Student Teachers and Action Research Projects: Developing School Leaders in Science Education

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Classroom-centered action research projects are an important component of the M.S. in Elementary Education Program at the University of Mary Washington's College of Education. This article provides a summary and discussion of the Projects completed by students in the Science Specialization area of the Master's program.

Introduction

In 2003, the Education Department at Mary Washington College (now the College of Education at the University of Mary Washington) moved from an undergraduate licensure program to a five-year licensure program with a M.S. in Elementary Education awarded after the end of the fifth year. Students would still receive their BA/BS degrees and take Education courses during their undergraduate years, but would continue for an additional year, taking only Education coursework and doing a year-long practicum/student teaching internship.

The change was dictated by two factors: an increase in licensure requirements, often causing students to delay their student teaching semester until after they had graduated, and requests from local school districts that we produce new teachers who would also be leaders in their schools. The addition of a fifth year would deal with the first problem. As for developing school leaders, the department decided that this need would best be served by providing students a level of expertise in some area related to teaching. These areas would be called specialization areas, and during the final semester of their undergraduate year, students would choose one of the specialization areas for the following graduate year. The specialization would be developed through graduate level seminars in that area, work with faculty advisors who specialize in that particular specialization, an internship placement with a host teacher skilled in that area, and an action research project, implemented in the internship classroom, developed around some teaching method or strategy focused on the area.

We felt the action research project would be a very strong component of this program. Our view of what action research should be was well articulated by Ferrance (2000):

> Typically, action research is undertaken in a school setting. It is a reflective process that allows for inquiry and discussion as components of the "research." Often, action research

> is a collaborative activity among colleagues searching for solutions to everyday, real problems experienced in schools, or looking for ways to improve instruction and increase student achievement. Rather than dealing with the theoretical, action research allows practitioners to address those concerns that are closest to them, ones over which they can exhibit some influence and make change.
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> (p. vi).

This view of action research would be the basis of the graduate level research class and would guide the development of our student's projects

The specialization areas, which have remained fairly constant since the beginning of the program included: Arts, Foreign Languages, Literacy, Instructional Technology, Mathematics, Science, Social Studies, and Special Education. The number of students choosing a particular specialization varies from year to year. The program graduates about 36 students each year and the number choosing science each year has ranged from two students to five.

The Fifth Year

During the first semester of the fifth year, students take graduate-level coursework in inclusive classrooms, constructivist and developmental teaching, educational research, and their specialization area. They also have a fifteen-hour/week practicum requirement, with practicum work closely linked to their coursework. This practicum takes place in one classroom, in the school where the students will also do their second-semester internship. The grade level for the practicum is determined by the grade level chosen by the student for their internship: if a student chooses to intern in an upper-level grade, the practicum will be in a lower-level grade.

The second semester is the internship (student-teaching) semester. The student will be placed with a host teacher who has expertise and experience in the chosen specialization area. During this semester, along with all the other responsibilities and tasks expected of a student teacher, the student will implement her action research project, planned during the first semester. The results of the action research are presented to an audience of faculty, peers, and host teachers during a research symposium held during final exams week.

Science Specialization

Students who have chosen the Science Specialization enroll in that Seminar for the fall semester of their graduate year. The seminar meets weekly throughout the semester, and it is during this time that the student's action research project is developed. The seminar usually begins with discussions of different strategies and approaches for elementary science teaching, philosophies that might guide the development of science curriculum, and an introduction to materials and technology that would enhance science instruction at the elementary level. Topics that might be covered during the seminar include the use of place-based and project-based learning, the role of mapping and schoolyard-based GIS systems, and the use of new technology such as the Vernier sensors and probes.

During the second half of the seminar, discussion of possible action research topics begins. The students are also encouraged to discuss possible research areas with their second-semester host teacher. As a topic begins to develop, students begin a review of relevant literature and begin to plan research methodology. As the semester progresses, students begin to develop a proposal presentation. This proposal consists of an introduction/rationale, a literature review, and a methodology section. At the end of the semester, during final exam week, the students will present their proposals to a group of faculty and an audience of their fellow graduate students. Each presentation is followed by time set aside for questions and discussion.

The approved action research project is implemented during the second semester in the student's internship classroom. The implementation takes place with guidance from the host teacher and the specialization area faculty member, who also acts as the student's internship supervisor. At the end of the internship experience, the student writes the research paper and prepares a final research presentation. The presentation consists of the previous introduction/rationale, literature review, and methodology, with the addition of results and conclusions sections. The presentation is made to a group of faculty, host teachers, and fellow graduate students.

Science Action Research Projects

This discussion is based on thirteen science specialization action research reports from academic years 2006-2007 through 2009-2010. None of this work has been published, but bound copies of the reports are kept by the College of Education. All of the authors of these reports successfully completed all requirements and were awarded the M.S. in Elementary Education degree.

While all students are urged to choose a topic that is of interest to them, they do seem to draw from three areas: ideas from topics covered during the specialization seminar, ideas from host teachers, and ideas developed as a result of some previous special interest. I will use those three categories to frame the discussion of individual reports, but it is important to note that there is a good degree of category overlap. All projects are developed with input from host teachers and the faculty advisor, so a combination of sources is more common than not.

Ideas from Host Teachers. Three students (Wood, 2008, Snyder, 2009, and Palmer, 2010) worked with a host teacher who was a strong advocate of the use of science notebooks. Palmer (2010) examined the use of science notebooks and the Four-Question strategy in teaching the Scientific Method in a third-grade classroom. She found that while students enjoyed working with science notebooks and were engaged in the process during the times notebooks were used, there was not much improvement in their understanding of the Scientific Method. She felt that time constraints proved a limiting factor. Students were not able to actually perform most of the experiments they designed using the Four-Question strategy. Palmer felt that students at this age must be able to implement the experiments they designed in order to enhance their understanding of the Scientific Method. Snyder (2009), in a study examining the overall benefits of using science notebooks in a fourth-grade classroom, found that while the notebooks were enjoyable and engaging they also provided a student-generated reference text for the material covered during science units. In a sense, students were creating their own textbooks. Wood (2008) studied the use of science notebooks in a first-grade classroom. She found that meaningful use of science notebooks at this age level must include introducing the notebooks early in the school year, beginning with a high level of structure for observations and ideas, and a gradual increase in complexity of assigned notebook tasks.

Ideas from the Specialization Seminar. Four students (Fultz, 2007, Mallory, 2007, Siebert, 2009, and Tripp, 2009) chose to develop an action research study using technology that

was introduced during the specialization seminar. Fultz (2007) studied the use of a Webquest in a unit on habitats in a third-grade classroom. While students enjoyed the opportunity to work with computers and enjoyed visiting the teacher-selected sites, they often struggled with gathering relevant information from the website. Students might find a website engaging and entertaining, but not see it as a source of information. She suggested that providing a high level of scaffolding and teacher-modeling of information gathering would be very important in helping students make meaningful use of Webquests. Mallory (2007) designed a Virtual Field Trip to prepare first-grade students for an upcoming field trip to the Science Museum of Virginia. She found that the Virtual Field Trip provided a high level of scaffolding for the actual visit, helping students to better understand the organization of the museum and the various exhibits they viewed during the field trip. Siebert (2007) introduced Vernier temperature sensors and the accompanying Logger Lite software to a second-grade classroom during a unit on temperature and thermometers. She found that not only were the students highly engaged by the technology, but they were also much better able to understand the process of graph making through observation of the real-time graph created during Vernier sensor experiments. Tripp (2009) paired traditional journal-based reflective writing and a Webquest in a fifth grade unit on the five kingdoms. She found that the daily reflections in student journals provided an excellent assessment of how work was progressing on Webquests. The reflections not only enabled her to assess student progress, but allowed her to make adjustments in the Webquest assignment as it was moving forward.

Ideas based on Student Interests. Research projects produced by five students (Brooks, 2007, Rasmussen, 2007, Vinagro, 2007, Litz, 2009, Taylor, 2009, and Mulligan, 2010) fall in this category. Brooks (2007) examined the use of paper and pencil vs. computer generated concept mapping in a third grade unit on living systems. She noted that while students found the process of creating concept maps on desktop computers enjoyable and engaging compared to paper and pencil maps, they found the task very frustrating when using handheld computers or Personal Data Assistant devices because of the small screens. Rasmussen (2007) studied the use of student-created dioramas as an assessment tool for a second-grade unit on habitats. She found that the students were better able to communicate their understanding of science concepts through their creation of dioramas than through the use of typical pen-and-pencil assessments.

Vinagro (2007) studied the use of digital and standard light microscopes in a fifth grade unit on cells. She found that the use of digital microscopes should be preceded by the use of standard light microscopes. The many features available in the digital microscopes often interfered with the primary purpose of the unit, examining cells. Litz (2009) examined the use of an art project as both a learning tool and an assessment tool during two third grade units on the Earth and Moon and the water cycle. She found that the art projects provided an excellent way for students to express their understanding of science concepts through a means that allows for personal and creative expression. Taylor (2009) studied the use of children's literature to develop critical thinking skills in a second-grade classroom. She found that through a careful choice of books with a strong link to a particular content area (in this case seasons), critical thinking skills could be taught in a way far more engaging than direct instruction. Mulligan (2010) developed an innovative, structured approach for working outside with first-grade students. Through the use of small magnifiers, science journals, and plastic hoops, she provided a framework that engaged students in the process of observing and recording those observations.

School Leaders

The process of developing and implementing an action research project produced a number of benefits for these students. They successfully engaged in highly reflective teaching, they became accustomed to the notion of researching a teaching strategy or approach before bringing it into the classroom, and they learned the importance of designing an assessment strategy that would inform them of the success of their practice. Have they become leaders in their schools in some aspect of science education? I believe they certainly have that potential and through conversations and work with former graduate students and their colleagues and administrators, I believe they have acted on that potential. They are comfortable with the techniques and strategies they made use of during their research and they have the ability to articulate those experiences. Confident classroom application of these ideas is often noticed by colleagues and their colleagues want to learn how to implement these ideas in their own classrooms. These new teachers have, on several occasions, been asked to lead development workshops emphasizing the techniques they make use of in their classrooms. I would say that they have become school leaders in a very real and practical sense.

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