacher to see student engagement as the behavior modifier to look for in identifying if student learning is happening.

Since doing a new power point on inquiry based teaching does not seem to change the inner fibers of a young teacher, would an inquiry based course that they participate in as a student promote the change? This led to an idea with two premises. First: If students could actually go through a course that was for them, that was inquiry based for a 15 week semester would it promote change that was significant and lasting? Second: Would I be able to see the difference as I observed them as student teachers, interns and first year teachers where possible?

Physics 313r, Modeling Methods in Teaching Physics was the first attempt. Modeling is what I would call a guided inquiry in the learning physics. Students would actually be taught the Modeling Physics curriculum that was developed at Arizona State University. Then they would student teach and I would observe if the fundamental ideas of the methods and modes that effect student understanding would follow through with these new teachers or would they fall back to the textbook being king and section 4.7- 4.9 would again rule the ideas the teacher had for students learning.

Physics 313r, Castle Electricity was the next class offered and it is a scripted inquiry class in that student set up circuits and measure and observe electrical phenomenon. After each observation of an experiment the students tweak their understanding of electricity and adjust the model they have for electricity. It is much scripted to elicit understanding of what is happening in the wires to electric fields and movement of electrons. The kits needed to teach the Castle Curriculum are quite simple electrical components, batteries, bulbs, compass, capacitors, resistors, genecons (hand held generators), transistors and things general to electricity, but it is important to have the materials that are listed for the class as the manual needs them because of the scripting of the inquiry.

These were added to the physics teaching students options for upper level physics classes they could take. They were able to substitute one of these courses for another 300 level, like advanced optics or another advanced class. Most students who take one of the inquiry courses also take the other course just because of the effect that the first inquiry course has on there understanding of how students learn.

After the first two go 'rounds of these two inquiry courses I have been able to watch student teachers who have taken these courses and those who have not student taught. I am impressed with the effort that the students who have been through these courses have had in trying to engage students in the understanding of physics verses just telling the students what they know and expecting the students to learn what they have been told. Much more than just an inquiry course, the physics 313r course seems to change the way a student thinks about teaching and learning.

In the inquiry course the dialogue of why this method is different and how it differs in helping students learn is discussed often. The inquiry course is not just a content course taught by inquiry methods, but it becomes another teaching methods course. Yet in this inquiry method of learning course the college student is the learner and going to be the practitioner of this type of student engaged teaching. The goal is that by going through the process, looking at the changes in the type of instruction that engages the students in learning by inquiry the new teacher will start to change how they feel students learn by the core value they see in a type of instruction they are now experiencing which is teaching for understanding.

In the end what has happened is that students who chose have up to three science teaching methods course with two of the course being specific content to physics teaching. In the first science teaching methods course we have all the physical science teaching majors in the same section. Earth Space, Physics, Chemistry, Physical Science students are all together. We discuss that wide range of topics that fall under science methods types of courses. But in the final two inquiry based physics courses they are content specific and students experience them as the student in the course and become immersed in the topics being modeled by inquiry styles of teaching. If a student takes both inquiry courses it is a full year in changing the thought process of what does help students learn for understanding.

All in all I feel that one science methods course in the development of young teachers is not enough. I also feel that another venture for another time is the need to talk about what we are doing for the first year teachers by way of induction even after they have left our schools. We may say that they have graduated and moved on so they are not our responsibility. My experience with visiting them is they still need good mentorship during these first years especially the first year. Another vexation and venture for another time.