Outsider on the Inside: A Cultural Analysis of the Development of the Scientific Academic Culture

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Joseph Stephen Covert

B.S., Jacksonville State University, 1995

This dissertation: "Outsider on the Inside: A Cultural Analysis of the Development of the Scientific Academic Culture," by Joseph Stephen Covert, is approved by:

Dissertation Committee Chair

Dr. Richard W. Schmertzing
Professor of Curriculum, Leadership, and Technology

Researcher

Dr. A. Lorraine C. Schmertzing
Professor of Curriculum, Leadership, and Technology

Committee Members

Dr. Ericka Helena Parra
Associate Professor of Spanish

Dr. Matthew Richard
Professor of Anthropology

Acting Dean of the College of Education

Dr. Brian L. Gerber
Professor of Secondary Education

Acting Dean of the Graduate School

Dr. James T. LaPlant
Professor of Political Science

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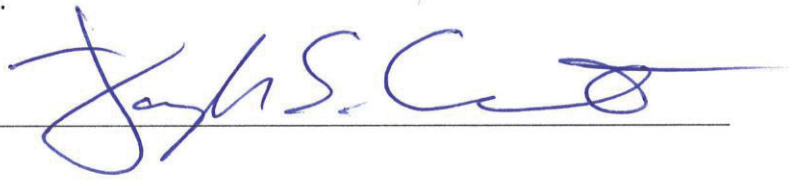
Signature 

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ABSTRACT

This dissertation examines the development of awareness among learners and teachers about the cultural values associated with science. Like any human endeavor, the discipline of science has a unique set of cultural values that are foundationally important to understanding the way in which humans engage in the scientific endeavor. The current study began as an ethnographic study focused on the impact of a single-sex schooling initiative, but morphed into a larger study investigating the origin of awareness of the cultural values of science as an academic discipline. Initial ethnographic observations of students in single-sex classrooms highlighted the unique approaches to science learning that occurred spontaneously among students in all-boy versus all-girl classrooms. These changes were durable and evident across classrooms within a school year, as well as across school years with different groups of students. The larger question of how these approaches to learning emerged, with specific emphasis on the role played by teachers in introducing the students to their approaches to science learning that emerged from my classrooms observations became of the focus on my dissertation research. To address the question about the sources of academic cultural knowledge, a group of classroom teachers were studied, looking for signs of cultural affiliation to science. This investigation of teachers indicated a clear lack of cultural knowledge about science among the teachers, raising questions about the efficacy of teacher preparation programs. My dissertation research concluded with an autoethnographic analysis of the researchers' own journey into science and teaching. Overall, the findings of my dissertation resulted in suggested modifications to the way that teachers are prepared to become science teachers.

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ACKNOWLEDGEMENTS

During my journey through academics I have been lucky enough to have several mentors who provided valuable guidance along the way. Dr. George Cline (aka Dr. Frog) was one of my beacons during my undergraduate studies, showing me the living, breathing aspects of science that do not readily appear in textbook accounts of science. Dr. Donald McGarey was my other beacon during the undergraduate years, giving me a realistic view of life inside the laboratory, as well as valuable life and professional lessons. It is through the actions of Drs. Cline and McGarey that I was introduced to undergraduate research, winning my first research grant and then presenting the findings of my work at state and regional research conferences.

As a graduate student, I can count Dr. Richard Schmertzing as the brightest light, guiding me through the realms of educational research, helping me to make sense of my path through the field. Our conversations have provided invaluable insight into the world of educational research and the importance of listening to the individuals we are studying. Without question, becoming the student of Dr. Richard Schmertzing helps to convince me that there might be a thing called destiny because if I had finished that first doctorate in biological oceanography all those years ago, our paths would likely not have crossed. Richard is a world-class mentor, and someone I look forward to calling colleague upon earning my doctorate.

In addition to Dr. Richard Schmertzing, I would like to thank the members of my committee for their efforts. Dr. Lorraine Schmertzing provided timely editorial advice and commentary on research methods, as well as keeping the ball rolling forward throughout the dissertation process. Dr. Ericka Parra provided valuable insight into Hispanic culture, which was very important in the early stages of my research. Finally, I would like to thank Dr. Matthew Richard for his contributions to my understanding of the origins of culture.

Finally, I would like to acknowledge the importance the late Jeffrey Weeks has played in my development, as teacher, scholar, and human. I taught with Jeff for four, too short years. Jeff was a world-class teacher and a knowledgeable mathematician. This mix of teacher and academic is the role that I try to emulate every day in the classroom. Jeff's lessons helped me learn how to connect with my students, learning to challenge the student academically, while providing them personal support. My life is better for having known and worked with Jeff.

DEDICATION

I dedicate this dissertation to my family – Wendi, my beautiful wife who has had to bear more of the load raising our beautiful family, and to Aaron, Jacob, and Catie Grace, who have put up with an absent and, when present, cranky father. Time for us all to go outside and play! I would also like to dedicate this dissertation to my parents, Stephen and the late Candace Covert, who provided unfailing support throughout the years as I have explored the worlds of music, science, and education, support that undeniably set the stage for the dissertation that follows.

I. PRELUDE

How do learners become members of the academic communities and cultures of the subjects they are studying in their classes? This is a question that arose during the midst of an ethnographic study of the implementation of a single-sex schooling initiative at a primarily Latino elementary school in the southeast United States. In this dissertation, I explore the introduction to and acculturation into academic cultures, with particular emphasis on science, beginning with a participant observation study of students and teachers in fifth grade classrooms and concluding with an autoethnographic exploration of my own introduction and immersion in the academic culture of science. The title of my dissertation is "Outsider on the Inside: A Cultural Analysis of the Development of the Scientific Academic Culture," and in all cases, the theme of outsider on the inside is emphasized, although in somewhat different ways, as the people I am studying are at different points on the journey to understanding the culture of academic fields in which they are immersed.

This is a story of a journey, or more accurately, the story of many journeys, all with a common destination, the journey towards knowing the culture of an academic subject. During the early phases of my doctoral studies, I realized that qualitative methods were going to be the best and most appropriate methods of study for me because I am keenly aware of the interactions within systems. My selection of qualitative methods was surprising to many who know me because I am a scientist and science teacher. Many assumed that my background would naturally lead to my selection of

quantitative methodologies. Quite to the contrary, my prior training in ecology, where understanding the interaction between members within a system is at the heart of the discipline, drew me towards qualitative methods. My ecological training taught me about a way to view the system, which composed of many interlocking and interacting parts and subsystems, as a holistic entity that could be studied. From this holistic, systems view, it was clear to me that the understandings about how students and teachers perform the activity we call school, which interest me so greatly, required the methods of qualitative inquiry, particularly participant observation and ethnography. My interest in ecology began expanding to include how humans learn science, and towards that end I set upon a career as a teacher.

For the 10 years prior to beginning my dissertation research, I was first a high school teacher and then a college professor. During my time in the classroom, I became increasingly aware of the importance of studying the interactions between the humans involved in the endeavor of teaching – teacher-to-student, student-to-student, and teacher-to-teacher. Teaching is a living and breathing endeavor that is very dynamic. My belief was that focusing my research on these qualities of the teaching and learning within a school, would appeal to my ecological self. During my exploration of qualitative methodologies, my interest in ecological fieldwork pointed me in the direction of ethnography.

Of all of the qualitative methodologies, ethnography was the most appealing to me because of the keen focus on what people are doing and how they subsequently engage in the culture. Initially, I wanted to focus my research on what factors led males into elementary school teaching following observations I made during my time as a

college professor working with future elementary school teachers. During my work with preservice elementary teachers, as well as inservice elementary teachers and schools, the lack of males entering or presently employed as elementary school teachers became quite apparent. I conducted interviews, as well as reviewed existing literature on the topic, and I was convinced that this was an interesting and relevant area for me to study. However, while doing early preliminary work on males as elementary school teachers, I came across an article that highlighted the active and current discussion about single-sex schooling in the United States. The discussion about single-sex schooling focused on whether or not there is scientific evidence to support the sex- or gender-based segregation of students in K-12 classrooms. The debate was particularly interesting and relevant to me because I was working at an elementary school that had recently begun a single-sex schooling program throughout the entire fifth grade. It is fair to say that becoming aware of the discussion about single-sex schooling changed my dissertation research path.

Moving the focus from the isolated teachers, either those preparing to teach or those already in the classroom, to the classroom and school level opened me up for a much more genuinely ecological study, which I took as a welcome opportunity. My original plan, and the subject of my research proposal (which can be found in Appendix A of this dissertation) was to conduct an ethnographic study focused on the students and teachers in the fifth grade of a school that was in the midst of implementing a single-sex schooling initiative. I already had access to the school in question and was therefore already known by the majority of the teaching staff, along with many of the students, as I had been working as a university professor teaching classes and supervising student teaching interns at this school, so adopting an ethnographic stance in this school was an

easy transition. My field observations and interactions for this study occurred over the course of a year and a half during my presence in the school a minimum of 2 days a week throughout that time. I was focusing on how girls and boys responded to the intervention of separating students based on sex/gender. During my study, an interesting and durable pattern of differential student engagement and participation emerged: boys working as individuals, loosely affiliated with each other; girls working in stable, defined groups, that showed high degrees of structure and organization. As the study progressed, my interest about how this clear and sharp division evolved.

The question that emerged during my ethnographic study of single-sex schooling was about how the sharp division taken by boys and girls arose. Instead of a direct answer, two related questions emerged: (1) how are teachers introduced to the cultural values and mores of the academic areas they teach? and (2) how do teachers share this knowledge of the academic cultures with their students? As a former scientist and current science educator, I was obviously focused on the way that culture of science values and mores were being brought into the classroom by teachers. This emergent question changed the focus of my study from being exclusively about how the single-sex schooling initiative impacted the learners to an inquiry that begins by looking at the emergence of learning cultures within single-sex classrooms, with emphasis on science learning; expanding outward to an analysis of how teachers were prepared to teach science, with emphasis on the sharing of the cultural values of science; and finally concluding with an autoethnographic account of my own journey through science and science education, looking for the signs of my own introduction to the cultural values of science. Starting out, it was not my intention to involve myself so clearly in the study,

but as I continued my way through the process, I found my own journey through academics was a very important part of the story.

This dissertation is built in the journal-ready model in which the dissertation research is presented in three journal-ready manuscripts. What follows is a collection of these journal-ready manuscripts that examine the issue of transmission of the academic culture of science, with an ever-narrowing focus yet higher resolution image, on subjects in the midst of learning about and demonstrating the views and values associated with the culture of science. I conclude the dissertation with a brief essay in which I draw some general conclusions about my research and reflect on the implications my research has for teacher education. The Appendices contain my research proposal, which includes a literature review that focuses on the study of a single-sex schooling initiative at a predominantly Latino elementary school, as well as all of the required IRB and school system approvals for my work in the school.

MANUSCRIPT I

THE DEVELOPMENT OF CLASSROOM ACADEMIC CULTURES BY STUDENTS IN SINGLE SEX CLASSROOMS

Joseph S. Covert

Valdosta State University

Department of Curriculum, Leadership, and Technology

This manuscript is prepared for submission to *Cultural Studies in Science Education* and is the first of three manuscripts prepared for this journal-ready doctoral dissertation. Style guidelines are provided immediately following the references of the manuscript.

The development of classroom academic cultures by students in single sex classrooms

Joseph S. Covert
Richard Schmertzing

Abstract In this ethnographic case study of the implementation of single-sex schooling at a predominately Latino elementary school, we examined the development of academic cultures by students in science learning situations. This school is one at risk of failing to meet state requirements for Adequate Yearly Progress (AYP), which led this school to discontinue teaching science and social studies as a regular part of the curriculum. As a consequence, students were not exposed to science learning and teachers were not involving themselves in on-going development as teachers of science. Single-sex schooling is one of many initiatives that were implemented at this school to improve student achievement and, in this study, we investigated the impact of single-sex schooling on academic culture creation in all-boys and all-girls classrooms.

Keywords single-sex schooling • science education • ethnography • culture • boys and girls

Joseph S. Covert
Department of Teacher Education, University of North Georgia, 82 College Circle, Dahlonega, GA 30597, USA
e-mail: joseph.covert@ung.edu

Richard Schmertzing
Department of Curriculum, Leadership, and Technology, Valdosta State University
Valdosta, GA 31698, USA
e-mail: rwschmer@valdosta.edu

Schools and school leaders are always looking to improve the educational experience and academic achievement of their students. One such method that schools have employed has been to reorganize their classes, and in some cases entire schools, based on the sex of students. Sex-based schooling, however, was illegal in public schools until Title IX was revised in October 2006 allowing single-sex programs in publicly funded schools (Chadwell 2010), and this change has been implicated in the expansion of single-sex schooling environments, at the class, grade, and school level, across the United States (Wiegert and Che 2010). Research on single-sex schooling has not, however, kept up with the proliferation of single-sex programs. Researchers have noted gaps in the literature with regard to the impact of single-sex schooling in elementary school settings (Mael, Alonso, Gibson, Rogers and Smith 2005), among low socioeconomic status (SES) and Latino populations (Baker 2002), and unequal learning opportunities, with an emphasis on scientific argumentation skills, that are afforded to students in single-sex settings (Glasser 2011).

Rebecca Bigler and Margaret Signorella (2011) identified several factors that led to the resurgence of single-sex educational programs in America: first, exclusion of boys from classrooms was suggested as an effective way of increasing the academic achievement of girls; second, the low scores of American students on international education comparisons; and third, claims about differences in male and female brain anatomy. The move towards single-sex schooling is occurring in spite of research that indicates mixed results in terms of long-term academic improvement (Mael et al., 2005) and questions about the long-term negative impact of single-sex schooling on the development and reinforcement of gender and racial stereotypes (Bigler and Signorella

2011). Mael et al. (2005) noted that the majority of studies on single-sex schooling have focused on secondary and post-secondary levels, with many fewer studies on single-sex schooling at the elementary level, and there is also a noted tendency for studies to focus on all-girls schools, rather than all-boys schools. Bigler and Signorella (2011) added that the majority of studies have been conducted in private, often times religiously affiliated schools.

Rosalina Diaz (2006) made the case that there are several issues in Latino culture that should be considered when working with Latino and Latina students: first, there is a history of Latinas being taught in single-sex settings that dates back hundreds of years; second, Latino/a teachers typically emphasize respect, discipline, and responsibility, qualities which are less evident in American schools; and third, Latino culture has strongly defined gender roles that can interfere with the ability of females to pursue careers outside of the household.

We first became aware of the nature of the controversy about single-sex schooling with the publication of the article entitled "The Pseudoscience of Single-Sex Schooling" (Halpern et al., 2011). Upon further reading of the literature, it became clear that there were two opposing *perspectives* regarding this matter: those who argue there are cultural differences between male and female students, which is referred to as the single-gendered ecosystem theory (Wills 2007), and those who see no biological or psychological difference between students and therefore see no justification for segregation based on gender, which was set forth in Janet Hyde's gender similarities hypothesis (2005/2007). It was the cultural angle that we were most interested in and chose to pursue in this investigation.

The concept of culture has been a central point of discussion within anthropology for the last 50 years (Erickson 2011). For the current study, we used the definition of culture from David McCurdy, James Spradley, and Dianna Shandy (2005) who defined culture as a type of knowledge that is learned by and shared among members of a group, defines the range of behavior for members, and helps members to interpret their experiences. McCurdy et al. (2005) further distinguished cultural knowledge from personal knowledge by outlining four key aspects of culture: culture is learned and not biologically inherited; cultural knowledge is a shared form of knowledge that is not unique to individuals; culture is used to generate behavior; culture is used to interpret experience.

Frederick Erickson (1997) noted that humans are part of the continuous and on-going construction of culture. Foley, Levenin, and Hurtig (2000) refined this point in the area of education stating, "education is a culture, that is education involves the continual remaking of culture human beings transmit and acquire the symbolic meanings that infuse social life" (p. 38). Extending the notion that education is an on-going and dynamic cultural experience; Ashley Maynard (2004) stated that education could be a cross-cultural experience for learners when the culture of the school does not closely match their home culture.

Science represents a culture (Maddock 1981) with unique values, meanings, and symbols that involve social interaction (Cobern and Aikenhead 1998). William Cobern and Glen Aikenhead (1998) further stated that the explanatory power of science leads to invasions of other systems of meaning that students harbor. Maxwell Maddock (1981)

argued that science education must assume an anthropological perspective to progress as a discipline.

In this study, we looked at the impact of institutional level sex-segregation on learning outcomes and the learners themselves. Our research is centered on the following questions:

1. Did the implementation of single-sex schooling lead to positive learning outcomes as measured by high-stakes testing?
2. How do students represent and enact the culture of science within sex-segregated classrooms.

Methods

Research Setting

During the 2011-2012 academic year, Oaks Elementary School (Oaks E. S.) (pseudonym) adopted and implemented a single-sex schooling model throughout all of the classes in the fifth grade. The majority of the students at Oaks E.S., which is located in a metropolitan area of northeast Georgia, were first generation Latino immigrants, with 95% of the students being recognized as Hispanic (The Governor's Office of Student Achievement 2011).

In contrast to the student body, 90% of the teaching staff at Oaks E.S. was White, and females made up the majority (96%) of the teaching and administrative staff during the 2010-2011 school year, the most recent reporting year available (The Governor's Office of Student Achievement 2011). The students at Oaks E.S. came from households of lower SES, with 99% of the students having received free or reduced lunch in 2011, which was a significantly higher percentage than the average for the local school system

at 59% (The Governor's Office of Student Achievement 2011). The school was also near colleges and universities and served as a site for teaching interns to complete training requirements.

Participants and Procedures

The situation at Oaks E.S. represented the interaction of a number of different cultures, the Latino culture of the majority of the students, the White culture of the majority of the teaching staff (all of the fifth grade teachers, administrative staff, and preservice and inservice teachers), and the cultures of a school and the academic disciplines, which led us to take an ethnographic approach to this study. Throughout this report, all participants are identified with pseudonyms. The two primary approaches used were participant observation (Erickson 1992) and ethnographic interviewing (Madden 2010).

The first author was frequently at the school to the point that he assumed the role of active participant (DeWalt and DeWalt 2011), having engaged in many of the activities within the school, short of becoming employed as an elementary school teacher. Prior to and throughout the course of this study, he met regularly with administrators, instructional coaches, teachers, and support staff, and was on a first name basis with the majority of the staff at the school, so his presence was not that of an outsider. He led professional learning workshops for teachers at Oaks E.S. on the subject of science inquiry, and was consequently known in the school as "Joe the Science Guy." He taught university classes at Oaks E.S. that included a component where his students went into the classes of Oak E.S. to teach science and he observed many of these lessons. During the course of the study, he supervised junior and senior preservice teaching interns placed

at Oaks E.S. Due to his observations of student interns in the classrooms, he was also known to many of the students in the school, although not necessarily by name.

Throughout the process of participating in the community at Oaks E.S., the first author conducted semi-structured ethnographic interviews with key informants, including the principal of the school and teachers in the fifth grade. These interviews were typically of an informal nature, with a few critical questions/prompts used in most cases, which included:

- What is your personal experience with single-sex schooling?
- Describe your experiences with single-sex schooling at Oaks E.S.
- In what ways were you involved in the implementation of single-sex schooling?

During the field research component of the study, field notes were taken that contained observations of classroom behaviors and interactions with various stakeholders in the school, including students, teachers, student teachers, instructional coaches, administrators, and various staff member. A Livescribe Echo pen, which records audio while simultaneously capturing images of text written in a Livescribe notebook (Livescribe, 2013), was used during all observations to capture audio recordings of the classroom environment. Additional data came from artifacts generated by the students and school records, such as results on high-stakes testing, as well as attendance and discipline records.

Analysis

Elaborate field notes were taken by hand during observations of instruction. A Livescribe pen was used to take notes, which allowed for the recording of audio throughout the collection of field notes. Once out of the field, these notes were converted

to digital text and the audio recordings were used to clarify and elaborate on notes taken in the field. Notes were then coded using a primary set of codes: students involved (i.e., all-boy, all-girl, or coed), type of adult involved (i.e., inservice teacher, preservice teacher, other academic professional, administrator, informal educator, or researcher), academic subject of observed lesson, type of lesson (i.e., teacher-centered vs. student-centered), and behavior (i.e., negative behavior, positive behavior, or talkative). A smaller list of secondary codes, including language used by students, types of instructional technology used in lesson, and user of instructional technology, was also used, but these results are not presented here. The coded notes were then categorized and larger themes of student engagement in science instruction were observed. Memos were written throughout the research process, allowing the researchers to reflect on the significance of observations and patterns that emerged throughout the process.

In addition to observations, data on student performance on high-stakes testing and student opinion surveys were gathered in order to triangulate the data. Member checks occurred during the study, through conversations with the faculty members and informal conversations with students.

Findings

Development and Implementation

The school chose to enact the single-sex schooling initiative in the fifth grade to improve the "focus" of the students, with particular reference to the boys (interview with Mrs. Daisy). According to the principal, this initiative was introduced by one of the fifth grade teachers. During the first year of the program, which was the 2011-2012 academic year, there were initially 2 all-boys classes, 2 all-girls classes, and 1 coeducational class. Mid-

way through the first year, students in the coeducational class were transitioned into all-boys or all-girls classrooms, with the total at the end of the year being 3 all-boys and 2 all-girls classes. During the second year of the implementation, the fifth grade had 2 all-boys, 2 all-girls, and 2 coeducational classrooms throughout the entire academic year.

None of the teachers or administrators from this school received any training on single-sex schooling. The only report of preparation for this initiative was by one of the teachers who read several trade books on the subject prior to the first year of implementation. Also, none of the staff or administrators were aware of the controversies in the literature on the subject of single-sex schooling.

Results from High-Stakes Testing

After 2 years of single-sex schooling in the fifth grade, the results on state-mandated, high-stakes testing show an overall decline in student performance in Reading and English/Language Arts and minor changes in student performance in Mathematics and Science (Table 1). The 2010-2011 scores were included in the analysis to serve as a basis for comparison because this was the year just prior to the single-sex schooling initiative and all classes in the fifth grade were coeducation. When the data is disaggregated by the sex of the student, there were interesting patterns in the performance of males and females. In Reading, the scores for males declined in 2011-2012 and 2012-2013. Female scores in Reading were also lower in the first two years of single-sex schooling, but then increases in 2012-2013, the second year of single-sex schooling. In English/Language Arts, scores for male students increased during the first year of single-sex schooling, but then declined during the second year. English/Language Arts scores for females declined during each of the two years of the single-sex schooling initiative. The Mathematics

scores for females were lower in the 2011-2012 school year, but rose to the highest pass rate, 94.8%, for mathematics during the entire period of study. During the first year of single-sex schooling, the average pass rate for male students increased, but then declined during the second year. Science scores initially declined for both males and females during the 2011-2012 school year, but then increased to an average pass rate higher than during the 2010-2011 school year. While science scores did increase between 2010-2011 and 2012-2013, a disturbing trend emerged where the distance between male and female performance increase. In 2010-2011, the difference between male and female average pass rates was only 3.5%, but in the 2011-2012 and 2012-2013 school years the difference rose to 8.9% and 5.2%, respectively.

Vignettes from the Classroom and Field

Mrs. Evans and Mrs. Daisy's boys. The teacher at the center of the single-sex initiative, Mrs. Daisy, split her time between an all-boys classroom in the fifth grade as a co-lead teacher and as an academic coach/reading intervention specialist for both boys and girls in all grade levels. When Mrs. Daisy was not in the room, Mrs. Evans took over and primarily taught math and social studies; Mrs. Evans also served as an academic coach/math specialist for the entire school when not teaching the fifth grade class. The classrooms of boys they shared across the 2 years were most representative of the male pattern of single individuals wrestling with the content of the classroom.

Mrs. Daisy was the originator of the single-sex schooling initiative within this school, and she was the greatest champion of the program. Among the benefits Mrs. Daisy saw in the single-sex program, two stood out. The first was the sense that "building community seemed to be a little bit easier" in an all-boys classroom versus in

coeducational classrooms that she had taught in previously. Her view was that boys were not acting out at the expense of each other to impress girls. This vision of a classroom as a community was evident during the majority of observations of Mrs. Daisy's classroom. The boys always demonstrated a sense of brotherhood and concern for one another. An example of this concern was witnessed when one of the boys very cautiously and quietly sharpened his pencil, looking around at the room observing the reaction of his fellow students. Also, there was clear sense of mutually shared warmth and affection between Mrs. Daisy and the boys in the classroom. Mrs. Daisy was always complimenting the boys on their work and encouraging them to try harder. The second theme was the idea that the separation of students by sex led to a situation where students of "both genders were able to ask more questions while learning and engaged in activities." From Mrs. Daisy's view of the classroom situation, sex segregation created the setting for better learning for students of both sexes because the students were not engaged in competition with one another for the attention of students from the opposite sex. While Mrs. Daisy's room was more community focused with less outward competition, the boys spent considerable time working individually. During many hours of observation, it became clear that the boys in this class preferred to work independently, asking for help more often from Mrs. Daisy than from other boys.

The journey of Mrs. Orion. One of the teachers involved in this single-sex schooling initiative began working at this school as a preservice teaching intern. This teacher will be identified as Mrs. Orion, and she was first tasked as a preservice teaching intern with teaching an all-boys class. This class was composed of students identified as low academic performers and/or those having behavior issues. As a preservice teaching

intern working in a single-sex classroom, Mrs. Orion was not given any training on teaching students in a single-sex classroom, a fact that she later told us she regretted. She felt that she had been thrown into a difficult situation by being placed in an all-boys classroom composed of the lowest academic performers and students with behavior problems in other fifth grade classes at a personally challenging time as she was beginning her student teaching. Mrs. Orion spent 6 months teaching in this all-boys classroom, and she was successfully able to connect with the boys, thereby bringing some order and learning to this group of students. Mrs. Orion told us that she believed her success with this group was due to her interest in racecars and hunting. Sharing these personal details helped her gain the attention of the boys in her class. After graduating, Mrs. Orion got a job at Oaks ES teaching in the fifth grade and was given an all-girls class, in contrast to the all-boys class in which she had just completed her student teaching.

Mrs. Orion made the transition into the all-girls class and there was a great deal of affection that built up between Mrs. Orion and her students. However, she stated quite openly that she would have preferred to be in an all-boys or coed setting. The state of affairs was best observed by Mrs. Orion when she told us that she was having a difficult time connecting with the girls, who were less direct than the boys and that the "girls are hiding things from me." Observations of Mrs. Orion's all-girls classroom supported the notion that the students were being quiet and not easily or freely sharing their thoughts or feelings with Mrs. Orion. This was in stark contrast to the way the students in the all-boys classes interacted, who were very eager, even to the point of being over eager, to share nearly anything with her. All the while, there was a clear bond between Mrs. Orion

and the students in her all-girls class. One of the ways the students made a connection with Mrs. Orion was through her hunting tales.

Mrs. Orion, while having been a cheerleader in high school, was a frequent and avid deer hunter. During hunting season, she would recount her hunting stories with the students, showing them pictures from the hunt. After some initial shock at the sight of Mrs. Orion in her hunting gear, as well as pictures of the animals she had hunted, the girls were very eager to hear new tales from Mrs. Orion. Due in part to Mrs. Orion's love for the outdoors and her general interest in science; Mrs. Orion's all-girls classroom provided the clearest example of the all-girls culture of science learning.

When compared to all of the other classrooms in the fifth grade, Mrs. Orion's all-girls class provided the best and clearest example of a collaborative, science classroom. This was due in large part to the fact that Mrs. Orion placed the greatest emphasis on science more than any other teacher in the fifth grade. She endeavored to bring science into the classroom throughout the school day through direct and indirect methods. It was directly brought into the classroom by her teaching a science lesson nearly each school day. The indirect means of bringing science into the classroom involved integrating it into other subject areas, for example having the students read a book on a standards related science topic during the reading/language arts instructional segment.

The positive signs of science instruction in Mrs. Orion's classroom were in contrast to the general omission of this subject throughout the rest of the fifth grade on a regular basis. During one of my visits, Mrs. Orion was discussing soil erosion with in her classroom. This lesson began with a review of the previous week's lesson, as well as watching a video on the subject. Throughout the discussion and video, the girls were all

very engaged in the activity, being focused and quiet when appropriate and engaging ub discusion when dictated by the activity. Then the class went outside to look for erosion and all of the girls were actively engaged in the process, with groups of girls fanning out around the playground looking for signs of erosion. The groups identified several areas that had clear signs of erosion and were eager to record their observations in their class notebooks, as well as share their findings with other groups. There was great collaboration among students, as well as enthusiasm for this work. One student told me "Lori really loves science." Mrs. Orion agreed with this statement and added, privately to me, that Lori had shown a high aptitude and interest in science over other academic areas. This collaborative behavior was also highly evident away from school, while the students were attending a day long field trip to a local nature center, which included a 90-minute boat tour focused on the ecology of a local lake.

On the same boat, but worlds apart. During each of the years of this study, all students and teachers in the fifth grade went on a field trip to a local lake to participate in an educational program presented by a local nature center. This trip involved two components, with each lasting roughly 90 minutes: (1) a trip out onto the lake to complete water chemistry testing and to make observations of the biology of the lake and (2) a study of the importance of forests to the health of watersheds and lake ecology. Among the many situations observed in this study, the most striking examples of student learning behavior that differed by sex occurred on the boat portion of the tour. During a typical day at school, boys and girls were not routinely in coeducational settings, with the exception being some of the elective classes, such as art and PE. When provided the opportunity to mix into coeducational groups when boarding the boat on this field trip,

one might anticipate that students might choose to more freely mix between boys and girls. This was, however, not the case. Instead students overwhelmingly chose to sex-segregate themselves. So, from the very beginning of the field trip, students were independently maintaining the sex-segregation patterns produced by their classroom experience.

Once in their sex-segregated groups, the sex differentiated patterns of grouping and interaction appeared. With the boys generally working as individuals and the girls working in collaborative groups. In some cases there were individual boys who were actively seeking out answers to questions they had on the boat tour. One student in particular, Charles, spent a considerable amount of time during the boat tour moving as an individual from station-to-station, peeking in on what one group was doing one moment before quickly moving on to read the Coast Guard warning sign on the boat, and finally getting his hands on a colorimeter to help make a measurement. While Charles serves as the example, there were numerous other observations of boys acting as independent agents of their own learning.

Girls, in contrast, typically worked in small groups, collaborating with one another, and being quiet while the instructors were speaking. The order and management of all-girls groups was established and maintained by the girls, without much visible or vocal effort by the girls in the group to establish or maintain the order. There were times when the structure broke down and girls did not form the collaborative groups, but this breakdown was more of an exception than the rule. During one of the boat trips, the seemingly self-organized order was challenged by an itinerant boy who was moving around the boat in a manner similar to that of Charles. When this boy joined the group,

without asking to gain entry, the girls gently, but forcefully told him that "We're going to do it together," when the boy asked for a turn at completing the science task. The boy responded that he still wanted to immediately take a turn, but the girls did not allow him to impose his will on the group. Eventually, the boy left the group because he was frustrated that he was not able to satisfy his approach to learning in a timeframe that suited him. From these observations of students in the field trip setting, it became clear that sex-based grouping was present on the field trips.

During observed field trips, the students consistently demonstrated patterns of behavior and interaction that were consistent with the observed patterns from their single-sex classroom settings. Being moved into the informal science settings present on the field trip (i.e., on a boat and in a forested picnic area) did not disrupt the established patterns of girls working together in small cooperative groups and boys acting as individual learners. Regardless of the setting, the sex-based learning approaches observed among the boys and girls in continued to occur. This indicated to us that these student generated learning cultures are durable, persisting across various settings. It was not the case that all of the girls acted as perfect group members, nor that all of the boys acted as eager free-agents of learning, but the exceptions do not undermine the pattern that was observed. An interesting additional finding is that the first year group of students went on the trip in May, at the end of the school year, while the second year group of students attended the field trip in the middle of October. This observation indicates that there is something inherent in these single-sex groupings that does not necessarily require an entire academic year to develop.

What did the students have to say?

At the end of the first year of single-sex schooling initiative, the teachers surveyed students about the single-sex program with three questions: "What was the difference in this year and last year when you were in a mixed class?" and "Do you think we should do it again next year? Why?" Teachers looked at the general results of the survey, tallying Yes, No, and Maybe responses. In general, the results indicated overall support of the initiative by the students; 71% of the students supporting the idea of continuing single-sex schooling with the next group of fifth grade students, while 26% did not think the initiative should be continued. Support for single-sex schooling was stronger among boys with 75% favoring single-sex schooling in contrast to the girls where only 63% favored continuing the program.

When looking for themes found across all student responses, the results in both boys' and girls' classes were very similar. In general, students thought the single-sex schooling environment was an improvement over the coeducational classes they were in during the fourth grade with two consistent themes of fewer distractions, reporting increased focus and concentration, and fewer boy-girl issues. For example, one of the girls stated, "The difference was because we can learn better without guys and with guys you don't really pay attention much." One of the boys responded similarly, "The difference was that you can talk more to your friends and you won't be afraid to say a (sic) answer when the teacher says a question."

Among the boys, improved grades was a theme of importance that emerged in a number of responses, for example this typical response from one of the male students "I think we should because I have better grades now than last year." It should be noted that this sentiment was reflective of changes in grades on teacher-graded assignments and not

necessarily on grades for high-stakes tests. This disconnect is an important and significant issue given the importance placed on high-stakes tests in contemporary American education.

While the girls and boys agreed that the single-sex classroom produced an improved learning environment, only the girls mentioned decreased noise/quiet in their responses. On the subject of whether the program should continue, the predominant themes for both boys and girls who responded positively to this question were improved academic environment and improved grades. Students who responded negatively to this question consistently stated that they would like more boy-girl interaction. Additionally, among the minority of girls who thought the program should not continue, a secondary theme was that girls only classes heightened girl "drama" and fighting; this notion that there were more relational issues among girls was supported by comments of one of the teachers who stated that there was a year long problem of girls requesting to go see the guidance counselor with personal issues.

Discussion

Impact on Academic Performance

Across the two academic years of single-sex schooling that we studied at Oaks E.S., the scores on state-mandated, high-stakes testing indicated moderate declines in the academic areas most important for NCLB Adequate Yearly Progress determinations (i.e., Mathematics, Reading, and English/Language Arts) (See Table 1). Three disturbing trends were evident in these results. First, average pass rates for males were lower than females in all subjects (Table 1). The pattern is similar to the one observed by Baker (2002) where girls held a slight advantage over boys in mathematics, but our findings at

Oaks E.S. extend this disparity to all tested subject. Second, the overall pass rate on the science test did not exceed 30% across both years of the study, with the average for females hovering around 30% in the years of single-sex schooling, as well as the year prior to this initiative. Finally, the average pass rate gap between males and females increased during the time of single-sex schooling. One of the stated goals of the single-sex program was to help the boys in the school. Unfortunately, the average pass rate data does not indicate that the single-sex schooling initiative positively impacted boys when measured with high-stakes tests.

Developing Academic Cultures, What is the Role of the Teacher?

A consistent theme across the time we were involved with the school was that regardless of the teacher, boys and girls formed unique academic cultures that were stable across the academic year. We found no systematic impact of the teacher with regard to creating the unique groupings. Whether the students were in classrooms, on the playground, or on field trips, the grouping was consistent: boys working as independent agents of their own learning, while girls formed stable groups that included structure and roles for each member.

A Theory of Sex Grouping

Boys and girls responded to sex segregation in radically different ways. After 18 months of classroom observations, it became clear that there were consistent patterns in the ways that boys and girls responded to being in sex-segregated settings: girls formed small, nuclear groups, consisting of 3-5 girls, while boys generally went in the other direction, becoming more individualistic and opportunistic. The all-girls groups were close-knit and orderly, with responsibility generally being shared among the students. Boys, in

contrast, formed loose groups with flexible boundaries; they travelled through material at their own individual speeds, constructing and reconstructing groups based on individual needs. Also, while forming different groupings than the girls observed in this study, the boys did not gain the label of being unteachable from their teachers, which is in contrast to findings from other studies of single-sex schooling implementations (Baker 2002). In fact, several of the fifth grade teachers, Mrs. Daisy, Mrs. Orion, and Mrs. Evans, each expressed a clear preference for teaching boys. In the case of these three teachers, working with boys was preferred because of the relative ease of connecting and interacting with the students in all-boys classrooms. The patterns observed among all-boys and all-girls classes were also consistent with different students across the 2 academic years of the single-sex schooling initiative. Further research should be conducted to examine how widespread this phenomenon is and whether students from other racial/ethnic groups form similar sex-segregated groups.

Conclusions

The single-sex schooling initiative, which lead to the opportunity to observe the rise of sex differentiated learning cultures, can be best described as a whimsical initiative. There was little to no preparation on the part of the teachers regarding how to teach students in sex segregated setting. Only one of the teachers did anything to specifically prepare for the teaching in single-sex classrooms. Additionally, there was little to no formal guidance or oversight from school-level administrators during the planning or implementation phases of the project. In fact, the only time administrators paid significant attention to the initiative was when the results on end of year, high-stakes tests did not yield the anticipated positive changes that were hoped to arise from the

implementation of single-sex schooling in the fifth grade. At the school level, there was little concern for the wider cultural impact of the sex-segregated program that had been instituted to improve student focus and performance on high-stakes tests.

Classrooms are laboratories in which a variety of cultures come into close contact, with the members of the classroom representing a range of cultures (Maynard 2004). In the classrooms we studied, students generated unique and sex differentiated approaches to learning, regardless of the influence of a particular teacher. These sex specific learning cultures developed by different students across the 18 months of our observations and were maintained in settings outside of the traditional classroom setting, including on field trips and in playground settings. The observed sex-specific groupings, in which girls formed tight-knit, collaborative groupings of 3-5 students and boys working alone in more freelancer type roles, supported student-led inquiry on the part of the individual students.

In contrast to the findings and conclusions of Barry Thorne (1993), the students in the fifth grade classrooms at the Oaks E.S. did form stable, dichotomous groupings based on sex. One of the central contrasts with Thorne's work is that the students in the classes at Oaks E.S. were all of similar ethnicities and backgrounds, so the "crosscutting sources of division and commonality like social class and ethnicity" (p. 96) were not present in the observed classrooms. These student created groupings, which were enabled by the sex-segregation instituted by the school as a part of the single-sex schooling initiative, were stable, persisting when the students were outside of the single-sex classroom settings, including on the playground and when on field trips.

The cultures we observed were at the level of microcultures, which McCurdy et al. (2005) defined as cultures found within a larger society that do not define the whole way of life of its members. These observed microcultures did not seem to be a reaction or out-growth of the influence of any particular classroom teacher, which gives rise to questions about the role played by these elementary school teachers as "culture brokers" described by Olugbemiro Jegede and Glen Aikenhead (1999). With the use of the term "culture brokers," Jegede and Aikenhead (1999) envision teachers as agents who provide assistance to students in crossing the border that divides the student from the subculture of science. This question about the teachers in this study serving as "culture brokers" can be extended to raise the question about the viability of the idea that traditionally prepared elementary school teachers have the training or the background to properly serve as culture brokers in any of the academic areas they are certified to teach.

Directions for future research

There are several areas of inquiry that arise from the current research that warrant further study. First, what is the long-term impact of single-sex schooling on students? With the specific emphasis being placed on understanding how having been a student in a single-sex classroom influenced student interactions with students of the opposite sex. Second, how durable are the classroom cultures that students created? Observations of students across two academic years indicated these cultures spontaneously form, but the open question is what will happen to these cultures as the students move into the next grade level but not in sex-segregated settings? Third, how can teachers be better prepared to serve as culture brokers into the world of science? Future research is needed to

investigate the training and preparation of elementary school teachers to attempt to better prepare them to become culture brokers in the world of science.

Manuscript I References

Baker, D. (2002). Good intentions: An experiment in middle school single-sex science and mathematics classrooms with high minority enrollment. *Journal of Women and Minorities in Science and Engineering*, *8*, 1–23.

Bigler, R. S., & Signorella, M. L. (2011). Single-sex education: New perspectives and evidence on a continuing controversy. *Sex Roles, 65*, 659-669.

Chadwell, D. W. (2010). *A gendered choice: designing and implementing single-sex programs and schools*. Thousand Oaks, CA: Corwin.

Cobern, W. W., & Aikenhead, G. S. (1998). Cultural aspects of learning science. In B. J. Fraser & K. G. Tobin (Eds.), *International handbook of science education* (pp. 39–52). Boston, MA: Kluwer Academic Publishers.

DeWalt, K. M., & DeWalt, B. R. (2011). *Participant observation: A guide for fieldworkers* (2nd ed.). Lanham, Md.: Rowman & Littlefield.

Diaz, R. (2006). Latinas in single-sex schools: An historical overview. In J. L. Kincheloe & K. Hayes (Eds.), *Teaching city kids: Understanding and appreciating them.* (pp. 41–55). New York: Peter Lang Publishing.

Erickson, F. (1992). Ethnographic microanalysis of interaction. In M. D. LeCompte, W. L. Millroy, & J. Preissle (Eds.), *The handbook of qualitative research in education* (pp. 201–255). San Diego, CA: Academic Press.

Erickson, F. (2011). Culture. In B. A. U. Levinson & M. Pollock (Eds.), *A companion to the anthropology of education* (1st ed., pp. 25–33). Malden, MA: Blackwell Publishing.

Foley, D. A., Levinson, B. A., & Hurtig, J. (2000). Anthropology goes inside: The new educational ethnography of ethnicity and gender. *Review of Research in Education*, *25*, 37. doi:10.2307/1167321

Glasser, H. M. (2011). Arguing separate but equal: a study of argumentation in public single-sex science classes in the United States. *International Journal of Gender, Science and Technology*, *3*(1), 70 – 92.

The Governor's Office of Student Achievement. (2011). Georgia's education scorecard: K-12 public schools. Retrieved November 12, 2011, from http://www.gaosa.org

Halpern, D. F., Eliot, L., Bigler, R. S., Fabes, R. A., Hanish, L. D., Hyde, J., … Martin, C. L. (2011). The pseudoscience of single-sex schooling. *Science*, *333*, 1706–1707. doi:10.1126/science.1205031

Hubbard, L., & Datnow, A. (2005). Do single-sex schools improve the education of low-income and minority students? An investigation of California's public single-gender academies. *Anthropology & Education Quarterly*, *36*, 115–131. doi:10.1525/aeq.2005.36.2.115

Hyde, J. S. (2005). The gender similarities hypothesis. *American Psychologist*, *60*, 581–592. doi:10.1037/0003-066X.60.6.581

Hyde, J. S. (2007). New directions in the study of gender similarities and differences. *Current Directions in Psychological Science*, *16*, 259–263. doi:10.1111/j.1467-8721.2007.00516.x

Jegede, O. J., & Aikenhead, G. S. (1999). Transcending cultural borders: Implications for science teaching. *Research in Science & Technological Education*, *17*, 45–66. doi:10.1080/0263514990170104

Livescribe. (2013). Echo overview. Retrieved April 06, 2012, from http://www.livescribe.com/en-us/smartpen/echo/

Madden, R. (2010). *Being ethnographic: a guide to the theory and practice of ethnography*. London: SAGE.

Maddock, M. N. (1981). Science education: an anthropological view point. *Studies in Science Education*, *8*, 1–26.

Mael, F., Alonso, A., Gibson, D., Rogers, K., & Smith, M. (2005). *Single-sex versus coeducational schooling: a systematic review* (U.S. Department of Education No. 2005-01). U.S. Department of Education. Retrieved November 22, 2011, from http://www2.ed.gov/rschstat/eval/other/single-sex/single-sex.pdf

Maynard, A. E. (2004). Cultures of teaching in childhood: formal schooling and Maya sibling teaching at home. *Cognitive Development*, *19*, 517–535. doi:10.1016/j.cogdev.2004.09.005

McCurdy, D. W., Spradley, J. P., & Shandy, D. J. (2005). *The cultural experience: ethnography in complex society* (2nd ed.). Long Grove, Ill.: Waveland Press.

McDermott, R., & Varenne, H. (2006). Reconstructing culture in educational research. In G. Spindler & L. Hammond (Eds.), *Innovations in educational ethnography: theory, methods, and results* (pp. 3–31). Mahweh, NJ: Lawrence Erlbaum Associates.

Wagner, J. (2010). Visual data in education research. In P. Peterson, E. Baker, & B. McGaw (Eds.), *International Encyclopedia of Education* (3rd ed., pp. 498–504). London: Elsevier.

Wiegert, E., & Che, S. M. (2010). Single-sex classrooms in a southern charter middle school: student, teacher, and parent perspectives. *Current Issues in Middle Level Education*, *15*(1), 1–9.

Wills, R. C. (2007). A new and different space in the primary school: single-gendered classes in coeducational schools. *Educational Studies, 33*, 129–143. doi:10.1080/03055690601068303

Table 1

Percent Passing Rates on the Fifth Grade High-Stakes Test

Group of Students	Pass Rate (%)			
	Reading	English/Language Arts	Mathematics	Science
2010-2011				
All	91.6	85.8	83.8	28.4
Male	86.5	74.6	75	26.7
Female	96.8	96.7	92.1	30.2
2011-2012				
All	84.2	86.4	85.7	24.8
Male	83.4	81.6	83.3	20.6
Female	85	91.7	88.4	29.5
2012-2013				
All	84.3	77.9	84.2	29.2
Male	80.3	74.1	76.5	27
Female	89.9	83.1	94.8	32.2

Biographical Information

Joseph S. Covert is a lecturer of science education in the Department of Teacher Education at the University of North Georgia. His research focuses on the preparation of K-12 science teachers and the integration of computer science into K-12 science and mathematics classrooms.

Richard W. Schmertzing is the coordinator of research in the Department of Curriculum, Instruction, and Technology in the Dewar College of Education at Valdosta State University. His research focus is on the application of qualitative research methods to education with a particular emphasis on race, culture, and schooling.

SCOPE AND GOALS OF THE JOURNAL

See the editorial for the first issue of Cultural Studies of Education for information on the scope and goals of the journal.

Roth, W-M., & Tobin, K. (2006). Announcing Cultural Studies of Science Education. *Cultural Studies of Science Education, 1,* 1-5.

STYLE GUIDELINES FOR CULTURAL STUDIES OF SCIENCE EDUCATION
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Global reproduction and transformation of science education
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C. Keywords
Keywords neoliberalism · globalization · macrostructures · equity · urban science
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CSSE discourages any use of serial citations in manuscripts. Over the years the editors of CSSE have
written extensively about the journal's position on the use and role of citations in papers published in the journal. The journal has a strong stance against symbolic citing of published research. See the following for more information about this issue:
Tobin, K. G. (2008). Contributing to the conversation in science education. *Cultural Studies of Science Education, 3,* 535-540.
Tobin, K. (2009). Acknowledging and building on the work of others. *Cultural Studies of Science Education, 4,* 255-258.

A. First mention of author

George Modelski used the term globalization in a paper that examined communism and its potential to be a global organization. He noted that, "globalization has become a process measurably significant in the past decade … particularly evident in the rapid growth of world organizations of all shapes and forms." (1968, p. 389)
Note: When an author is first mentioned in the manuscript both first name and last name should be used. No titles except maybe for "Sir," Reverend, Pope etc.

B. Citing author in text

Noel Gough's (1999) poststructural standpoint, I opt not to define globalization too tightly, preferring to adopt a hermeneutic framework, allowing its meanings to emerge from its uses—as illustrated in selected examples in which globalization is salient to science education.
Note: Use of citation when author is mentioned in text of manuscript.

C. Citing author in brackets

As ideology, globalization includes political–economic and sociocultural phenomena theorized in terms of macrostructures such as neoliberalism, neocolonialism, democracy, and capitalism (Harvey 2005).
Note: In bracketed citation no comma after author. NEVER more than one reference source within parentheses.

D. Including page reference within a citation

Diane Ravitch (2007, p. 269), the former Assistant Secretary of Education in the U.S., noted that the commission concluded that we must start all over.
Note: Check how a page is referenced within a citation.

E. Multiple authors in citation

Next, I use auto/ethnography to re-examine a study of science education situated in an urban high school (Tobin, Elmesky and Seiler 2005).
Note: No use of ampersand [&]. "and" should be used instead.

4. Headings, paragraphs, and footnotes

A. Level 1 headings

Diffusion of neoliberalism

In the 1960s, neoliberalism was adopted as a rationale for economic thought and practice, notably in the U.S. and Britain, before spreading to Asia and other parts of the …

Note: Level 1 heading should be bold, flush with the left side margin, and only first word capitalized except for proper nouns. No indent for first paragraph after Level 1 heading. Second and all following paragraphs should be indented 0.4 centimeters.

B. Level 2 headings

Learning from others

As a British colony, it is no surprise that Australia inherited an educational system that resembles that of the mother country. Accordingly, when I attended high school, I studied physics and chemistry for five years (1957-1961), taking high stakes, state level external examinations at the end of both grades 10 and 12. The curriculum in the courses …

Note: Second level headings- should be the same as first level headings except that it is not bold. No indent for first paragraph after Level 2 headings. Second and all following paragraphs should be indented 0.4 centimeters.

C. Level 3 headings

Macroscopic analysis for classroom interactions. This type of analysis is . . . .

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Note: Make sure that there is no heading of "Introduction" in the manuscript. The storyline of the research study begins without such a sign. Also, we encourage authors to incorporate material they include typically as an aside in footnotes into the body of the manuscript.

5. References

A. Periodical References accessed online

Alter, J. (2007, February 12). Stop pandering on education. *Newsweek.* Retrieved March 01, 2010, from http://www.msnbc.msn.com/id/16960416/site/newsweek/

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B. Journal single author reference

Carter, L. (2005). Globalisation and science education: rethinking science education reforms. *Journal of Research in Science Teaching*, *42*, 561-580.

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C. Journal references more than single author

Axford, B., & Seddon, T. (2006). Lifelong learning in a market economy: education, training and the citizen-consumer. *Australian Journal of Education*, *50*(2), 167-184.

Note: Also, if there are two authors, make sure there is a comma following the initial of the name of the first author (i.e. Axford, B., &) and the ampersand.

D. Book chapter references

CaOrion, C. (2005). Learning science and the centrality of student participation. In K. Tobin, R. Elmesky, & G. Seiler (Eds.), *Improving urban science education: new roles for teachers, students, and researchers* (pp.165–180). New York: Rowman & Littlefield.

Note: This is how book chapters should be referenced. Also, note no capitalization after the colon.

E. Book references

Wenger, E. (1998). *Communities of practice.* Cambridge: Cambridge University Press.

F. DOI – document object identifier system

Consistent with current APA Guidelines, CSSE requires authors to include the doi of manuscripts they reference where this information is available. One quick resource for doing this is provided by http://www.crossref.org/SimpleTextQuery/

6. Biographical Information

Kenneth Tobin is Presidential Professor of Urban Education at the Graduate Center of the City University of New York. His research focuses on the teaching and learning of science in urban schools. His latest book is a co-edited volume with Wolff-Michael Roth entitled World of science education: North America (Sense). Tobin is the founding co-editor of Cultural Studies of Science Education.

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Roth, W-M., & Tobin, K. (2006). Announcing Cultural Studies of Science Education. *Cultural Studies of Science Education, 1,* 1-5.

Tobin, K. G. (2008). Contributing to the conversation in science education. *Cultural Studies of Science Education, 3,* 535-540.

MANUSCRIPT II

THE ROLE TEACHERS PLAY IN THE DEVELOPMENT OF CLASSROOM ACADEMIC CULTURES

Joseph S. Covert

Valdosta State University

Department of Curriculum, Leadership, and Technology

This manuscript is prepared for submission to *Journal of Science Teacher Education* and is the second of three manuscripts prepared for this journal-ready doctoral dissertation. Style guidelines are provided immediately following the references of the manuscript.

The role teachers play in development of classroom academic cultures

Joseph S. Covert
Department of Teacher Education
University of North Georgia
Dahlonega, GA 30597, USA
Email: joseph.covert@ung.edu

Richard Schmertzing
Department of Curriculum, Leadership, and Technology
Valdosta State University
Valdosta, GA 31698, USA
Email: rwschmer@valdosta.edu

Abstract

This is the report of an investigation of the role that teachers play in the development of the academic culture of elementary school science classrooms. Specifically, our study focuses on the effect that teachers have on the development of academic culture in elementary school science classrooms. Ethnographic observations of classrooms and informal interviews with teachers were conducted over the course of 2 academic years. Central findings call into question the ability of teachers to serve as culture brokers for the various academic subjects covered in their classes, with particular emphasis on the representation of science as a way of knowing the world that requires members of the culture to be knowledgeable of a relatively fixed set of cultural practices.

Keywords: science, teacher, culture of science, culture broker, teacher preparation

The teacher must be a scholar, an intellectual, and a knowledge worker oriented toward the interpretation, communication, and construction of such knowledge in the interests of student learning.

Lee Shulman (1999, p. xiii)

I have pondered the salutary effect it might have on the teaching profession if teachers were to take 'learning' as their central professional and intellectual concern, committed to knowing what is known about learning, conversant with and critical of competing theories, thoroughly up-to-date on current research, and intrigued with understanding how learning occurs not only among their students but among themselves as well.

Harry Wolcott (1982/1997, p. 314)

Science has long been a part of the elementary school curriculum (DeBoer, 1991), but changes in federal education policy (i.e., No Child Left Behind) led a number of elementary schools to discontinue or reduce the frequency of science instruction (Blank, 2013; Cuban, 2013; Judson, 2013). As with many things in education, federal and state policies are changing and science is returning to the elementary school classroom. This renewed emphasis on science comes in the form of high stakes test results that are used to evaluate both teacher and school performance, as well as the impending implementation of the recently created Next Generation Science Standards (Achieve, 2013). Such cycles of change or innovation in the science curriculum have been the norm throughout the modern history of education in the United States, from the 1890s through the present, with the constant being a reactive attempt to correct some socially defined lack, rather than a proactive attempt to systematically and fundamentally improve science teaching and learning (Cuban, 2013).

Research in science education supports the notion that constructivism is the most effective means to learn science (Driver, Asoko, Leach, Mortimer, & Scott, 1994; Settlage & Southerland, 2012). Many teachers, however, do not enact constructivist lessons or units in their classrooms (Settlage & Southerland, 2012) and it is well known that planning for inquiry lessons is much easier than actually implementing them in a classroom (Cuban, 2013). In the high-stakes era of education that we are currently in, Wallace (2011) noted the absence of inquiry-based learning approaches in science instruction, contending that this occurred because teachers are focusing almost exclusively on the content knowledge that will be emphasized on high-stakes tests. Furthermore, science content knowledge acquisition is emphasized because scientific

process skills, such as problem solving and reasoning skills will not be tested (Wallace, 2011). Additionally, it has been noted that the reform-based inquiry approach to teaching science is not one that many teachers have experienced themselves as learners, contrasting with the behaviorist views of teaching that predominated when many teachers were in K-12 settings as students (Magnusson, Krajcik, & Borko, 1999). Finally, the current generation of preservice teaching interns are products of the high-stakes testing and accountability era of modern American education (Cuban, 2013), and are themselves even less acquainted with the more student-centered approaches to teaching, including the science classroom, than previous generations of teachers.

Theoretical Framework

Erickson (1986) defined culture as the "learned and shared standards for ways of thinking, feeling, and acting" (p. 117) and there has been a long tradition within anthropology of classifying science as a subculture of modern Western society (Aikenhead, 1996; Jegede & Aikenhead, 1999; Maddock, 1981; Mead & Metraux, 1957; Pomeroy, 1994). Studies of the culture of science (e.g., Stanley & Brickhouse, 1994) have highlighted the idea that science should be approached from a multicultural perspective, challenging the universalist view of science as something that transcends differences of gender, age, and culture. Instead, science educators need to understand and embrace the diversity of worldviews while ensuring that Western students understand the functioning of modern Western science. Teachers are both products and purveyors of the educational/academic culture (Meier, 2012). It is, therefore, critical that we understand the knowledge and experience teachers have in the subculture of science to help us better understand the ways that science will be introduced to students.

An important educational concept that is significantly related to studies of culture is the pedagogical content knowledge (PCK) construct, which was introduced by Shulman (1986). PCK can be viewed as a critical aspect in the development of a teacher's understanding of the culture of science teaching because it represents the intersection between a deep knowledge of the content in a particular subject area and a keen understanding of the best ways to teach that particular subject (Magnusson et al., 1999). The training of teachers deeply enmeshes them in general pedagogical knowledge (PK) and skills, but there are questions about whether or not teachers, particularly in elementary and middle schools, have enough subject matter knowledge (SMK) to make the most effective or deep PCK related connections in science (Abell, 2007).

Over the years, many questions have been made about efficacy of elementary science teaching and how to improve the situation (Appleton, 2007). Noted astronomer, Carl Sagan, questioned the validity of science teaching by recounting his poor science learning experiences prior to college (Sagan, 1996), with a scathing quote: "I wish I could tell you about inspirational teachers in science from elementary or junior high or high school days. But as I think back on it, there were none" (p. xiii). Ominously, Louden (1992) questioned whether our formula to improve science teaching was lacking or, more ominously, if we do not clearly understand the problem.

Research Questions

1. What role do teachers play in the development of learning cultures in their classrooms?
2. What experiences inform the development of cultural knowledge in content areas among teachers?

Methods

Context of the Study

The current study was conducted at Oaks Elementary School (E.S.) (pseudonym), a school that served a high poverty, majority Latino community. The current study was conducted over the course of the 2011-2012 and 2012-2013 academic years. During this period of time, the school was experimenting with a single-sex schooling initiative in the fifth grade in which there were three all-girls and three all-boys classrooms during the 2011-2012 academic year and two all-girls, two all-boys, and two coed classes during the 2012-2013 academic year.

Participants

The participants in this study were fifth grade teachers and preservice teachers at Oaks E.S. In contrast to the student body of the school, all of the inservice and preservice teachers who taught in the fifth grade were White. Additionally, all of the teachers were female. The inservice teachers ranged in teaching experience from 5 to 30+ years, while all of the preservice teachers included in this study were traditional students completing their senior year of student internship (student teaching). Pseudonyms are used throughout this article when referring to individual teachers.

Methodology

This study began as an ethnographic study of the culture of schooling in the midst of a significant change in school organization. The primary researcher was embedded in the classrooms of this school as a participant observer with supervision of preservice teaching interns being the primary reason for the first author's presence. In addition to serving as a supervisor for student teaching interns, the primary researcher also met

regularly with faculty and administrators in the school and also taught the occasional science lessons to fifth grade classes. Extensive field notes covering observations made at the school were collected throughout the duration of the study. In addition, a number of informal interviews were conducted with both inservice and preservice teachers.

Data analysis involved the coding and categorization of field notes of classroom observations and informal interviews. During the analysis, emphasis was placed on the preparation and training of each teacher, enactment of classroom cultural values and norms, and classroom artifacts as they relate to science teaching.

Findings

The majority of the inservice teachers, which included teachers who had earned advanced degrees, had two or fewer science classes in college. None of the science classes taken by those teachers were more advanced than introductory level courses. Whether or not a teacher expressed a preference for science was, therefore, not linked to exposure to science in formal classroom or laboratory settings. This interest was instead driven by factors that are disconnected from formal science experiences. The current discussion focuses on six of the teachers, Mrs. Austen, Ms. Williams, Mrs. Jane, Mrs. Lovelace, Mrs. Orion, and Mrs. Daisy, who served as the focal points of in-class observations and interviews.

Each of the teachers made decisions that influenced the course of instruction, with specific emphasis on the decision to teach science. Mrs. Austen was an example of a teacher whose lack of background in science definitively influenced the courses she taught. When asked about her level of anxiety towards teaching science, she expressed an above average level of anxiety. This anxiety was clearly linked to her statement that,

"I don't feel that I ever saw a good model of how to teach science therefore science intimidates me!" However, Mrs. Austen eagerly expressed a desire to learn more about teaching science, " I would love to see someone who does a great job of teaching science to see how they integrate content and information with hands-on type experiments." While she indicated she would like to see better models of science instruction, Mrs. Austen was clearly still ambivalent to the potential of hands-on approaches to science learning meeting the necessary outcomes on high-stakes testing. In an interview, Mrs. Austen expressed the desire to only teach writing or co-teach with other fifth grade teachers, and she made it clear that she had shared this desire with administrators at the school.

Mrs. Austen's expressed preference to teach writing led to just that, which changed the dynamic of the traditional model where one teacher teaches all of the subjects. Further, her request led to the quasi-departmentalization of the fifth grade, with Mrs. Austen teaching writing to groups of students from across the fifth grade, instead of just her homeroom. In this way, Mrs. Austen actively represented her own training and preferences and focused on the teaching of the academic subject she felt most prepared to teach.

While Mrs. Austen's actions created a situation where she was able to focus on one academic subject, the majority of the fifth grade teachers were comfortable enough to maintain the status quo, teaching a wider range, if not the entire range, of academic content classes. The other teachers in the fifth grade maintained the stance that one teacher could effectively teach the content from a wide range of disciplines that has been historically characteristic of elementary schools (Asoko, 2000). These teachers had a

varied range of personal experiences in science, which influenced the level of importance that science took in their classrooms.

Ms. Williams stated in conversation that she had a moderate amount of science anxiety. Additionally, she stated she did not have a favorite academic subject, going further to say that "as a student, I personally struggled in all academic areas." Ms. Williams taught an all-boys classroom and did attempt to make science a regular part of her weekly instruction. When reflecting on her past experiences in science, Ms. Williams said, "As sad as this is to say, I cannot remember having fun, interactive, inquiry-based science lessons as a student. This is why I am encouraged to ensure I create this for my students." Ms. Williams went on to advocate the potential of teaching science through integrating it with other subjects in the elementary school curriculum: "I feel strongly that other content like reading, math, and even writing can be taught through the science curriculum. I have found it easy to integrate science into all these areas and it's been fun." Integration between science and other content areas and student engagement were key themes that emerged in Ms. Williams' discussion of how she approached science instruction.

In contrast to both Mrs. Austen and Ms. Williams who both reported moderate to high science anxiety, Mrs. Jane reported that she had a very low anxiety towards science, the lowest reported anxiety of any of the teachers in this study. She told us that she loved the way that she was taught elementary science. "I think my love of science and the way that my elementary teachers taught me (inquiry) allows me to do the same." Ironically, Mrs. Jane only had 1 science class in college, which clearly calls into question the impact of college science classes on elementary school teachers. In addition to her prior

experiences in science and as a student in elementary school science settings, Mrs. Jane placed a strong emphasis on the importance of the state approved teaching standards, she said that "The more I learn about the standards and the capabilities of the students, the more I am able to push the students to discover and explore through inquiry based learning." Mrs. Jane's favorite subject to teach was math, which was also the favorite subject of another one of the fifth grade teachers.

Within the group of fifth grade teachers that were the focus of this study, only Mrs. Jane and Mrs. Lovelace listed math as their favorite subject to teach. Mrs. Lovelace's preference for math was evident in observations of her instruction, as well as in her report of having no math anxiety. Mrs. Lovelace's reported lack of math anxiety contrasted with the majority of teachers in this study who reported high math anxiety. Her lack of anxiety in math was in direct opposition to her report of a moderate level of science anxiety. Mrs. Lovelace was a co-teacher with Mrs. Daisy throughout the time of the study. While Mrs. Daisy was responsible for most of the science teaching, Mrs. Lovelace took the lead on math and social studies. When asked about her prior science learning experience, Mrs. Lovelace reported learning "science in a very traditional way (i.e., textbooks, take notes, take a test)" throughout her student career, including the two science classes she took in college. From this quote, it is clear that what she labels as traditional science teaching does not satisfy her. She went on to further state "when I teach science, I do it the complete opposite way. I do all experiments or hands-on activities." As noted earlier, however, her co-teacher Mrs. Daisy was generally the teacher responsible for science lessons in their classroom.

Of all the teachers in the fifth grade, Mrs. Daisy was the most vocal proponent for the need to teach science to the students. Mrs. Daisy had taught for nearly thirty years, focusing primarily on reading instruction, including time spent as a literacy coach. She did not let her self-reported moderate to low science anxiety prevent her from teaching science. In fact, she was only one of two teachers to engage in significant planning and execution of science lessons during the time of this study, with the most notable example being her use of the classic baking soda and vinegar volcano lab during the 2012-2013 school year. Mrs. Daisy did not have any more science classes in college than the rest of the teachers, instead she attributed her emphasis on science teaching to her own personal interest in the subject, as well as her recognition of the students' interest in science. Mrs. Daisy made it clear that nothing in her teacher university coursework prepared her for the kind of science teaching she enacted in her classroom:

> Nothing in my past contributed. I don't think…unless it was raising 3 boys who took things apart and asked 'how' and 'why' questions all the time. My wiring is kinesthetic so science only speaks to me through hands-on activities, experiments, or discovery-mode learning. I approach science through my wiring because that is the only way that I understand it.

Much of what Mrs. Daisy knew about and enacted from the culture of science was, therefore, not directly derived from experiences in any formal science setting. Her lack of first-hand experiences in the sciences, however, did not diminish her enthusiasm to teach science, but the cultural values she was sharing with the students did not necessarily align with the values elaborated in the Standard Account of Science (Cobern & Loving, 2001) or the Seven Pillars of Science (Gauch, 2006).

All of the teachers described to this point had a minimum of 5-10 years of teaching experience by the time of this study. Experience as a classroom teacher was not, however, necessarily a good predictor for whether or not science was brought into the classroom. This situation is illustrated by the case of Mrs. Orion. Mrs. Orion was a preservice teacher during the beginning of our study and, upon graduation, worked in a full-time teaching position in the fifth grade during the second year of the study. Along with all of the other preservice teachers in her teacher preparation program, Mrs. Orion took 4 science content classes at the college level plus a science teaching methods course, which was a minimum of two more than any of the inservice teachers. Mrs. Orion encouraged her students to ask questions based on observations made in and out of the classroom, which was noted many times by the researcher. She was clearly trying to stimulate the curiosity among her students. Mrs. Orion worked in both all-boy and all-girl settings during her time at this school, and during this time was observed to encourage her students to make empirically based observations that served as the basis of explanations that were consistent with the dimensions of the Standard Account of Science (Cobern & Loving, 2001).

Discussion

Of the fifth grade teachers, only two of the six actively expressed and exhibited an on-going desire to teach science in a student-centered manner (i.e., hands-on inquiry activities) during the course of this study. The remaining teachers either found ways to avoid teaching science, a la Mrs. Austen, through the teaching of one subject to many different classes in the fifth grade, or using methods of instruction that focused on the rote memorization of scientific facts and theories in preparation for high-stakes tests. We

contend that it is not a systematic attempt on the part of these teachers to avoid teaching science or to not teach in an engaging manner. Rather, this outcome was more likely due to the lack of exposure to student-centered science learning in their educational backgrounds, K-12 and college experiences, and the pressure of teaching to high-stakes tests.

Typical science majors at the undergraduate level complete upwards of 20 science content classes, which include extensive laboratory experiences, albeit few that are truly student-centered and inquiry-based (Johnson, 2009). The inservice teachers averaged only 2 science classes at the university level, including their science teaching methods class. In contrast, the preservice teacher involved in this study took a maximum of 4 science content classes at the university level, with an additional science teaching methods class. This disconnect between the number and quality of science learning experiences that teachers have relative to future scientists has profound implications for the insight into the process of science that these teachers can offer their students, based on the limited content knowledge and cultural awareness that teachers have from their science learning experiences at the university level. When posing the age-old challenge to their students to "think like scientists" (Settlage & Southerland, 2012, p. 25), the teachers have not been adequately prepared to support this kind of science learning in their own lives, raising the reciprocal challenge of how the teachers expect their students to respond to that question.

For many teachers, their most significant and long-standing exposure to the culture of science is through the science curricula that they are assigned to teach. The curriculum is a sustained source of information about science that is readily available to

all teachers. During informal conversations and interviews, all of the teachers in this study spoke about the importance of following the curriculum in their classrooms. An additional source of information for teachers about science is the textbooks that they are assigned to use in their classes, which tend to misrepresent the importance of the historical development of scientific knowledge (Agar, 2012), severely retarding the understanding among teachers about how the culture of science leads to the production of knew scientific knowledge.

Conclusions

Is the culture of science shared by elementary school teachers? Or, put another way, to what degree are the cultural values of science shared, appreciated, and understood by elementary school teachers? We feel that there is a continuum of understanding regarding the culture of science. At the highest end of the continuum, or at least the one closest to the actual culture of science, are high school teachers. At the most distant end, the vast majority are elementary teachers, which is not surprising for a number of reasons. First, all elementary teachers in the United States are expected to be science teachers and it is difficult to imagine that a large number of individuals would gravitate to science to the point of understanding the culture. Second, the majority of elementary teachers have limited exposure to the culture of science. In most cases, their K-20 educational experiences would be unlikely to expose them in any significant way to the culture of science. One could make the argument that only a fraction of undergraduate science majors understand the culture of science (Wieman, 2007), with an emphasis on those that have spent time involved in undergraduate research under the tutelage of university faculty. Third, many elementary teachers did not experience significant

success in K-20 science settings, limiting their self-efficacy in science and science teaching, thereby limiting their valuation of the culture of science.

Implications for Teacher Education and Further Research

There is a profound tension between the goals of teacher educators and educational policy makers and this tension is manifested in the differing goals/outcomes each group has for students in the classroom. Teacher educators are concerned with the fullest cognitive engagement of the learner, while the policy maker aims to better quantify the progress of the leaner, in both cases differing ideologies about the goals of education and role of the teacher are evident. At the point of this intersection is the classroom teacher. Classroom teachers are torn between the somewhat contradictory goals of the two forces in education: the people who prepare teachers and those who set policy regarding teachers' careers. Innovation emphasized by teacher educators, including student-centered classrooms, student inquiry, and technology integration, has been shown to be difficult to implement in the classroom because of the difficulties involved in using the high-stakes tests from the educational policy makers to assess the implementation of student-centered methods of instruction. High-stakes tests, as currently constructed and administered, are best suited for the evaluation of student acquisition of facts and theories within a discipline, without fundamental assessment of the learner's ability to use these facts in a constructive or generative manner.

The current emphasis on high-stakes testing has led to the development of an "audit culture" (Burns, 2014, The Big Story section, para. 2) in education, with education engaged in a "race to the bottom" (The Big Story section, para. 3). In addition to the effect this emphasis on a testing-based, audit culture has had on current students, there is

reason to be concerned for the future of education because our current and future teaching candidates have been raised in this culture of evaluation and certitude, which limits the learner to focus on mistakes and differences as bad (Burns, 2014), rather than the positive role that mistakes and differences make in the life of a scholar.

One seemingly obvious solution to the problems in science teaching is to increase the amount of time devoted to science instruction. Blank (2013) reported a positive relationship between the amount of time spent in science instruction and scores on the National Assessment of Educational Progress (NAEP) Grade 4 Science Assessment. Across the nation, however, the amount of time spent teaching science in the elementary grades has been declining since 1993, with a national average of 2.8 hours per week of science instruction in the fourth grade during 2009 compared with 3.0 hours in 1993-1994 (Blank, 2013). The average amount of instructional time in the state of Georgia during 2009 was 3.1, but the NAEP score was below the national average (Blank, 2013), indicating that the correlation between the amount of time devoted to science instruction and science test outcomes is not the singular determinant of success.

Both teacher education programs and the organization of elementary schools need to be restructured to achieve better outcomes in science education. First, reform is needed in the way we prepare future teachers. This reform should take the shape of programs that are designed to provide future teachers with adequate exposure to the cultural values of science. Future teachers need to be prepared to teach science from the perspective of individuals who have first hand knowledge of the culture of science. These experiences should be centered on rigorous and deep experiences in the science classroom and laboratory, learning both the content of science and the process skills and

habits of mind that are critical elements of the toolkit of a scientist. Science is a way of knowing, not just an accumulation of factual information, and future teachers of science need to be actively exposed to the cultural values of science. Exposing teachers to the cultural values of science in this way would stand a much greater chance of preparing them to become true brokers of the culture of science (Aikenhead, 1994; Jegede and Aikenhead, 1999). This first-hand exposure to science would truly allow them to know what to expect of their students when they pose the perennial science education challenge to "think like scientists."

Preparing teachers to approach science from the culture of science angle would represent a significant step towards a solution to our science teaching problem. But reforming the preparation of teachers is not the only required change. Elementary schools would need to be fundamentally restructured to capitalize on these improvements in teacher education. Elementary schools need to give serious consideration to departmentalization or specialization by content area, in a manner similar to what is practiced in middle school and beyond (Schwartz & Gess-Newsome, 2008). In addition to content specialization, teachers and schools should implement grade-level integration between academic subjects to emphasize the balance and interplay between content areas without falling victim to the problems associated with teachers becoming isolated in egg-crates (Lortie, 1975).

In a real and practical way, the changes to science teacher preparation model the path taken by future teachers in the arts and vocational areas. In these fields, future teachers are actively engaged in practices that develop content, pedagogical, and pedagogical content knowledge, the three dimensions of Shulman's pedagogical content

knowledge (PCK) model (Shulman, 1986). In music, for example, the process involves a tri-focus approach in which they master the performance of a particular instrument (e.g., voice, trumpet, percussion, violin, etc.), as well as develop skills on the other instruments in the band or orchestra or chorus while developing the pedagogical skills necessary to teach others how to perform the same tasks. It does also have to be stated that for future arts and vocational teachers, the preparation pathway begins earlier than their entry to a college-level preparation program, with many arts and vocational students having already spent years honing their content knowledge in the area prior to considering entry into the teaching profession.

Our call for the reform of teacher preparation programs, aligns with the work of Milner et al. (2012) who called for programs to ensure that teachers have "the educational preparation, resources, time, and support to teach science effectively" (p. 127) while making sure that teachers understand the implications of high-quality science teaching. All the while, we must contemplate the idea that acculturating new and future teachers into the endeavor of science is a very challenging proposition because of the diversity of approaches taken when scientists are doing science (Wong & Hodson, 2009).

References for Manuscript II

Abell, S. K. (2007). Research on science teacher knowledge. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education* (pp. 1105-1149). New York, NY: Routledge.

Achieve. (2013). *State-created standards for science education in the 21st Century*. http://www.nextgenscience.org/final-next-generation-science-standards-released. Accessed 18 February 2014.

Agar, J. (2012). *Science in the 20th Century and beyond*. Malden, MA: Polity Press.

Aikenhead, G. S. (1996). Science education: Border crossing into the culture of science. *Studies in Science Education*, *27*, 1–52.

Aikenhead, G. S., & Jegede, O. J. (1999). Cross-cultural science education: A cognitive explanation of a cultural phenomenon. *Journal of Research in Science Teaching*, *36*, 269–287.

Appleton, K. (2007). Elementary science teaching. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education* (pp. 493-535). New York, NY: Routledge.

Asoko, H. (2000). Learning to teach science in the primary school. In R. Millar, J. Leach, & J. Osborne (Eds.), *Improving science education: The contribution of research* (pp. 79-93). Philadelphia, PA: Open University Press.

Blank, R. K. (2013). Science instructional time is declining in elementary schools: What are the implications for student achievement and closing the gap? *Science Education*, *97*, 830–847. doi:10.1002/sce.21078

Burns, J. (2014, May 4). Our impoverished view of teacher education. *Teachers College Record*. http://www.tcrecord.org/Content.asp?ContentId=17523. Journal article. Accessed 5 May 2014.

Cobern, W. W., & Aikenhead, G. S. (1998). Cultural aspects of learning science. In B. J. Fraser & K. G. Tobin (Eds.), *International handbook of science education* (pp. 39–52). Boston, MA: Kluwer Academic Publishers.

Cobern, W. W., & Loving, C. C. (2001). Defining "science" in a multicultural world: Implications for science education. *Science Education*, *85*(1), 50–67.

Cuban, L. (2013). *Inside the black box of classroom practice: Change without reform in American education*. Cambridge, MA: Harvard Education Press.

DeBoer, G. E. (1991). *A history of ideas in science education: Implications for practice*. New York: Teachers College Press.

Driver, R., Asoko, H., Leach, J., Mortimer, E., & Scott, P. (1994). Constructing scientific knowledge in the classroom. *Educational Researcher*, *23*, 5–12. doi:10.2307/1176933

Erickson, F. (1986). Culture difference and science education. *The Urban Review*, *18*, 117–24.

Gauch, H. G. (2009). Science, worldviews, and education. *Science & Education*, *18*(6-7), 667–695w. doi:10.1007/s11191-006-9059-1

Jegede, O. J., & Aikenhead, G. S. (1999). Transcending cultural borders: Implications for science teaching. *Research in Science & Technological Education*, *17*, 45–66. doi:10.1080/0263514990170104

Johnson, A. D. (2009). *40 inquiry exercises for the college biology lab*. Arlington, VA: NSTA Press.

Judson, E. (2013). The relationship between time allocated for science in elementary schools and state accountability policies. *Science Education*, *97*(4), 621–636. http://doi.org/10.1002/sce.21058

Lockshin, R. A. (2010). *The joy of science: An examination of how scientists ask and answer questions using the story of evolution as a paradigm*. Dordrecht: Springer.

Lortie, D. (1975). *Schoolteacher: A sociological study*. Chicago, IL: University of Chicago Press.

Maddock, M. N. (1981). Science education: An anthropological viewpoint. *Studies in Science Education*, *8*, 1–26.

Magnusson, S., Krajcik, J., & Borko, H. (1999). Nature, sources, and development of pedagogical content knowledge for science teaching. In J. Gess-Newsome & N. G. Lederman (Eds.), *Examining pedagogical knowledge: The construct and its implications for science education* (pp. 95–132). Dordrecht: Kluwer Academic Publishers.

Mead, M., & Métraux, R. (1957). Image of the scientist among high-school students: A pilot study. *Science*, *126*, 384–390. doi:10.1126/science.126.3270.384

Meier, L. (2012). The effect of school culture on science education at an ideologically innovative elementary magnet school: An ethnographic case study. *Journal of Science Teacher Education*, *23*, 805–822.

Morrison, J. A. (2012). Exploring exemplary elementary teachers' conceptions and implementation of inquiry science. *Journal of Science Teacher Education*, *24*, 573–588. doi:10.1007/s10972-012-9302-3

Pomeroy, D. (1994). Science education and cultural diversity: Mapping the field. *Studies in Science Education*, *24*, 49–73.

Sagan, C. (1995). *The demon-haunted world: Science as a candle in the dark* (1st ed.). New York: Random House.

Schwartz, R. S., & Gess-Newsome, J. (2008). Elementary science specialists: A pilot study of current models and a call for participation in the research. *Science Educator*, *17*(2), 19–30.

Settlage, J., & Southerland, S. A. (2012). *Teaching science to every child: Using culture as a starting point* (2nd ed.). New York, NY: Routledge.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, *15*(2), 4–14.

Stanley, W. B., & Brickhouse, N. W. (1994). Multiculturalism, universalism, and science education. *Science Education*, *78*, 387–398. doi:10.1002/sce.3730780405

Wallace, J., & Louden, W. (1992). Science teaching and teachers' knowledge: Prospects for reform of elementary classrooms. *Science Education*, *76*, 507–521.

Wallace, C. S. (2012). Authoritarian science curriculum standards as barriers to teaching and learning: An interpretation of personal experience. *Science Education*, *96*, 291–310. doi:10.1002/sce.20470

Wieman, C. (2007, September/October). Why not try a scientific approach to science education? *Change*, 9–15.

Wong, S. L., & Hodson, D. (2009). From the horse's mouth: What scientists say about scientific investigation and scientific knowledge. *Science Education*, *93*, 109–130. doi:10.1002/sce.20290

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• Negotiation research spans many disciplines (Thompson, 1990).
• This result was later contradicted by Becker and Seligman (1996).
• This effect has been widely studied (Abbott, 1991; Barakat et al., 1995; Kelso & Smith, 1998; Medvec et al., 1999).
Citations should follow APA style, as per the Publication Manual of the American Psychological Association, 6th edition.
Reference list
References should follow APA style, as per the Publication Manual of the American Psychological Association, 6th edition.
The list of references should only include works that are cited in the text and that have been published or accepted for publication. Personal communications and unpublished works should only be mentioned in the text. Do not use footnotes or endnotes as a substitute for a reference list.

Reference list entries should be alphabetized by the last names of the first author of each work.

Journal article

Harris, M., Karper, E., Stacks, G., Hoffman, D., DeNiro, R., Cruz, P., et al. (2001). Writing labs and the Hollywood connection. Journal of Film Writing, 44(3), 213–245.

Article by DOI

Slifka, M. K., & Whitton, J. L. (2000) Clinical implications of dysregulated cytokine production. Journal of Molecular Medicine, doi:10.1007/s001090000086

Book

Calfee, R. C., & Valencia, R. R. (1991). APA guide to preparing manuscripts for journal publication. Washington, DC: American Psychological Association.

Book chapter

O'Neil, J. M., & Egan, J. (1992). Men's and women's gender role journeys: Metaphor for healing, transition, and transformation. In B. R. Wainrib (Ed.), Gender issues across the life cycle (pp. 107–123). New York: Springer.

Online document

Abou-Allaban, Y., Dell, M. L., Greenberg, W., Lomax, J., Peteet, J., Torres, M., & Cowell, V. (2006). Religious/spiritual commitments and psychiatric practice. Resource document. American Psychiatric Association. http://www.psych.org/edu/other_res/lib_archives/archives/200604.pdf. Accessed 25 June 2007.

Journal names and book titles should be italicized.

MANUSCRIPT III

THE OUTSIDER ON THE INSIDE: AN AUTOETHNOGRAPHIC ACCOUNT OF A SCIENTIST'S JOURNEY INTO EDUCATION

Joseph S. Covert

Valdosta State University

Department of Curriculum, Leadership, and Technology

This manuscript is prepared for submission to *Ethnography* and is the third of three manuscripts prepared for this journal-ready doctoral dissertation. Style guidelines are provided immediately following the references of the manuscript.

The outsider on the inside: An autoethnographic account of a scientist's journey into education

Joseph S. Covert
Department of Teacher Education
University of North Georgia
Dahlonega, GA 30597, USA
Email: joseph.covert@ung.edu

"Culture is not a past cause to a current self. Culture is the current challenge to possible future selves" (McDermott and Varenne, 2006: p. 8).

"Scientific ideas just aren't any ideas. They are ideas grounded in evidence." (Cobern and Loving, 2001: p. 58).

"We are culturally constructed and constructing beings, and in that construction we are never standing still" (Erickson, 1997: p. 40).

Prologue

As I sit down to write this, I look at my bookshelf and see a dichotomy: a heterogenous mixture of both science and education books. A sampling of the heterogeneity in my collection contains a book on the details of how university-K-12 school partnerships work, a book on the structure of matter, followed by a book on efforts to improve science education, and finally a book on the tectonic history of the Appalachian Mountains. This sampling of books on my shelf is a reflection of my professional life; someone who began his educational journey with aspirations of becoming an environmental scientist, but then became incredibly interested in, and passionate about, the process of educating others about science. The journey I have taken is unique and personal, reflecting an on-going process of evolution regarding what I value and on what I place emphasis in both my personal and professional lives. I feel as if I am a person between worlds, a person with training in the sciences working in the world of education, someone with inside knowledge of not just the content of science, but also a cultural membership in that world, all the while trying to increase the quality of science teaching in the K-16 world.

I struggle with duality almost on a daily basis: I have inside knowledge of an academic area in education as a result of graduate studies in biological oceanography, to a degree that makes me an outsider because many of my education colleagues, at both the K-12 and collegiate levels, do not have the depth of knowledge of the content and culture of science that I do, making me an outsider on the inside. When I say "academic culture of science" I use the work of Cobern and Loving (2001) and Gauch (2006) to establish the framework. Cobern and Loving (2001) set forth a definition for the standard account of science, which established a very articulated definition with 10 dimensions. The most essential dimensions from the Cobern and Loving (2001) definition can be summarized in the following statements. First, science is a systematic, explanatory system that requires empirical testing of naturally occurring phenomena or other scientific explanations. Second, science presupposes that there is order in nature that can be understood through systematic study, identifying causation in the natural world. Third, science is a community effort with consensus being an important step in the process of new scientific discoveries becoming a part of the larger body of scientific knowledge. Similarly, Gauch (2006) outlined a detailed multi-level definition of science. Gauch's seven pillars of science can be summarized as: first, science is a worldview that includes the participation of people from all cultures; second, science focuses on studies of physical world, which is orderly and comprehensible; third, claims in science require evidence and arguments in science are based on a shared logic. Taken together, the work of Cobern and Loving (2001) and Gauch (2006) outline a way of engaging science that does not typically occur in science classrooms and laboratories.

Introduction

My journey through the culture of science was significantly impacted by my doctoral work in biological oceanography. My course work and research in that area introduced me to the many ways that scientists approach solving problems. The specific emphasis of this problem-solving approach is on detached empiricism, where the individual researcher approaches the problem from an objective position, with the attempt to subtract emotion from the problem at hand, focusing instead on solving the problems from a purely rational and reason-based approach. And even though I was studying problems in the ecological and environmental sciences, areas that have inherent connections to humans, both in the sense that humans are impacted by the environment and can at the same time initiate significant impacts on the environment, there has been an ever-present attempt to maintain objectivity (Wallington and Moore, 2005). On this personal journey through the culture of science, I was initially drawn towards this notion of objectivity, as embodied in the form of detached empiricism, to the point that I avoided taking classes in the areas of sociology, anthropology, and psychology, unless absolutely mandated to do so as a curricular requirement. I believed that humans, while important, should not be included as part of the research and certainly not as the situated instrument of that research.

The current paper is a clear sign of a personal change for me with regard to the notion of detached empiricism and objectivity. Objectivity is a misunderstood construct for many people and in 1988 Peshkin, an educational anthropologist, provided a thoughtful critique of the construct, challenging notions of objectivity with the idea that we are all subjective in our judgments, including those in research and that, as such, we

need to be mindful of these subjectivities. According to Peshkin, identifying our subjectivities is a critical first step in the qualitative research process and for me personally, this was a critical step because of my initial academic upbringing where objectivity was a critical axiom of the discipline in which I was trained. The idea that we must confront our subjectivities was an eye-opening realization for me. This realization paved the way for me to expand my research focus beyond looking outward, to a situation where I clearly acknowledge the role that I personally play in the research process and how my journey has played an integral role in defining the course of my teaching and scholarship. In this way, I have come to realize that my journey has been and continues to be a critical part of the lens through which I view and interact with the world. This article is a report of that journey in the form of an autoethnography. Autoethnography can be a form of research that maintains the rigor, theory, and analytical characteristics which are highly valued in research, while adding dimensions that are inclusive of personal and social phenomena (Ellis, Adams, and Borchner, 2011).

A bit on culture, with emphasis on the culture of science

Over the last 35 years, there has been increasing awareness of the fact that science is a unique subculture of the overall Western culture with distinct ways of looking at the world, along with unique cultural norms and values (Maddock, 1981). Jegede and Aikenhead (1999) emphasized an awareness that teachers serve as "culture brokers," helping students negotiate the transitions between their personal worldviews, which may or may not clearly overlap with the cultural dimensions of science. Further, modern science teaching methods books are beginning to include the notion that culture is a central part of their model for effective teaching of science, for example, Settlage and

Southerland's (2012) textbook *Teaching Science to Every Child: Using Culture as a Starting Point*.

McCurdy, Spradley, and Shandy (2005) delineated four key aspects of culture. First, culture is not biologically inherited; rather culture is learned by exposure. Second, culture is a shared form of social knowledge. Third, behavior is generated by an individual's interpretation of their culture; individuals enact behavior that allows them to express their culture. Fourth, experience is interpreted through the lens of culture.

McCurdy et al. (2005) defined subcultures as "a whole way of life culture found within a larger society" (p. 14). This definition of a subculture fits science very well, overall, with the notion that scientists, the keepers and practitioners of the culture of science, in many instances have worldviews that are dominated by the culture of science perspective (Wong & Hodson, 2008). McCurdy et al. went on to describe microcultures as cultures within the culture of larger society, but that these microcultures do not define the way of life of individuals. This relates to scientists in that not all scientists are from the same microcultural group, given the wide range of disciplines with science, ranging from molecular biochemists, to field geologists, and then outward to astrophysicists and cosmologists, but all are members of the culture of science, either explicitly or implicitly sharing many of the values described by Gauch (2006), who outlined the seven pillars of science, and Cobern and Loving (2001), who derived a definition of the standard account of science. The seven pillars as outlined by Gauch are: the world is real and science attempts to understand this world; the discipline of science presupposes that the world is orderly and comprehensible; conclusions made in science must be grounded in evidence; scientists use a standard logical approach to problem solving; there are questions about

the world that science cannot answer; science is a public endeavor that is welcoming of input from all peoples, regardless gender or race/ethnicity; and finally, science strives to contribute to a meaningful worldview.

Matthews (2011) outlined the "Lederman Seven" elements of the nature of science in honor of the work of Norman Lederman and his students. The Lederman Seven does not represent a consensus listing of the nature of science elements present across all scientific disciplines, but rather this statement of the nature of science (NOS) is an effective listing of the properties that should be emphasized in K-12 education. The seven elements are: "the empirical nature of science, scientific laws and theories, creative and imaginative nature of scientific knowledge, theoretical-laden nature of scientific knowledge, social and cultural embeddedness of scientific knowledge, the myth of the scientific method, and the tentative nature of scientific knowledge" (pp. 10-11).

The focus of the inquiry

What story does my journey through science as a learner, researcher, and eventual teacher of the subject, tell us about the development of teacher identity with a particular emphasis on awareness of the cultural aspects of the academic discipline? How can aspects of my journey be distilled down to an essence that can be shared with students who are directly on the path towards becoming science teachers without the detour into the academic content area itself?

The journey begins

Beginning with my last 2 years of high school, I was committed to the idea that I was going to become a scientist. My first memories that relate to this awakening can be traced back to a statistics class and my experience in a 2-year sequence of chemistry

classes. The methods of instruction, which focused on hands-on learning of science with many laboratory activities, as well as the content of those classes, helped me to realize that I had curiosity and capability in math and science, which was worth further exploration. My experience in physics during my senior year built upon that existing foundation, further convincing me that I should study science when I went to college. I can remember asking the teacher in this physics class a question, one that I thought to be quite profound at the time, during a unit about light: "What would we see if we were to slow light down?" The teacher's answer, "Ask your physics teacher in college," only heightened my sense that I was on to something. I was also very much into Stephen Hawking at the time, reading *A Brief History of Time*, exploring the dimensions of space and time. Truly exciting things!

The collegiate years

Carrying forward the enthusiasm I had developed for physics, I went to college with the intention of studying the secrets of nature that were revealed through physics. During my freshman year I took the standard sequence of introductory classes in science and mathematics, including astronomy with the lab. I had a keen interest in environmental issues that was only increased during my first year in college, so I changed my major from physics to biology and I was ready to fully embark on studies in biology. Throughout my time as an undergraduate, I was exposed to the dichotomy that is science learning: science as a body of facts to learn and science as a process useful in the creation and resolution of questions about the world. I, like most undergraduates, spent a considerable number of hours in the lecture setting, hearing about the facts and theories found in the various sub-disciplines of science that are required learning for biology

majors (e.g., cell biology, organic chemistry, genetics, ecology, etc.), but I also had an excellent introduction to the process side of science through various independent research opportunities in which I participated. These research experiences were at the vanguard of a new trend in American higher education, an emphasis on the importance of undergraduate research, which was in its nascent stages in the early 1990s with a formal movement calling for the adoption of undergraduate research coming out of the influential Boyer Report in 1998 (Boyer Commission on Educating Undergraduates in the Research University, 1998). My campus-based research efforts were a part of the regular academic schedule for me, occurring throughout my junior and senior years. Prior to my campus-based research, I became involved in research at an internationally recognized center for marine ecology.

Summers on Sapelo and the importance of fieldwork

Early during my undergraduate studies, I was given the opportunity to work at the University of Georgia Marine Institute (UGAMI) on Sapelo Island, Georgia. This opportunity involved working with one of Dr. Richard Wiegert's graduate students during the summers between my sophomore and junior years. Dr. Wiegert was an internationally renowned ecological modeler, who focused on studying the salt marsh ecosystem (Pomeroy and Wiegert, 1981). As luck would have it, Dr. Wiegert's wife was giving a seminar on my campus and he was asked to give a talk on his research by one of my undergraduate professors, Dr. George Cline. After the lecture, I briefly spoke to Dr. Wiegert and with the help of Dr. Cline, in the weeks that followed, I was invited to serve as a research assistant for one of Dr. Wiegert's graduate students at UGAMI.

The experiences I had at UGAMI provided me a window into the process of science as practiced by active research scientists, including a significant amount of both field and laboratory based science research. In a very real sense, it was this experience that helped me see the reality of science: established theories and facts are critical to the progress of science, but the accumulated information itself is not the end, one must take those facts and theories and use the process of science to further refine current facts and theories in the service of a better understanding of the world around us. I had a lot to learn from a facts and theories perspective about marine ecology, so I spent considerable time reading and working in the research library at UGAMI. That reading greatly expanded my view of the literature of science by taking me beyond the textbook readings typical of undergraduate classes.

In addition to the literature work, I spent countless hours working in the laboratory and the field collecting data. To state it mildly, this experience removed any glamour that I might have associated with the inner workings of science. Hours spent driving back and forth to the docks to collect samplers at the next high tide, regardless of the time of day, countless more hours spent rinsing and soaking the samplers, the hot hours spent in a small boat in the salt marsh collecting and tagging blue crabs, all the while keeping a watchful eye out for the ever present, yet elusive alligators that were certainly nearby, and finally the hours spent examining samples with a microscope. I learned very early in this process that science is made of routines that take considerable time and focus, and are often boring and monotonous. It became clear that the accumulation of facts that are necessary for the development of theory in science can be quite an arduous task that requires considerable dedication. In addition to providing me

with the opportunity to conduct ecological research, what Dr. Wiegert also provided was the subject of my first social science research conducted for an environmental history class I took as an undergraduate (Oral History Collection, 1994).

The next step in the training of an academic scientist

Graduate school was initially, a very exciting endeavor. All of the new content, at much greater levels of detail, I was learning in the classroom, along with all of the new experiences I was having in the laboratory, made the first several years quite exciting. However, with the vast differences between my experiences to that point in science, even when factoring in the research experiences I had as an undergraduate, it became increasingly clear that I was in a world quite different from the world presented in science classes. When looking back at my experiences as a graduate student in biological oceanography, there were three general areas of focus: my work as a teaching assistant, experiences as a research assistant, and finally efforts to expand high-quality teaching across the campus.

Teaching assistant experiences

During my first year as a graduate student, I was placed in the role of graduate teaching assistant (TA). The role of teacher was a new one for me, but a welcome opportunity that provided new challenges and insights. The biggest challenge was the general lack of attention paid to the act of teaching, with few opportunities to systematically learn about teaching from anyone considered a master teacher. Much of what I learned was self-initiated, including hosting a training session for a nationally known water education curriculum for fellow TAs in and out of my department. I learned a considerable bit about what I was interested in during my time as a TA and one of the most surprising

aspects was that I derived energy from teaching others about science, a fact about myself that I did not know prior to that point. Another one of the things that I learned during my time as a TA was a commitment to bringing science into the classroom and teaching laboratory. During my time as a TA, I strove to bring the same kinds of inquiry learning and focus on empirical observations that I had experienced into the learning experiences in labs that I taught.

High-quality teaching reform

Near the end of my time at the University of Georgia, I worked as a teaching assistant in the Center for Undergraduate Research Opportunities (CURO), which had been established in the late 1990s to increase student participation in undergraduate research (Fechheimer, Webber, and Kleiber, 2011). I was among the first classes of TAs working in CURO and over the course of that year, the CURO TAs worked together on raising the status of teaching among teaching assistants in our own departments, as well as worked the issues surrounding undergraduate student involvement in research across campus. This was fulfilling work that was undervalued by the faculty in my department where the primary focus was on scholarship with very little emphasis on teaching. From a cultural perspective, working in the CURO shone light upon the incredible emphasis of doing science versus teaching science. The majority of the professors I worked for had a clear passion for science, but did not, for a mix of personal and professional reasons, place emphasis on teaching science, which is to share the wonders of the world with others outside of the profession. The cultural values of practicing science and publishing the results of such inquiry, without thinking about how to share this knowledge with the

larger public world, seemed to me an absent yet crucial missing a key step in the process of expanding knowledge.

In the field and laboratory

To be honest, I might have chosen the wrong sub-field of study when entering the world of biological oceanography research. In the end, I believe that I accomplished a lot in that area with several publications in high-quality research journals, co-authorship of a couple of book chapters, and presentation of my research findings at prestigious national and international conferences. However, I was not satisfied by these experiences. I say it might have been the wrong sub-field because I was originally been drawn to ecology due to the time spent in the field, but the area of research I was pursuing had a different balance of fieldwork to lab work, with lab work taking up the majority of my time. In hindsight, the challenges of fieldwork emphasized problem solving on a larger, more concrete scale. Working with others to arrange boat transport, choosing field sampling locations, and collecting data on things not restricted to the microscopic scale, all appealed to me in ways that the research involving microscopic and sub-microscopic objects and test tubes did not. Throughout it all, I learned critical lessons about what science is and what it is not. Science for me was an empirical endeavor that required the collection of data, which would be used to develop and support claims, a worldview that was encompassing, and a body of knowledge that was ever expanding due to the on-going work of scientists. I learned that science is not an easy discipline to practice, hard work, perseverance, uncertainty, and, to a certain degree, luck or serendipity are involved in the process, with all of the features not typically showing themselves as part of the

science lessons I had during my K-12 years or throughout much of my undergraduate science classes.

The detour into high school teaching

Several years into my doctoral training in biological oceanography, I began to become disillusioned about the prospects of becoming a full time member of the academic research community. I realized that I am, in fact, a bit too much of an out-going person to continue down what I perceived to be the lonely path of an academic, spending considerable hours in a laboratory conducting research or in an office writing manuscripts and grant applications. I had some experience teaching undergraduates, as well as preparing and teaching lessons for elementary school students that made me think that teaching might be the right path for me. I have a vivid memory from this time when I announced my decision to switch career paths. I stated that I wanted to teach high school because teaching college-level science majors was like "preaching to the choir. I want to work with students who have not had an opportunity to experience science from a first-hand perspective." In short, I entered the high school teaching world as an idealist; I wanted to change the world of science teaching as I saw it because I believed there was a significant amount that could/should be done to improve it.

In a very clearly stated way, one of my express goals has been to expose students to "real" science through their work in the classroom. I chose the path of becoming a high school teacher to help students learn about "real" science with the hope that they will become more aware of how science operates and the beautiful things you can learn about the universe through science. A quote from Pushkin (1999) expresses my motivation most succinctly:

> I want learning for my students to be *purposeful*....And I do not want my students to learn science as if it were a routine void of soul and emotion. I want my students to see why science is a part of me, why it keeps me up at night, and why it makes me smile when I discuss it….I want to give my students the freedom to choose how science might be part of their future; how can one choose without being offered choices? (p. 458)

My first high school science-teaching job was in a high-poverty, rural school, but served as a good introduction to the many issues surrounding contemporary education in America. This was just prior to the No Child Left Behind (NCLB) era, but in many ways the principal at this school anticipated and implemented many of the trends that would occur in the NCLB and post-NCLB world. One of the first new aspects of this world was the use of externally generated standards to serve as the guideposts for instruction. During my time as a TA, external standards did not exist. Instead, we worked under the guidance of the faculty members in charge of the class to develop and implement lab and discussion activities. In addition to this guidance, we also used our growing knowledge of our fields to select material for inclusion in the labs and discussions. In short, a community of experts was working together to plan instruction for the particular classes we were teaching, with little to no guidance from outside. Curriculum mapping and high-stakes testing at the end of courses was a critical aspect of the principal's approach at this school and represented key NCLB and post-NCLB views of education that the principal was anticipating at this school. I had experience planning learning sequences as a graduate student, but little experience with the idea of aligning all instruction to a high-stakes test taken at the end of the semester. This testing was a key constraint to the way

that people taught because once they designed the test, they had to stick to a prescribed curriculum with little deviation to insure student success at the end of the semester because once the tests were created, they could not be modified. This kind of dogged motion through a curriculum limited opportunities for student interests to be pursued and limited opportunities for students who were unable to learn the curriculum the first time through to receive remediation or reteaching. In essence, we were required to create a map and stick to it regardless of the outcome on students.

My second job as a teacher was at a high school that has a math and science program for gifted and talented students where the central areas of academic focus are on scientific research and the medical sciences. The majority of students in this program were minority and female. Initially, the faculty selected to teach within this school program either had extensive training in their academic area or years of training and experience as teachers. As the years progressed, these rigorous requirements for faculty experience in the discipline declined. In their place, we had an increasing number of teachers with the troubling view of secondary education described by Delamont (2012) where social aspects of schooling, for example, organizing prom, preparing the yearbook, and coaching cheerleading, were emphasized move over academic and scholarly approaches to schooling and learning.

During my time teaching in the gifted and talented program, we were always finding ways to interject our own personal experience with science as a living, breathing discipline into our courses and overall requirements for the program. One of the core aspects of the program was the option students had to make between participating in the research or medical science tracks; participation in the tracks was not mutually exclusive,

but it was a rare case when a student selected to participate in both tracks. Students choosing to participate in the research track were first introduced to the process of research, something that was generally quite foreign to them in spite of over 8 years of learning in grades K through 8. Students were not familiar with the process of science, particularly the falsifiability and creative aspects, so we spent considerable time introducing them to the literature of a particular area of science and then to the process of developing and testing unique questions in that area. I was involved with students during two years of their journey through the research process, the introductory course in their freshman year and then the sophomore level research class in which they began to implement their empirical research ideas. In many ways, these students thought about the process of science in a manner similar to beginning graduate students, which is no small feat given the noted flaws in contemporary American science classrooms at the high school (Schwartz et al., 2008) and college levels (Wieman, 2007). It was a testament to the ability of these particular students that they approached science from a process perspective while the system of traditional education has been slow to keep up.

One of the teachers that I worked with at this high school was profoundly influential to me in helping to make the connection between the rigors of academics and humans the intimately involved in the process. Sam Roberts (pseudonym) was a critical person on my journey as a high school teacher. Sam was a veteran mathematics teacher, having spent nearly 30 years in middle and high school classrooms, teaching math to all learners, from those designated gifted to those designated at-risk and everyone in between. Although the time I knew Sam was short, only 4 years due to his untimely death, I learned a great deal from him about how to engage learners in the task of

learning. I also learned that teaching, while involving the application of a great deal of theoretical knowledge, both from the content and learning theories perspectives, was at the core an art in the way we had to situationally apply knowledge while working with the learner on the other side of the desk. Learning to apply this kind of nuance to my teaching was an important lesson because I had been rather black or white in my approach in the classroom prior to that point. Sam really helped me see events more from the view of the individual learners, not just from my view at the front of the classroom. An example of this approach to teaching and learning involves a student that Sam and I both taught. This student, who I will refer to as Warren, was the kind of student that the system of education labels unteachable, largely because of his checkered past, which included time spent in juvenile detention, multiple moves between cities of his divorced parents who did not want to be responsible for Warren, as well as being under the supervision of a parole officer at the time of his enrollment at our school. Sam helped me see through all of these aspects of Warrren's life and work to teach the child that was in my classroom, not the past that was clinging to Warren. When it became clear to Warren that Sam and I were open to his interests and potential, rather that his past, Warren blossomed as a student, engaging my zoology class and Sam's geometry class. There was considerable enthusiasm in Warren's approach to learning. Our classrooms were on separate floors of the same building, but we were comfortable enough to allow Warren to travel between our classrooms freely during our class time when he had a question or just wanted to share an insight with the other teacher. I am thankful that I had the chance to teach Warren. I wonder what has become of him in the many years since he was in my class.

My final stop as a high school teacher further opened my eyes to the potential of students to accomplish the kind of process-focused learning that scientists conduct. It also made me realize that, in many ways, teachers are not prepared to engage students in the kinds of learning experiences that lead to process-focused thinking – a goal I believe them to be capable of achieving. This school contained a pent up capacity among the student body to go above and beyond the bounds of the science curriculum, but were largely held back by the lack of initiative of teachers to implement more student-centered, inquiry-based teaching. Many of the teachers in the introductory biology classes did not conduct any laboratory activities rather they supported more teacher-centered activities. The lab prep rooms were in profound disarray, indicating years of non-use for anything other than the storage of textbooks. The students in this school were more than capable of performing at the highest levels on state-mandated tests; regardless of the type or quality of instruction they received in class. This student capability ultimately led to a situation where the teachers and students had what I described as an unofficial and unspoken "pact" in which the teachers did not place great demands on the students. For example, few out of class projects or homework were assigned, and in return students were generally very well behaved and provided the type of scores needed by the teachers and school on high-stakes tests required by the state to measure achievement of federally-mandated educational goals. I never planned on staying at this school for long, and this "pact" solidified my plans to make this school a stepping stone to my next professional destination. While I was there, I did try to break this "pact" whenever possible by raising the expectations I placed on my students, including the full-scale implementation of laboratories as a part of my instruction. Without a doubt, this school represents one of

the saddest stops on my journey through teaching given the remarkable level of potential for students to perform at the highest levels of the process of science and the near neglect that both teachers and administrators showed for this potential.

Teaching teachers

After several years of teaching at the high school level, I had the opportunity to become a faculty member at a college of education. Initially, I was primarily focused on the teaching of science content to preservice teachers, but within the first year of my new job, I became the person who also taught the preservice teachers *how* to teach science. From the beginning of my time teaching teachers how to teach science, introducing the preservice teachers to the process of science and how it works was an important part of the process for me. In that first semester of my methods course, I had the students engage in the typical science fair type project, in which I asked the students to begin by compiling a list of questions about the world, a list we entitled, "Things that make me go, 'Huh?'" I think it is fair to say that this project was a success. It introduced students to the process of science, with an emphasis on an eyes wide-open curiosity that is a central part of the process (Lockshin, 2010). This gave the teachers an introductory look at how scientists approach science, and gave them some perspective about the process and nature of science when they implore their students to "think like scientists" (Settlage & Southerland, 2012, p. 25). One example stands out from this early period during my time as a teacher educator. A senior in the elementary school education program produced a list of over 30 questions on her "Things that make me go, 'Huh?'" assignment. She had never looked at the world in that way, and once she began looking at the world with this

kind of curiosity she had a difficult time closing her mind to the questions that appeared ever where she looked.

Throughout the next several years I continued to teach preservice teachers science content, while also helping them develop the skills necessary to teach science in K-8 classrooms. I did so through science teaching methods classes and the supervision of teaching interns. One of the most striking things to come from my experience working with these preservice teachers, as well as the inservice teachers with whom they were working, was the lack of dedication to the core principals of engaged science learning across grades K-8. I saw the most striking part of this problem in the middle grades classrooms in which I have worked because these teachers were solely teachers of science, not like the academic generalists found in elementary school classrooms (Appleton, 2006). I saw no evidence of these teachers being any better able than their elementary school counterparts to engage students in the process of learning science as a performance-focused, creative endeavor.

An example that highlights this lack of preparation at the middle school level comes from a middle school earth science classroom. The teacher in this class was also the head coach for the girls' soccer team at this school. When you entered this classroom there was no evidence of performance-based science learning anywhere in the room, no rock samples, no measuring devices, no posters highlighting student work. In contrast to the lack of evidence of science performances, there was soccer gear throughout the room. This teacher clearly knew what it took to produce performances on the soccer field, but either did not know how or chose not to engage learners in authentic science learning performances. The consequences for not engaging a soccer team in authentic

performances is clear: defeat on the soccer field and a losing record. A losing record could result losing the job as soccer coach. In contrast, our current educational system does not require authentic performances of science because the high-stakes tests overwhelming emphasize regurgitation of bits of knowledge that have been memorized. This teacher was able to adequately prepare students for success on high-stakes tests, so she was able to keep her earth science teaching job.

In my observations of their teaching, I was constantly drawn back to the questions "How did they get introduced to the process of science?" and "How are these experiences manifested in their classroom teaching?" The general conclusion I can draw, after both observation of teaching and interviews with teachers, is that their view of science came primarily from their own classroom experiences as science learners, which in most cases reinforced the common classroom view of science instruction as being about the accumulation of facts, disconnected from the process from which these facts and theories were derived.

Lessons to learned from fine arts and vocational education

We are all multidimensional individuals, bringing a diversity of background experiences to our current situations, and in this way I am no different than most. In addition to science, music has been something very important to me, going back to middle school when I took band as an elective. Over the last 25 years I have been involved in music and music education in a variety of capacities, as a learner, performer, and instructor. Reflecting on my experiences in music education and comparing them to science education, I have come to a striking conclusion about a problem central to our

preparation of teachers in academic areas, specifically that the problem is that the teachers we train do not have enough experience learning the process of a discipline.

In the past, the problem with the lack of content that is given to future science teachers has been highlighted (Schwartz and Gess-Newsome, 2008). When I reflect on my journey through the worlds of science and music, I do not agree that that is the largest problem. Instead, our training of teachers in science, as well as in other academic subject areas (e.g., math, social studies, and language arts), does not prepare future teachers to be scientists, but rather how to be vessels for the facts and theories of that discipline. Once a preservice teacher completes the necessary academic classes for his/her undergraduate degree, it is entirely possible for him/her to not ever take another content class in their chosen academic discipline. This is in stark contrast to the preparation of P-12 arts, music, and vocational teachers, who are dually trained as knowledgeable and skilled practitioners or performers within their disciplines and pedagogues in that same field of study. It is common for music teachers to continue performing with musical ensembles throughout their teaching careers, including those music teachers who earn advanced degrees and must complete juried performances on their given instrument. No such parallel exists within the academic subjects in K-12 settings. Advanced degrees in education do not routinely provide additional opportunities for teachers to learn more about science. Beyond the initial training and qualification issues and clear differences in post-graduate educational opportunities for academic versus arts and vocational teachers, school funding decisions differentially affect these two groups of teachers.

In addition to the strikingly different preparation pathways, academic and arts and vocational teachers experience contrasting levels of support from school administrators

when budget decisions are being made. When schools and school systems experience a shortfall and/or are looking to increase performance on high-stakes tests, the arts programs are threatened with reduction or closure (Holcomb 2007). At the same time as the reduction in arts areas, many of these same schools and school systems are placing increased emphasis on science, technology, engineering, and mathematics (STEM) disciplines by awarding salary bonuses to teachers in the STEM areas (Diamond 2009). These teaching bonuses would be going to individuals who, it could be argued, are less qualified to authentically introduce students into their academic areas through high-level performances than the arts faculty members who are being fired.

Conclusions and Implications

1. My experience becoming a teacher is atypical of the traditional teacher education pathways.
2. Teacher education, particularly in the K-8 levels and to a lesser degree in the 9-12 levels, is missing an opportunity to introduce teachers to science as a process.
3. Arts and vocational education effectively mix content and process during the training of new teachers, creating practitioners of pedagogy and their specific arts or vocational area.

One of the disconnects that I constantly face when working with other science educators is their lack of appreciation for the finer points of the scientific process. My experience as a science graduate student and researcher provided me with a conceptual and theoretical lens that is quite different from the one of a typical science educator. In a sense, ***I am an outsider on the inside***. I am not of the same culture as most science educators, and for that matter most of my colleagues in the college of education, because

my academic upbringing and cultural and theoretical origins are rooted within the world of science. None of my colleagues have the level of background or experience within a content area, which reinforces the idea that I am the outsider on the inside. I am a trained insider in the world of academics, having done scientific research and then written papers and book chapters. When I entered the K-12 classroom, however, I discovered that I was an ***outsider*** when ***inside*** the culture of K-12 science teaching. Over my nearly 15 year journey in the K-12 world, first as a K-12 educator and then as an educator of future K-12 teachers, I have observed that the paths designed to prepare scholars within the sciences and those for the preparation of future science teachers diverge significantly. From the classes that are taken by students in the different paths (i.e., teacher preparation versus science content classes) to the experiences they have, there is significant divergence in the level of introduction and acculturation to the cultural norms and values of science that future science teachers receive relative to students pursuing degrees within science content majors. This contrast raises the notion that the essential cultural values of academic disciplines like science are not well represented in K-12 settings. Within the K-12 setting, the general exception to this rule are the fine arts and vocational/technology teachers, who are trained members of their discipline first, or at least in parallel, relative to training as teachers.

Culture is learned and not transferred through biological inheritance, and the learning values and details of any culture require the learner to be exposed to these values on a repeated basis over a long period of time. Without exposure to these learning opportunities, it is difficult, if not impossible, to imagine a situation where the learner will acquire a functioning understanding of the culture in question. In the specific

context of science teachers, it is unreasonable for us to expect a better outcome from another generation of newly produced science teachers until we systematically reform our methods of preparing these teachers. The reformed view would, of course, continue to emphasize inquiry-based methods of instruction, but would do so in a way that truly engages future teachers in the culture of science. Allowing teachers to see what science is (and is not) while also understanding how scientists do their work, leading to the generation of claims, and the construction of theory.

Science produces a subculture, or whole way of life found within a larger society (McCurdy et al., 2005). Becoming a member of a subculture takes time, time that many teachers do not currently have. In particular, elementary school teachers are generalists, covering all of the academic subjects during their preparation, as well as teaching on a daily basis once they begin teaching. Some, including Schwartz and Gess-Newsome (2008), have called for the creation of elementary science specialists, but this call has not been widely accepted. I believe that placing the focus on the cultural angle and specifically the need to find ways to develop this cultural awareness and understanding among preservice teachers is critical. We need to identify university students who have both the interest in working with elementary aged children and interest and ability in science. Identifying these students early in their university education will better help teacher educators identify science experiences that will begin the process of acculturating preservice teachers into the subculture of science, developing an understanding of science that highlights the seven pillars of science (Gauch, 2006), as well as the standard account of science (Cobern and Loving, 2001).

The general suggestion that I can derive from this autoethnographic account is that teacher education programs need to consider adding more authentic and realistic experiences within the academic content areas. This exposure would, from my perspective, begin to provide future teachers with a deeper and richer understanding of how science progresses, better preparing them to teach science as a performance. A long-range goal would be to increase the membership of teachers within the given academic areas in which they teach. This is in stark contrast to the current model in which academic subject teachers are primarily members of the teaching profession, with secondary membership in their respective academic disciplines.

References for Manuscript III

Anderson L and Glass-Coffin B (2013) I learn by going: Autoethnographic modes of inquiry. In Jones SH, Adams TE, and Ellis C (eds) *Handbook of Autoethnography.* Walnut Creek, CA: Left Coast Press, pp. 57–83.

Appleton K (2006) Science pedagogical content knowledge and elementary school teachers. In Appleton K (ed) *Elementary Science Teacher Education: International Perspectives on Contemporary Issues and Practice*. Mahwah, N.J.: Lawrence Erlbaum Associates, pp. 31–54.

Boyer Commission on Educating Undergraduates in the Research University (1998) Reinventing undergraduate education: A blueprint for America's research universities. Available at http://eric.ed.gov/?id=ED424840

Cobern WW and Loving CC (2001) Defining "science" in a multicultural world: Implications for science education. *Science Education* 85(1): 50–67.

Delamont S (2012) The parochial paradox: Anthropology of education in the Anglophone world. In Anderson-Levitt KM (ed) *Anthropologies of Education: A Global Guide to Ethnographic Studies of Learning and Schooling*. New York, NY: Berghahn Books, pp. 49–69.

Diamond L (2009) Salary boost for math, science teachers. In: Get Schooled with Maureen Downey. Available at: http://blogs.ajc.com/get-schooled-blog/2009/03/30/bonuses-for-math-science-teachers/ (accessed 28 September 2014).

Ellis C, Adams TE and Bochner AP (2010) Autoethnography: An overview. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *12*(1). Available at: http://www.qualitative-research.net/index.php/fqs/article/view/1589

Erickson F (1997). Culture in society and in educational practices. In Banks JA and McGee CA (eds) *Multicultural Education: Issues and Perspectives,* 3rd edn. Boston: Allyn and Bacon, pp. 32–60.

Fechheimer M, Webber K and Kleiber PB (2011) How well do undergraduate research programs promote engagement and success of students? *CBE Life Sciences Education* 10(2): 156–163.

Gauch HG (2009) Science, worldviews, and education. *Science & Education* 18 (6-7), 667–695.

Holcomb S (2007) State of the arts: Despite mounting evidence of its role in student achievement, arts education is disappearing in the schools that need it most. In: NEA Today. Available at: http://www.nea.org/home/10630.htm# (Accessed 5 October 2014).

Hughes S, Pennington JL and Makrisa S (2012) Translating autoethnography across the AERA Standards: Toward understanding autoethnographic scholarship as empirical research. *Educational Researcher* 41(6): 209–219.

Jegede OJ and Aikenhead GS (1999) Transcending cultural borders: Implications for science teaching. *Research in Science & Technological Education* 17(1): 45–66.

Lockshin RA (2010) *The Joy of Science: An Examination of How Scientists Ask and Answer Questions Using the Story of Evolution as a Paradigm*. Dordrecht: Springer.

Maddock MN (1981) Science education: An anthropological viewpoint. *Studies in Science Education* 8(1): 1–26.

Matthews MR (2012) Changing the focus: From nature of science (NOS) to features of science (FOS). In Khine MS (ed), *Advances in Nature of Science Research.* Dordrecht: Springer, pp. 3–26.

McCurdy DW, Spradley JP and Shandy DJ (2005) *The Cultural Experience: Ethnography in Complex Society*, 2nd edn. Long Grove, Ill.: Waveland Press.

McDermott R and Varenne H (2006) Reconstructing culture in educational research. In Spindler G and Hammond L (eds.) *Innovations in Educational Ethnography: Theory, Methods, and Results*. Mahweh, NJ: Lawrence Erlbaum Associates, pp. 3–31.

Peshkin A (1988) In search of subjectivity—One's own. *Educational Researcher* 17(7): 17–21.

Pomeroy LR and Wiegert RG (1981) *The Ecology of a Salt Marsh*. New York: Springer-Verlag.

Pushkin DL (1999) Post-formal thinking and science education: How and why do we understand concepts and solve problems? In Steinberg SR, Kincheloe J, and Hinchey PH (eds) *The Post-Formal Reader: Cognition and Education.* New York, NY: Falmer Press, pp. 449–467.

Settlage J and Southerland SA (2012) *Teaching Science to Every Child: Using Culture as a Starting Point*, 2nd edn. New York, NY: Routledge.

Schwartz RS and Gess-Newsome J (2008) Elementary science specialists: A pilot study of current models and a call for participation in the research. *Science Educator* 17(2): 19–30.

Shulman LS (1986) Those who understand: Knowledge growth in teaching. *Educational Researcher* 15(2): 4–14.

Oral History Collection (1994) *Oral History No. 22 - Interview with Richard Weigert*. Available at: http://www.jsu.edu/library/collections/oh22_richard_wiegert.html. (Accessed 05 October 14).

Wallington TJ and SA Moore (2005) Ecology, values, and objectivity: Advancing the debate. *BioScience* 55(10): 873–878.

Wieman C (2007) Why not try a scientific approach to science education? *Change*, 9–15.

Wong SL and Hodson D (2009) From the horse's mouth: What scientists say about scientific investigation and scientific knowledge. *Science Education 93*(1): 109–130.

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V. CLOSING AND REFLECTION

My study highlights what I believe to be the central issue facing education, generally, and the preparation of educators today, specifically: the awareness of and acculturation of teachers and students into the culture of academic disciplines. Science education has struggled over the last 5 decades to change the ways that science is represented and enacted in classrooms, with a strong focus on student-led inquiry, following the seminal work of Lev Vygotsky and the social constructivists (Driver, Asoko, Leach, Mortimer, & Scott, 1994). What has been missing from the discussion is how to better introduce future teachers to the idea of inquiry and the importance of inquiry in teaching through authentic, personal engagement with the academic discipline of science. Fundamentally, we are not preparing academic teachers in the same way we prepare arts and vocational teachers. Instead of insisting that teachers become competent performers in their disciplines, as is done in the arts and vocational areas, we instead prepare academic teachers, particularly those at the K-8 level to be effective classroom managers, who are very knowledgeable about the various teaching strategies available in education, but with a very limited set of experiences working in the actual academic areas. This challenge will only grow as K-8 schools continue to look for ways to improve instruction and instructional outcomes for their students.

For those beginning a dissertation in education, I would strongly encourage you to remember that learners are our central focus. When I was beginning my journey through educational research I was challenged with the notion of doing a quantitative dissertation because of my prior experience in a hard science (biological oceanography). However, I

learned that the kind of educational researcher I wanted to conduct was more ecological, and also much more personal, than a generally possible through quantitative research methods. So, my advice to those about to embark on an educational research project is to begin by understanding the nature of the question you want to ask and then let that idea guide your choice of methodologies.

For those who find more ecologically valid forms of inquiry, I encourage you to consider ethnography and autoethnography when considering methodologies because these methods allow you special insights into events that inform the decisions taken by individuals. Getting to know individuals is a critical part of the ethnographic enterprise, and is a process that is very natural to many who call themselves teachers. With this focus on the individual and groups of individuals, you will learn a great deal about the personal, intimate impact of education.

Finally, do not be dogmatic about the methodology you employ. There is no one perfect approach to educational research to answer all research questions because of the complexity and diversity of humans and the widely variable classroom settings in which we find humans. Explore the wide range of methods, across the whole spectrum from qualitative to mixed methods to quantitative methods, before deciding on the method that best suits the goals of your study.

Dissertation References

Abell, S. K. (2007). Research on science teacher knowledge. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of Research on Science Education* (pp. 1105-1149). New York, NY: Routledge.

Agar, J. (2012). *Science in the 20th Century and Beyond*. Malden, MA: Polity Press.

Aikenhead, G. S. (1996). Science education: Border crossing into the culture of science. *Studies in Science Education*, *27*, 1–52.

Aikenhead, G. S., & Jegede, O. J. (1999). Cross-cultural science education: A cognitive explanation of a cultural phenomenon. *Journal of Research in Science Teaching*, *36*, 269–287.

Anderson, L., & Glass-Coffin, B. (2013). I learn by going: Autoethnographic modes of inquiry. In S. H. Jones, T. E. Adams, & C. Ellis (Eds.), *Handbook of Autoethnography* (pp. 57–83). Walnut Creek, CA: Left Coast Press.

Appleton, K. (2006). Science pedagogical content knowledge and elementary school teachers. In K. Appleton (Ed.) *Elementary Science Teacher Education: International Perspectives on Contemporary Issues and Practice* (pp. 31–54). Mahwah, N.J.: Lawrence Erlbaum Associates.

Appleton, K. (2007). Elementary science teaching. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of Research on Science Education* (pp. 493-535). New York, NY: Routledge.

Asoko, H. (2000). Learning to teach science in the primary school. In R. Millar, J. Leach, & J. Osborne (Eds.), *Improving Science Education: The Contribution of Research* (pp. 79-93). Philadelphia, PA: Open University Press.

Baker, D. (2002). Good intentions: An experiment in middle school single-sex science and mathematics classrooms with high minority enrollment. *Journal of Women and Minorities in Science and Engineering*, *8*, 1–23.

Bigler, R. S., & Signorella, M. L. (2011). Single-sex education: New perspectives and evidence on a continuing controversy. *Sex Roles, 65*, 659-669.

Blank, R. K. (2013). Science instructional time is declining in elementary schools: What are the implications for student achievement and closing the gap? *Science Education*, *97*, 830–847. doi:10.1002/sce.21078

Boyer Commission on Educating Undergraduates in the Research University. (1998). Reinventing undergraduate education: A blueprint for America's research universities. Retrieved from http://eric.ed.gov/?id=ED424840

Burns, J. (2014, May 4). Our impoverished view of teacher education. *Teachers College Record*. Retrieved from http://www.tcrecord.org/

Chadwell, D. W. (2010). *A Gendered Choice: Designing and Implementing Single-Sex Programs and Schools*. Thousand Oaks, CA: Corwin.

Cobern, W. W., & Aikenhead, G. S. (1998). Cultural aspects of learning science. In B. J. Fraser & K. G. Tobin (Eds.), *International Handbook of Science Education* (pp. 39–52). Boston, MA: Kluwer Academic Publishers.

Cobern, W. W., & Loving, C. C. (2001). Defining "science" in a multicultural world: Implications for science education. *Science Education*, *85*(1), 50–67.

Cuban, L. (2013). *Inside the Black Box of Classroom Practice: Change Without Reform in American Education*. Cambridge, MA: Harvard Education Press.

DeBoer, G. E. (1991). *A History of Ideas in Science Education: Implications for Practice*. New York: Teachers College Press.

Delamont, S. (2012). The parochial paradox: Anthropology of education in the Anglophone world. In Anderson-Levitt, K. M. (Ed.) *Anthropologies of Education: A Global Guide to Ethnographic Studies of Learning and Schooling* (pp. 49-69). New York, NY: Berghahn Books.

DeWalt, K. M., & DeWalt, B. R. (2011). *Participant Observation: A Guide for Fieldworkers* (2nd ed.). Lanham, Md.: Rowman & Littlefield.

Diamond, L. (2009). Salary boost for math, science teachers. Retrieved from http://blogs.ajc.com/get-schooled-blog/2009/03/30/bonuses-for-math-science-teachers/

Diaz, R. (2006). Latinas in single-sex schools: An historical overview. In J. L. Kincheloe & K. Hayes (Eds.), *Teaching City Kids: Understanding and Appreciating Them.* (pp. 41–55). New York: Peter Lang Publishing.

Driver, R., Asoko, H., Leach, J., Mortimer, E., & Scott, P. (1994). Constructing scientific knowledge in the classroom. *Educational Researcher*, *23*, 5–12. doi:10.2307/1176933

Ellis, C., Adams, T. E, & Bochner, A. P. (2010). Autoethnography: An overview. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *12*(1). Retrieved from http://www.qualitative-research.net/index.php/fqs/article/view/1589

Erickson, F. (1986). Culture difference and science education. *The Urban Review*, *18*, 117–24.

Erickson, F. (1992). Ethnographic microanalysis of interaction. In M. D. LeCompte, W. L. Millroy, & J. Preissle (Eds.), *The Handbook of Qualitative Research in Education* (pp. 201–255). San Diego, CA: Academic Press.

Erickson, F. (1997). Culture in society and in educational practices. In Banks, J. A. & McGee, C. A. (Eds.), *Multicultural Education: Issues and Perspectives* (3rd ed., pp. 32–60). Boston: Allyn and Bacon.

Erickson, F. (2011). Culture. In B. A. U. Levinson & M. Pollock (Eds.), *A Companion to the Anthropology of Education* (1st ed., pp. 25–33). Malden, MA: Blackwell Publishing.

Fechheimer, M., Webber, K., & Kleiber, P.B. (2011). How well do undergraduate research programs promote engagement and success of students? *CBE Life Sciences Education 10*(2), 156–163.

Foley, D. A., Levinson, B. A., & Hurtig, J. (2000). Anthropology goes inside: The new educational ethnography of ethnicity and gender. *Review of Research in Education*, *25*, 37. doi:10.2307/1167321

Final Next Generation Science Standards released*: State-created standards for science education in the 21st Century. (2013).* Retrieved from http://www.nextgenscience.org/final-next-generation-science-standards-released

Gauch, H. G. (2009). Science, worldviews, and education. *Science & Education*, *18*(6-7), 667–695w. doi:10.1007/s11191-006-9059-1

Glasser, H. M. (2011). Arguing separate but equal: A study of argumentation in public single-sex science classes in the United States. *International Journal of Gender, Science and Technology*, *3*(1), 70 – 92.

The Governor's Office of Student Achievement. (2011). Georgia's education scorecard: K-12 public schools. Retrieved from http://www.gaosa.org

Halpern, D. F., Eliot, L., Bigler, R. S., Fabes, R. A., Hanish, L. D., Hyde, J., … Martin, C. L. (2011). The pseudoscience of single-sex schooling. *Science*, *333*, 1706–1707. doi:10.1126/science.1205031

Holcomb, S. (2007). State of the arts: Despite mounting evidence of its role in student achievement, arts education is disappearing in the schools that need it most. Retrieved from http://www.nea.org/home/10630.htm#

Hubbard, L., & Datnow, A. (2005). Do single-sex schools improve the education of low-income and minority students? An investigation of California's public single-gender academies. *Anthropology & Education Quarterly*, *36*, 115–131. doi:10.1525/aeq.2005.36.2.115

Hughes, S., Pennington, J. L., & Makrisa, S. (2012). Translating autoethnography across the AERA Standards: Toward understanding autoethnographic scholarship as empirical research. *Educational Researcher 41*, 209–219.

Hyde, J. S. (2005). The gender similarities hypothesis. *American Psychologist*, *60*, 581–592. doi:10.1037/0003-066X.60.6.581

Hyde, J. S. (2007). New directions in the study of gender similarities and differences. *Current Directions in Psychological Science*, *16*, 259–263. doi:10.1111/j.1467-8721.2007.00516.x

Jegede, O. J., & Aikenhead, G. S. (1999). Transcending cultural borders: Implications for science teaching. *Research in Science & Technological Education*, *17*, 45–66. doi:10.1080/0263514990170104

Johnson, A. D. (2009). *40 Inquiry Exercises for the College Biology Lab*. Arlington, VA: NSTA Press.

Judson, E (2013). The relationship between time allocated for science in elementary schools and state accountability policies. *Science Education*, *97*(4), 621–636. http://doi.org/10.1002/sce.21058

Livescribe. (2013). Echo overview. Retrieved from http://www.livescribe.com/en-us/smartpen/echo/

Lockshin, R. A. (2010). *The Joy of Science: An Examination of How Scientists Ask and Answer Questions Using the Story of Evolution as a Paradigm*. Dordrecht: Springer.

Lortie, D. (1975). *Schoolteacher: A Sociological Study*. Chicago, IL: University of Chicago Press.

Madden, R. (2010). *Being Ethnographic: A Guide to the Theory and Practice of Ethnography*. London: SAGE.

Maddock, M. N. (1981). Science education: An anthropological view point. *Studies in Science Education*, *8*, 1–26.

Mael, F., Alonso, A., Gibson, D., Rogers, K., & Smith, M. (2005). *Single-sex versus coeducational schooling: A systematic review* (U.S. Department of Education No. 2005-01). U.S. Department of Education. Retrieved from http://www2.ed.gov/rschstat/eval/other/single-sex/single-sex.pd

Magnusson, S., Krajcik, J., & Borko, H. (1999). Nature, sources, and development of pedagogical content knowledge for science teaching. In J. Gess-Newsome & N. G. Lederman (Eds.), *Examining Pedagogical Knowledge: The Construct and Its Implications for Science Education* (pp. 95–132). Dordrecht: Kluwer Academic Publishers.

Matthews, M. R. (2012). Changing the focus: From nature of science (NOS) to features of science (FOS). In Khine MS (Ed.), *Advances in Nature of Science Research (pp. 3-26).* Dordrecht: Springer.

Maynard, A. E. (2004). Cultures of teaching in childhood: Formal schooling and Maya sibling teaching at home. *Cognitive Development*, *19*, 517–535. doi:10.1016/j.cogdev.2004.09.005

McCurdy, D. W., Spradley, J. P., & Shandy, D. J. (2005). *The Cultural Experience: Ethnography in Complex Society* (2nd ed.). Long Grove, Ill.: Waveland Press.

McDermott, R., & Varenne, H. (2006). Reconstructing culture in educational research. In G. Spindler & L. Hammond (Eds.), *Innovations in Educational Ethnography: Theory, Methods, and Results* (pp. 3–31). Mahweh, NJ: Lawrence Erlbaum Associates.

Mead, M., & Métraux, R. (1957). Image of the scientist among high-school students: A pilot study. *Science*, *126*, 384–390. doi:10.1126/science.126.3270.384

Meier, L. (2012). The effect of school culture on science education at an ideologically innovative elementary magnet school: An ethnographic case study. *Journal of Science Teacher Education*, *23*, 805–822.

Morrison, J. A. (2012). Exploring exemplary elementary teachers' conceptions and implementation of inquiry science. *Journal of Science Teacher Education*, *24*, 573–588. doi:10.1007/s10972-012-9302-3

Peshkin, A. (1988). In search of subjectivity—One's own. *Educational Researcher 17*(7), 17–21.

Pomeroy, D. (1994). Science education and cultural diversity: Mapping the field. *Studies in Science Education*, *24*, 49–73.

Pomeroy, L. R., & Wiegert, R. G. (1981). *The Ecology of a Salt Marsh*. New York: Springer-Verlag.

Pushkin, D. L. (1999). Post-formal thinking and science education: How and why do we understand concepts and solve problems? In Steinberg, S. R., Kincheloe, J., & Hinchey, P. H. (Eds.), *The Post-Formal Reader: Cognition and Education* (pp. 449–467). New York, NY: Falmer Press.

Sagan, C. (1995). *The Demon-Haunted World: Science as a Candle in the Dark* (1st ed.). New York: Random House.

Schwartz, R. S., & Gess-Newsome, J. (2008). Elementary science specialists: A pilot study of current models and a call for participation in the research. *Science Educator, 17*(2): 19–30.

Settlage, J., & Southerland, S. A. (2012). *Teaching Science to Every Child: Using Culture as a Starting Point* (2nd ed.). New York, NY: Routledge.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, *15*(2), 4–14.

Stanley, W. B., & Brickhouse, N. W. (1994). Multiculturalism, universalism, and science education. *Science Education*, *78*, 387–398. doi:10.1002/sce.3730780405

Tobin, J., & Henward, A. (2011). Ethnographic studies of children and youth and the media. In B. A. Levinson & M. Pollock (Eds.), *A Companion to the Anthropology of Education* (1st Ed., pp. 212–231). Malden, MA: Blackwell Publishing.

Wagner, J. (2010). Visual data in education research. In P. Peterson, E. Baker, & B. McGaw (Eds.), *International Encyclopedia of Education* (3rd ed., pp. 498–504). London: Elsevier.

Wallace, J., & Louden, W. (1992). Science teaching and teachers' knowledge: Prospects for reform of elementary classrooms. *Science Education*, *76*, 507–521.

Wallace, C. S. (2012). Authoritarian science curriculum standards as barriers to teaching and learning: An interpretation of personal experience. *Science Education*, *96*, 291–310. doi:10.1002/sce.20470

Wallington, T. J., & Moore, S. A. (2005). Ecology, values, and objectivity: Advancing the debate. *BioScience*, *55*(10), 873–878.

Wiegert, E., & Che, S. M. (2010). Single-sex classrooms in a southern charter middle school: Student, teacher, and parent perspectives. *Current Issues in Middle Level Education*, *15*(1), 1–9.

Wiegert, R. G. (1994, May 13). *Oral History No. 22 - Interview with Richard Weigert*. Retrieved from http://www.jsu.edu/library/collections/oh22_richard_wiegert.html

Wieman, C. (2007, September/October). Why not try a scientific approach to science education? *Change*, 9–15.

Wills, R. C. (2007). A new and different space in the primary school: Single-gendered classes in coeducational schools. *Educational Studies, 33*, 129–143. doi:10.1080/03055690601068303

Wong, S. L., & Hodson, D. (2009). From the horse's mouth: What scientists say about scientific investigation and scientific knowledge. *Science Education*, *93*, 109–130. doi:10.1002/sce.20290

APPENDIX A:

Dissertation Proposal

Dissertation Proposal:

Single-sex schooling at a predominately Latino elementary school

Joseph S. Covert

Curriculum and Instruction

Valdosta State University

April 29, 2013

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CHAPTER 1: INTRODUCTION

Title IX was revised in October 2006 to allow single-sex programs in publicly funded schools and led to the expansion of single-sex schooling environments across the nation (Wiegert & Che, 2010). During the 2011-2012 academic year, Oaks Elementary School (pseudonym) adopted and implemented a single-sex schooling model throughout all of the classes in the fifth grade.

The proposed study of the implementation of single-sex schooling at Oaks ES is timely and appropriate due to the on-going discussion about this topic and the economic and racial/ethnic composition of the school. I first became aware of the nature of the controversy about single-sex schooling when I read the article by Halpern et al., (2011) entitled "The Pseudoscience of Single-Sex Schooling." Upon further reading of the literature, it became clear to me that there are two opposing camps regarding this matter: those who argue there are cultural differences between male and female students, which is referred to as the single-gendered ecosystem theory (Wills, 2007), and those who see no biological or psychological difference between students and therefore see no justification for segregation based on gender, which was set forth in Hyde's gender similarities hypothesis (2005, 2007). Furthermore, this study is timely in that it has been noted in the literature that little study has been done on the impact of single-sex schooling in elementary school settings (Mael, Alonso, Gibson, Rogers, & Smith, 2005) and among low SES and Latino populations (Baker, 2002).

Given the current state of the literature, I believe that the proposed work might be able to add valuable insight into the impact of single-sex schooling on the process of learning among elementary school aged Latino children in a high poverty school setting.

Given the spread of single-sex schooling throughout American public education, I believe my research will be able to add to the national conversation about this topic. Additionally, I would like to investigate an instructional innovation throughout its life cycle within a particular school, learning about the genesis of the idea through implementation and evaluation phases of the project. The positive social change that I hope to achieve through this study has three general dimensions. First of all, the results of my study might potentially lead to a better understanding of the way(s) that sex segregation impacts the process of learning within the elementary school setting. Second, my study of single-sex classrooms might also be able to better prepare teachers, both pre-service and in-service, for their work with students in single-sex classrooms. Finally, understanding the life cycle of such a significant shift in school policy might help school leadership make better and more informed decisions about instructional changes.

CHAPTER 2: CONCEPTUAL FRAMEWORK

Sex discrimination in any education program receiving Federal funding assistance was prohibited by Federal law with the passage of Title IX in 1972 (Zittleman, 2007). Prior to the implementation of Title IX, public education in the United States was quite often sex-segregated (Zittleman, 2007). Beginning with a reinterpretation of Title IX in 2006, public educators implemented single-sex educational programs across the United States (D. F. Halpern et al., 2011). To demonstrate the extent of the expansion of single-sex programs, Wiegert and Che (2010) cite an example from South Carolina where nearly 40% of public middle schools in the state have adopted some sort of single-sex schooling as of the 2008-2009 school year. Bigler and Signorella (2011) identified several factors that led to the resurgence of single-sex educational programs in America: first, exclusion of boys from classrooms has been suggested as an effective way of increasing the academic achievement of girls; second, the low scores of American students on international education comparisons; and third, claims about differences in male and female brain anatomy.

The move towards single-sex schooling is occurring in spite of research that indicates mixed results in terms of long-term academic improvement (Mael et al., 2005), as well as questions about the long-term negative impact of single-sex schooling on the development and reinforcement of gender and racial stereotypes (Bigler & Signorella, 2011; Halpern et al., 2011; Hubbard & Datnow, 2005). The majority of studies on single-sex schooling have focused on secondary and post-secondary levels, with many fewer studies on single-sex schooling at the elementary level and there is also a noted tendency for studies to focus on girls' schools, rather than boys' schools (Mael et al.,

2005). Bigler and Signorella further added that the majority of studies on single-sex schooling were conducted at private, often times religiously affiliated schools.

In addition to the general lack of studies done at the elementary school level, class and ethnicity have been largely overlooked in studies on the impact of single-sex schooling with Latino students (Baker, 2002). Diaz (2006) made the case that there are several issues in Latino culture that should be considered when working with Latino and Latina students: first, there is a history of Latinas being taught in single-sex settings that dates back hundreds of years; second, Latino/a teachers typically emphasize respect, discipline, and responsibility, qualities which are less evident in American schools; and third, Latino culture has strongly defined gender roles that can interfere with the ability of females to pursue careers outside of the household.

The public entrusts educators and educational administrators to make the best decisions possible for our children, a task that is made difficult when the research is still inconclusive in an area, such as single-sex schooling. Two distinct sides have emerged on this subject, offering conflicting visions on the impact of single-sex schooling: the National Association for Single-Sex Public Education (NASSPE) and the American Council for CoEducational Schooling (ACCES). These associations each offer resources to support their positions. In addition, the NASSPE holds annual meetings and training workshops for teachers and administrators (National Association for Single-Sex Public Education, 2013).

My study of the single-sex schooling initiative is informed by a wide range, and in some ways contradictory base of theoretical perspectives. From the biological perspective, the two relevant theories that emerge from the literature are the gender

similarities hypothesis (Hyde, 2005, 2007) and cognitive process taxonomy (Halpern, 2004), which, when taken together, argue the point that males and females are not fundamentally different at the biological or psychological level. From the cultural direction, the theoretical perspective is informed by the single-gendered ecosystem theory (Wills, 2007) and aspects of queer theory (Gunckel, 2009) in support of the notion that there is a great deal of importance on understanding the cultural aspects of learning and the ways in which learners construct their understandings of the subjects at school, as well as the world at large.

The study I am proposing will focus on the numerous subcultures and microcultures that are interacting within Oaks ES during the single-sex schooling initiative. According to McCurdy, Spradley, and Shandy (2005), culture is a type of knowledge that is learned by and shared among members of a group, defines the range of behavior for members, and helps members to interpret their experiences. Erickson (1997) noted that humans are part of the continuous and on-going construction of culture, and Tobin and Henward (2011) further noted that cultures are continually in the process of changing. I want to watch as the culture of the single-sex classroom proceeds, from student-student, student-teacher, and teacher-teacher interactions, along with the development of a school culture that includes single-sex schooling as one of it's guiding principles/values. The cultures that I will be observing are at the level of microcultures, which McCurdy et al., (2005) defined as cultures found within a larger society that do not define the whole way of life of its members. Further, I want to see how these microcultures develop among the different groups present in the school, each responding

to the challenge of McDermott and Varenne (2006): “Culture is not a past cause to a current self. Culture is the current challenge to possible futures selves” (p. 8).

Personal Interest

I am a college professor who is involved in the training of future elementary school teachers, with an emphasis on developing the science teaching skills of these future teachers. Prior to becoming a college professor, I was a high school science teacher for seven years and before that I was a graduate researcher studying biological oceanography. In my educational background, I did not have any male teachers until reaching middle school and I was never in a gender-segregated classroom. During my career as a high school science teacher, I had the privilege to teach for four years in a science and mathematics magnet program that drew students from across a large metropolitan county. This magnet program was majority female, without any planning or selection criteria in place that favored the admission of females, and this experience served as an introduction to the role of gender in education. What I witnessed while teaching in that program was almost a reversal of roles in terms of science and math achievement, with girls taking the lead in almost every way. I also learned about the many obstacles that my female students had to face in their educational journey in grades K-8 that almost prevented some of them from pursuing their interest in science. Due in large part to my experience at that program, I am quite interested in the impact of gender segregation on elementary student behavior and academic achievement, with a particular emphasis on science.

During my seven years as a high school teacher, I was never impressed with the intellectual background of the implementations that I was a part of OR the way in which

building or district level leaders implemented the innovation. There are numerous examples I could cite, but what they all have in common, from my perspective, is a quick-fix, snake oil salesman kind of quality. By that I mean that the school had identified some need (either real or perceived) and then found a quick solution to the problem.

Prior Work at Site

I have completed a pilot study of this work on gender-based schooling and I have been in the school throughout both years of implementation of the single-sex classrooms in the fifth grade. During the pilot study and my on-going work for student teaching interns at Oaks ES, I have made observations of student behavior in the newly sex-segregated classrooms, engaged in conversation with my university students who have taught in these classrooms, and spoken to a number of critical informants, teachers and administrators, who have been involved in the implementation.

I have been working with the principal and teachers at Oaks ES for nearly three years, participating in the expansion of the partnership between my university and Oaks ES, which has allowed me to place my university classes at this elementary school, as well as allowed me the opportunity to observe university students as they complete their teaching internships. I worked closely with the principal who initiated the single-sex program, as well as with the two instructional coaches at the school, one of whom was instrumental in bringing the single-sex schooling concept to Oaks ES.

Research Questions

My research questions are centered on three central areas of focus regarding single-sex schooling: student response, pre-service and in-service teaching response, and

the development and implementation of the initiative. Within each of those central areas, there are sub-questions that focus attention on specific details of single-sex schooling.

1. What impact has the implementation of single-sex schooling had on students?
    a. How do boys and girls respond to single-sex schooling?
    b. What impact does single-sex schooling have on student learning?
2. How does single-sex schooling influence classroom teaching?
    a. How do teachers respond to/interact with single-sex versus coeducational classes?
    b. What impact does teaching in a single-sex classroom have on the development of pre-service teachers?
3. How did single-sex schooling arise at this school?
    a. How was the single-sex schooling initiative developed and implemented?
    b. Why was the single-sex schooling initiative implemented?

CHAPTER 3: METHODS

Research Site

During the 2011-2012 academic year, Oaks ES implemented a single-sex schooling model throughout all of the classes in the fifth grade, which produced three all boy and three all girl classes. The school continued this model for the 2012-2013 academic year, with the notable change of reconstituting two coeducational classes in the fifth grade. During the 2012-2013 academic year, there are two all boy, two all girl, and two coeducational classes in the fifth grade.

The majority of the students at Oaks ES, which is located in a metropolitan area of northeast Georgia, are first generation Latino immigrants, with 95% of the students being recognized as Hispanic (The Governor's Office of Student Achievement, 2011). In contrast to the student body, 90% of the teaching staff at Oaks ES was White and females made up the majority (96%) of the teaching and administrative staff during the 2010-2011 school year, the most recent reporting year available (The Governor's Office of Student Achievement, 2011). The students at Oaks ES come from households of lower socioeconomic status (SES), with 99% of the students receiving free or reduced lunch in 2011, which is a significantly higher percentage than the average for the local school system at 59% (The Governor's Office of Student Achievement, 2011).

Research Methods

The situation I have described represents the interaction of a number of different cultures: the Hispanic culture of the majority of the students, the White culture of the majority of the teaching staff (all of the fifth grade teachers, administrative staff, and pre-service and in-service teachers), and the culture of a school, so I am proposing to take an

ethnographic approach in this study of the implementation of single-sex schooling. The three primary approaches to data collection in the proposed study are participant observation (DeWalt & DeWalt, 2011; Erickson, 1992), microethnography (Wagner, 2010), and ethnographic interviewing (Madden, 2010).

As I described above, I am frequently at the school to the point that I have assumed the role of active participant (DeWalt & DeWalt, 2011), having engaged in many of the activities present within the school, short of becoming employed as an elementary school teacher. I meet regularly with administrators, instructional coaches, teachers, and support staff, and am on a first name basis with the majority of the staff at the school, so my presence is no longer that of an outsider. I have led two professional learning workshops for teachers at Oaks ES on the subject of science inquiry, so I am known in the school as "Joe the Science Guy." I have taught university classes at Oaks ES that included a component where my students went into the classes of Oak ES to teach science and I observed many of these lessons. Currently, I have 10 pre-service teacher interns who I observe regularly in their placement classrooms. Due to my observations of student interns in the classrooms, I am also known to many of the students in the school, although not by name.

In addition to the field-based participant observer approach, in which I have been engaged, I have also been looking at classroom culture through microethnograhic analysis. There are two sources of video for my analysis: lessons recorded for the purpose of evaluating pre-service teaching interns who are completing placements in fifth grade classrooms and video recorded expressly for the purposes of the proposed study.

Throughout the process of participating in the community at Oaks ES, I have been conducting semi-structured ethnographic interviews with key informants, including the principal of the school and teachers in the fifth grade. These interviews have typically been of a more informal nature, with a few critical questions/prompts that are used in most cases, which include: background experience with single-sex schooling, experience with single-sex schooling at Oaks ES, and personal involvement in the implementation of single-sex schooling.

Data Collection

Field notes and interviews

The types of data that I plan on collecting are consistent with that of a participant observer who is engaging in microethnographic analysis of the classroom. During the period of my research, I will record field notes on observations of classroom behavior and interactions with various stakeholders in the school, including students, teachers, student teachers, instructional coaches, administrators, and various staff members at the school. Informal interviews will be conducted with the faculty and staff of the school about the implementation of the gender-based schooling innovation. I am particularly interested in learning the process the school went through prior to and during the implementation, with an emphasis on the history of the how and why single-sex schooling was chosen as an instructional innovation and what sorts of professional development opportunities were given to the teachers and other school staff. In addition to interviews of faculty and staff, I plan on completing ethnographic interviews with pre-service teachers who taught in the fifth grade classes during the life cycle of the single-sex initiative. A Livescribe Echo pen, which records audio while simultaneously

capturing images of text written in a Livescribe notebook (Livescribe, 2013), will be used during all observations to capture audio recordings of the classroom environment.

Microethnographic video

In addition to live observations, I am also planning on video recording lessons in fifth grade classrooms. In all cases, video will be recorded to capture the entire room, or as much as feasibly possible, with no panning the camera to follow the teacher, but rather focused on the whole room to capture as many of the interactions as possible (Erickson, 1992). Where possible, I will follow another suggestion from Erickson to use two video cameras, with one camera stationary to capture the widest view possible and another camera hand-held to capture specific events within the classroom. During any given recording session, Flip video cameras, iPhones and/or iPad 2s will be used to record video.

My university students routinely record video of lessons they teach and there is also a systematic school wide effort to capture teaching best practices on video, so the students at Oaks ES are already accustomed to being videotaped. The video will also be used for member checks (more in later section).

Artifacts

I plan on looking at three main categories of artifacts: test scores, behavior and attendance data, and student-generated artifacts. The primary tests in question are the state-mandated Criterion Referenced Competency Test (CRCT), which students take in third, fourth, and fifth grades, in all four major subject areas and the Diagnostic Reading Assessment, which is a teacher administered test of student reading levels. Behavior and attendance data will be examined to look for trends within the grade level data. I will be

looking at classroom and grade-level data in the aggregate and in no case will data of individual students be accessed or included in the analysis. I plan to use the findings from the analysis of these artifacts to serve as the basis of conversations with teachers about their perceptions of the role the single-sex schooling might have had on test scores and discipline referrals. The third category of artifacts is student-generated material, which will include, but not be limited to student essays, responses to teacher generated surveys about classroom environments, and pictures of student work on the walls of the classroom and hallways.

Data Analysis

Cultural Analysis

My data analysis will be driven by principles of cultural analysis laid down by McDermott and Varenne (2006), who listed three critical requirements for cultural analysis:

1. The study should focus on a minimum of three people working to interpret each other over time.
2. The researcher(s) should work to move beyond received categories.
3. A focus is placed on looking at the ways individuals within a group work to isolate each other.

Field notes and interviews

According to DeWalt and DeWalt (2011), data analysis is the most mysterious of all of the methods employed by qualitative researchers who use participant observation methods. The first step of data analysis is data reduction (DeWalt & DeWalt, 2011) in

which the complexities inherent in my field notes will be reduced and focused. By the design of my study, I have already focused on a specific set of factors, which will be the center of my attention during the observations. These central areas of focus or themes will be student-student (SS) and student-teacher (ST) interactions. These themes are the highest-level codes that will be used and serve as the umbrella under which other, more specific terms will be used. In terms of specific codes that will be used for observations, there are several that could be used from the beginning: positive academic support (PAS), negative academic support (NAS), positive social support (PSS), negative social support (NSS), dyad interaction (DI), group interaction (GI), single-sex (SS), or mixed gender (MG). An index will be generated from the coded field notes and this information will be used to refer to specific instances for further examination with microethnographic analysis.

Microethnographic video

Analysis of video will focus on analyzing and interpreting the interactions recorded between students and teachers in each of the classrooms. Two of the critical aspects of ethnographic microanalysis that I will need to be sensitive to are: (1) identification of the full range of variation of interaction in the setting and (2) determination of how typical or atypical the different interactions are within the setting (Erickson, 1992). The videos will be coded for student behavior and engagement, as well as teacher behavior and response. Studiocode data analysis software will be used to facilitate coding and collection of relevant video segments. Video will also be shared with stakeholders to corroborate conclusions drawn from microethnographic analysis.

Artifacts

For both artifacts, test scores and discipline referrals, I will be looking at trends exclusively. It is not the intention to look at individual students during the analysis. Instead, what I plan to do is look at the data at the class and grade level, disaggregating for gender. The primary assumption at Oaks ES that led to the switch to single-sex schooling was that student achievement and discipline would improve. Analysis of these class and grade level artifacts will produce tentative support to or could serve to undermine these assumptions. Anecdotal reports from teachers and student interns in the school indicate that there has been an improvement in behavior. Student-generated artifacts will be used to document the student perspective on single-sex schooling.

Validity

I am a member of this community and have been for almost 2 years and I will continue to be a member of the Oaks Elementary School community for the duration of my study and beyond, and I believe my study will benefit from my long-term, intensive involvement. I am in this school multiple times per week for several hours per visit, which provides me ample opportunity to observe and interact with the culture of the school, allowing me to develop and test alternate explanations.

Following closely from my intensive, long-term involvement with the school would be a "rich" and detailed data set. I will have opportunity to observe and video record as many classrooms as possible, leading to numerous transcripts and coded videos. Field notes will be taken during observations of classrooms and other student-centered locations (e.g., playground, cafeteria, gym etc.), as well as during hallway conversations

with adult stakeholders in the school, including teachers, administrators, the janitors, and media center staff.

I will be routinely engaging in respondent validation with members of the Oaks ES community by sharing my developing explanations and conclusions with them, including the sharing of recorded videos to compare my explanations and conclusions with those from other members of the Oaks ES community. These member checks will be an important part of the research process.

I will not be formally participating in the single-sex schooling manipulation per se, but I am a presence in the school, which translates into me being an intervention at Oaks ES. This is evident when I walk into classes for observations, especially at the beginning of a semester or after a prolonged absence from the classrooms on my part (as evidenced earlier in my involvement with Oaks ES, when I was out of town for over two weeks and upon returning to classrooms at Oaks ES the whispers about the college professor went around the room again). Specific elements of my intervention are: I teach science teaching methods courses to university students at this location, I have, in the past, taught Oaks faculty members in professional learning workshops, and I visit classrooms on a weekly basis when conducting observations of my student interns.

Additionally, I am planning to involve Javier Gonzalez, Director of Multicultural Programs at Abraham Baldwin Agricultural College, in my research to help provide an insider perspective on what is happening at Oaks ES. Javier is originally from Mexico and shares much in common with the students at Oaks ES. He is fluent in Spanish and can help me understand how the role that the culture that students bring with them from home influences their interactions and activities at school. Javier will be spending a day

at the school in the late spring of 2013, observing classrooms and interacting with pre-service and in-service teachers. I will be conducting a semi-formal interview with Javier at the conclusion of his visit to Oaks ES. Following his visit, I plan to continue consulting with Javier regarding my observations and interpretations of classroom activities.

My data will be rich and multi-dimensional, so triangulation will be occurring throughout. I will be observing live classrooms and interviewing adult stakeholders and also recording the audio, video, or both for all observations and conversations, so I will be able to access the original events to corroborate them in the future. I will be analyzing artifacts to provide an observation independent view of discipline, as well as student achievement.

Preliminary Results

My proposal is informed by an on-going pilot study. The pilot study began in May 2012 and started as a collaborative project with an undergraduate student from my home institution. The pilot study received approval from the local school board, the university I work for, and Valdosta State University (see Appendices for research and IRB applications, as well as approval letters).

During the course of the pilot study, my undergraduate collaborator and I have conducted many observations and completed several ethnographic interviews of key informants. There are several trends that have become evident during the course of our on-going research. First, the initiative grew out of work that one of the instructional coaches was doing with her students, particularly boys in the fifth grade, which is an interesting contrast from the literature that talks about this type of innovation being

focused on raising underachievement among girls (Bigler & Signorella, 2011; Diaz, 2006). Second, this instructional coach then approached the principal with the idea of implementing single-sex schooling across one or two grade levels, interestingly, the principal had previously led a middle school roughly 10 years ago where single-sex schooling was attempted, but the principal did not bring this reform to the school. Third, there has not been any formal training on single-sex strategies; the individual teachers have adapted different approaches to working with students in single-sex classrooms, but only one reports accessing any literature to inform their decision making or teaching. Fourth, a majority of students from the 2011-2012 fifth grade classes reported satisfaction with the single-sex schooling, recommending it continue for future fifth grade classes.

REFERENCES

Baker, D. (2002). Good intentions: An experiment in middle school single-sex science and mathematics classrooms with high minority enrollment. *Journal of Women and Minorities in Science and Engineering*, *8*(1), 1–23.

Bigler, R., & Signorella, M. (2011). Single-sex education: New perspectives and evidence on a continuing controversy. *Sex Roles*, *65*(9), 659–669. doi:10.1007/s11199-011-0046-x

DeWalt, K. M., & DeWalt, B. R. (2011). *Participant observation: A guide for fieldworkers* (2nd edition.). Lanham, Md.: Rowman & Littlefield.

Diaz, R. (2006). Latinas in single-sex schools: An historical overview. In J. L. Kincheloe & K. Hayes (Eds.), *Teaching city kids: Understanding and appreciating them.* (pp. 41–55). New York: Peter Lang Publishing.

Erickson, F. (1992). Ethnographic microanalysis of interaction. In M. D. LeCompte, W. L. Millroy, & J. Preissle (Eds.), *The handbook of qualitative research in education* (pp. 201–255). San Diego, CA: Academic Press.

Erickson, F. (1997). Culture in society and in educational practices. In J. A. Banks & C. A. McGee (Eds.), *Multicultural education: Issues and perspectives.* (3rd. edition., pp. 32–60). Boston: Allyn and Bacon.

The Governor's Office of Student Achievement. (2011). Georgia's education scorecard: K-12 public schools. Retrieved from http://www.gaosa.org.

Gunckel, K. L. (2009). Queering science for all: Probing queer theory in science education. *Journal of Curriculum Theorizing*, *25*(2), 62–75.

Halpern, D. F., Eliot, L., Bigler, R. S., Fabes, R. A., Hanish, L. D., Hyde, J., … Martin, C. L. (2011). The pseudoscience of single-sex schooling. *Science*, *333*(6050), 1706–1707. doi:10.1126/science.1205031

Halpern, D. F. (2004). A cognitive-process taxonomy for sex differences in cognitive abilities. *Current Directions in Psychological Science*, *13*(4), 135–139. doi:10.1111/j.0963-7214.2004.00292.x

Hubbard, L., & Datnow, A. (2005). Do single-sex schools improve the education of low-income and minority students? An investigation of California's public single-gender academies. *Anthropology & Education Quarterly*, *36*(2), 115–131. doi:10.1525/aeq.2005.36.2.115

Hyde, J. S. (2005). The gender similarities hypothesis. *American Psychologist*, *60*(6), 581–592. doi:10.1037/0003-066X.60.6.581

Hyde, J. S. (2007). New directions in the study of gender similarities and differences. *Current Directions in Psychological Science*, *16*(5), 259–263. doi:10.1111/j.1467-8721.2007.00516.x

Livescribe. (2013). Echo overview. Retreived from http://www.livescribe.com/en-us/smartpen/echo/

Madden, R. (2010). *Being ethnographic: A guide to the theory and practice of ethnography*. London: SAGE.

Mael, F., Alonso, A., Gibson, D., Rogers, K., & Smith, M. (2005). *Single-sex versus coeducational schooling: A systematic review* (U.S. Department of Education No. 2005-01). U.S. Department of Education. Retrieved from http://www2.ed.gov/rschstat/eval/other/single-sex/single-sex.pdf

McCurdy, D. W., Spradley, J. P., & Shandy, D. J. (2005). *The cultural experience: Ethnography in complex society* (2nd edition.). Long Grove, Ill.: Waveland Press.

McDermott, R., & Varenne, H. (2006). Reconstructing culture in educational research. In G. Spindler & L. Hammond (Eds.), *Innovations in educational ethnography: Theory, methods, and results* (pp. 3–31). Mahweh, NJ: Lawrence Erlbaum Associates.

National Association for Single-Sex Public Education. (2013). Events. Retrieved from http://www.singlesexschools.org/events-2010conference.htm.

Tobin, J., & Henward, A. (2011). Ethnographic studies of children and youth and the media. In B. A. Levinson & M. Pollock (Eds.), *A companion to the anthropology of education* (1st Ed., pp. 212–231). Malden, MA: Blackwell Publishing.

Wagner, J. (2010). Visual data in education research. In P. Peterson, E. Baker, & B. McGaw (Eds.), *International Encyclopedia of Education, 8-Volume Set, Third Edition* (Vols. 1-8, pp. 498–504). London: Elsevier.

Wiegert, E., & Che, S. M. (2010). Single-sex classrooms in a southern charter middle school: Student, teacher, and parent perspectives. *Current Issues in Middle Level Education*, *15*(1), 1–9.

Wills, R. C. (2007). A new and different space in the primary school: Single-gendered classes in coeducational schools. *Educational Studies, 33*(2), 129–143. doi:10.1080/03055690601068303

Zittleman, K. (2007). Teachers, students, and Title IX: A promise for fairness. In *Gender in the classroom: Foundations, skills, methods, and strategies across in the curriculum* (pp. 73–107). Mahweh, NJ: Lawrence Erlbaum Associates.

Zittleman, K. R. (2007). Gender perceptions of middle schoolers: The good and the bad. *Middle Grades Research Journal*, *2*(2), 65–97.

APPENDIX B:

NGCSU IRB Appplication

North Georgia College & State University

APPLICATION FOR APPROVAL OF RESEARCH WITH
HUMAN RESEARCH PARTICIPANTS

- Review "Human Subjects Guidelines at North Georgia College & State University" which can be found at: http://www.ngcsu.edu/Resource/irb/guidelines.shtml
- Deadlines for applications are one week prior to meeting dates. See the IRB website for dates: http://www.ngcsu.edu/Resource/irb/meetings.shtml
- Submit the application and all accompanying documentation (e.g., consent forms, surveys, instruments, interview protocol, etc.) to Dr. Teresa Fletcher at tbfletcher@ngcsu.edu.

Date:	April 4, 2012
Department:	Teacher Education
Primary Investigator (PI):	Joseph S. Covert
E-Mail	jscovert@northgeorgia.edu
Title of Research	Single-sex schooling in a predominantly Hispanic elementary school
*Faculty advisor of Student Research	
E-Mail:	

*Faculty advisors must review applications prior to submitting to the IRB. By agreeing to be a faculty advisor, you will be responsible for submitting any significant changes in procedures and/or instruments for prior approval and will inform the IRB of any unanticipated risks to research participants which may occur.

Review Process:

ALL STUDIES REQUIRE A COMPLETED APPLICATION, REGARDLESS OF STATUS (FULL REVIEW, CONTINUATION OF A PREVIOUS STUDY, EXEMPT, EXPEDITED).
If this study is funded, the name and amount of funding source

___This study is not funded

X This study is funded by FUSE 2012 for $8,000

If this study is a continuation of a prior approved study, list approval date, title, and name of primary researcher (also include application # if able):

Approval Date/Application #:

Primary Investigator:

Title:

Some research studies may qualify for ***EXEMPT*** status. If you believe this study is n ***EXEMPT*** from a Full Review of the IRB Committee, identify which of the following criteria apply and explain below.

EXEMPT STATUS:	Yes	No	N/A
(1) Research on regular and special instructional strategies, or research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.	X		
Please explain: *We are investigating the implementation of a single-sex education program at a local elementary school, specifically looking at the details of the implementation and the reaction of various stakeholders to this program. There is considerable existing literature on the subject of single-sex education, but the overwhelming majority of the research is quantitative in nature, as well as focused on higher income and non-minority school settings.*	Yes	No	N/A
(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), voluntary survey procedures, voluntary interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human participants can be identified, directly or through identifiers linked to the participant; and (ii) any disclosure of the human participants' responses outside the research could reasonably place the participants at risk of criminal or civil liability or be damaging to the participants' financial standing, employability, or reputation.	X		

Please Explain: We will be observing in-class behavior of students, as well as informally interviewing teachers and other school personnel. Students and teachers will not be named specifically in any reporting of our results. We will also be video recording classrooms, which we have prior permission from parents and the school system.	Yes	No	N/A

(3) Research involving the use of educational tests (cognitive, diagnostic, aptitude. achievement), survey procedures, interview procedures or observation of public behavior that is not exempt under (2) above if: (1) the human participants are elected or appointed public officials or candidates for public office; or (ii) Federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.	X		
Please Explain: We will be looking at class level trends in state administered CRCT tests for students in the 4th and 5th grade. We will not be looking at individual student results.	Yes	No	N/A
(4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in a manner that participants cannot be identified, directly or through identifiers linked to the participants.	X		
Please Explain: We will be including state testing (CRCT) data and total numbers of discipline referrals in our analysis. We will be focusing on trends and not individual students in our analysis.	Yes	No	N/A
(5) Research and demonstration projects which are conducted by or subject to the approval of State or Federal Department or Agency heads, and which are designed to study, evaluate, or otherwise examine: (1) Public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs, (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.			X
Please Explain:	Yes	No	N/A
(6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed or (ii) if a food is consumed that contains a food ingredient at or below the level for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency, or the Food			X

Safety and Inspection Service of the U.S. Department of Agriculture.			
Please Explain:	Yes	No	N/A

Some research studies may qualify for ***EXPEDITED*** status, which consists of research involving no more than *minimal risk* and in which the only involvement of human participants will be in one or more of the following categories (carried out through standard methods) may be reviewed by the Institutional Review Board through the expedited review procedure authorized in 46.110 of Title 45, Code of Federal Regulations, Part 46.

If you believe this study qualifies for an ***EXPEDITED*** review from select members of the IRB Committee, identify which of the following criteria apply and explain below.

EXPEDITED STATUS:	Yes	No	N/A
(1) Minor changes in previously approved research during the period (of one year or less) for which approval is authorized.			
Please Explain:	Yes	No	N/A
(2) Collection of: hair and nail clippings, in a nondisfiguring manner; deciduous teeth; and permanent teeth if patient care indicated need for extraction.			
Please Explain:	Yes	No	N/A
(3) Collection of excreta and external secretions including sweat, uncannulated saliva, placenta removed at delivery, and amniotic fluid at the time of rupture of the membrane prior to or during labor.			
Please Explain:	Yes	No	N/A
(4) Recording of data from participants 18 years of age or older using noninvasive procedures routinely employed in clinical practice. This includes the use of physical sensors that are applied either to the surface of the body or at a distance and do not involve input of matter or significant amounts of energy into the participant or an invasion of the participant's privacy. It also includes such procedures as weighing, testing sensory acuity, electrocardiography, electroencephalography, thermography, detection of naturally occurring radioactivity, diagnostic echography, and electroretinography. It does not include exposure to electromagnetic radiation outside the visible range (e.g., x-rays, microwaves).			

Please Explain:	Yes	No	N/A
(5) Collection of blood samples by venipuncture, in amounts not exceeding 450 ml in an eight-week period and no more often than two times per week, from participants 18 years of age or older and who are in good health and not pregnant.			
Please Explain:	Yes	No	N/A
(6) Collection of both supra- and subgingival plaque and calculus, provided the procedure is not more invasive than routine prophylactic scaling of the teeth and the process is accomplished in accordance with accepted prophylactic techniques.			
Please Explain:	Yes	No	N/A
(8) Moderate exercise by healthy volunteers.			
Please Explain:	Yes	No	N/A
(9) The study of existing data, documents, records, pathological specimens, or diagnostic specimens.			
Please Explain:	Yes	No	N/A
(10) Research on individual or group behavior or characteristics of individuals, such as studies of perception, cognition, game theory, or test development, where the investigator does not manipulate participants' behavior and the research will not involve stress to participants.			
Please Explain:	Yes	No	N/A
(11) Research on drugs or devices for which an investigational new drug exemption or an investigational device exemption is not required.			
Please Explain:	Yes	No	N/A

Purpose of the Study:

State the purpose of the study:

To examine the implementation and impact of single-sex schooling at a predominantly Hispanic elementary school.

State Research Questions/Hypotheses:

4. Have single-sex classes had an impact on student behavior and overall classroom management? 5. Have single-sex classes had an impact on student learning outcomes?

a. Particular emphasis on science and mathematics learning outcomes.
6. What impact does single-sex schooling have on students from a traditionally male dominated culture when the all of the teachers are female?
7. What role did administrators, teachers, staff, students, and parents have in the process of switching to single-sex schooling in the fifth grade?
8. Does the incidence or frequency of code switching vary between all-boys, all-girls, or mixed gender classes?

Participants:

Describe proposed research participants (number, age, gender, etc.). Include how participants will be recruited and inclusion/exclusion criteria.

The participants of the proposed study are members of the Oaks Elementary School (pseudonym) community. The researchers are participant observers in this school in our current capacities as a North Georgia student in the Early Childhood Education/Special Education program (Carver) and faculty member in the School of Education at NGCSU (Covert). We have gained access to this school through the permission of the school principal. We will be making observations of students in the 4th and 5th grades at Oaks ES; there are six classes in each the 4th and 5th grade.

Please note if any participants are from a "vulnerable" category (See below).

"Vulnerable" Participants	Yes	No	N/A
Prisoners		X	
Minors /under age 18	X		
Poor/uninsured	X		
Institutionalized		X	
Immigrants	X		
Limited or non-readers		X	
Wards of the state (e.g., foster children)		X	
Pregnant women		X	
Elderly/Nursing home residents recruited in a nursing home		X	
Students of Principle Investigator (PI) or study staff/research team		X	
Students to be recruited in their education setting, (i.e., in class or at school)	X		
Employees directly supervised by PI or research team member		X	
Employees of Research Site or Sponsor	X		
Military personnel to be recruited by military personnel		X	
Cognitively impaired		X	

Adult subjects who cannot consent for themselves (legal guardian consent)		X	
Others (specify):			

Procedures:

Describe (in detail) the procedures used in this study:

For this ethnographic study, we will be using participant observation and visual ethnographic methods. Danielle Carver, an undergraduate at NGCSU, and I are already participant observers in this school setting.

1. During the period of our research, we will record field notes on our observations of classroom behavior and our interactions with various stakeholders in the school, including students, teachers, student teachers, instructional coaches, administrators, and various staff members at the school.
2. In addition to our live observations, we are also planning on video recording lessons, not taught by either of the researchers, in 4th and 5th grade classrooms. The 4th grade classrooms are mixed gender, while the 5th grade classrooms are single gender. The videos will be coded for student behavior and engagement, as well as teacher behavior and response.
3. We will also analyze data on student performance on the state-mandated CRCT test, looking for any trends that might be related to whether or not the classroom the gender organization of the classroom. We also plan to use the findings from this analysis to serve as the basis of conversations with teachers about their perceptions of the role the gender based classroom organization might have had on the score trends.
4. We will be conducting informal interviews with the faculty and staff of the school about the implementation of the gender based schooling innovation. We are particularly interested in learning the process the school went through prior to and during the implementation.
5. We will be looking at trends in discipline referrals over the last two years in the 4th and 5th grade. This information will also serve as the basis of informal interviews with teachers, checking the record of referrals against teacher perceptions and feelings about changes in discipline over the last two years.

Benefits/potential risks of participation	**Yes**	**No**	**N/A**
Will any incentives or compensation be provided for participation?		X	
If so, please explain:			
Are there benefits to participating in this study?		X	
If so, please explain:			
Are there any foreseeable (physical, psychological, economic, legal, or social) risks?		X	
If so, please explain:			
Are efforts made to minimize risks?	X		
If so, please explain: *There is no formal intervention during this study. Instead we will be making observations of students and teachers in the classroom, along with informal interviews of school principal, instructional coaches, and other adult staff members.*			
Are appropriate steps taken to protect confidentiality?	X		
If so, please explain: *Recorded observations will include student names, but these records will be stored in a secure location. For all subsequent publication and presentation of our findings we will use pseudonyms for the school and all study participants.*			
If collecting fluids (e.g., blood, saliva, etc) are precautions taken to protect the participant as well as the research staff, which include procedures to discard bio-hazardous materials.		X	
If so, please explain:			
Is deception used?		X	
If so, please justify and explain:			
Is any sensitive information requested? (See below)			
Income		X	
Sexual Orientation		X	
Political/religious orientation		X	
Historical data such as abuse, mental or physical illness		X	
Other (please include):			X
If so, please justify and explain:			
Are resources for participants included?		X	
Please list:			
Data Collection/Maintenance			
Are there any verbal instructions prior to completing the study given to participants?		**X**	
If so, please include:			
Are there any verbal instructions (debrief) given to participants upon completing the study?		**X**	
If so, please include:			

Is confidentiality/anonymity protected? (i.e., aggregate reporting, pseudonyms, coding). See below.	**X**		
Please explain how data will be stored (locked filing cabinet, password-protected computer): All data from this study will be stored in locked filing cabinets and/or on password protected computers in a locked room.	**X**		
Are all measures (demographic questionnaires, surveys, instruments, etc.) attached?	**X**		
Please list all measures included in the study: This study will be based on observation of students and teachers in the classroom. Additional summary statistics will be computed for behavior referrals and CRCT data.	**X**		

Confidentiality:

Precautions taken (please note all that apply):	Yes	No	N/A
Paper-based records will be kept in a secure location and only be accessible to personnel involved in the study	X		
Computer-based files will only be made available to personnel involved in the study through the use of access privileges and passwords	X		
Prior to access to any study-related information, personnel will be required to sign statements agreeing to protect the security and confidentiality of identifiable information	X		
Whenever feasible, identifiers will be removed from study-related information	X		
Because the research involves web-based surveys, precautions are in place to ensure the data is secure by using passwords and encryption			X
Audio and/or video recordings of subjects will be transcribed and then destroyed to eliminate audible identification of participants	X		
Other (please specify):			

Consent:

Type of Consent	Yes	No	N/A
Online Consent		**X**	
Paper/signature	**X**		

Is consent obtained from the appropriate individual? (participant, parent/guardian; assent for children)	X		
Is consent written at a level (6th grade) where participants can understand?	X		
Does the consent form include the following:			
Procedures	X		
Benefits	X		
Risks/stresses/discomforts and appropriate resources	X		
Confidentiality of data collection and storage	X		
Statement of voluntary participation	X		
Signatures of participant/statement of agreement for online	X		
Parent/guardian signature; assent for children			X
IRB Chair contact information?	X		

Please include all materials:

Additional Materials	Yes	No	N/A
Consent/Assent Form	X		
Recruitment flyers or advertisements			X
Interview protocol/verbal instructions	X		
Debriefing statement (instructions after study is completed)			X
Questionnaires, instruments, surveys, etc.			X

For IRB Committee Members Only	Yes	No
Approved with no changes		
Approved with the following changes (See below)		
Revise with significant changes and resubmit to IRB		

Changes:

APPENDIX C

VSU Exemption Report

Institutional Review Board (IRB)
for the Protection of Human Research Participants

PROTOCOL EXEMPTION REPORT

PROTOCOL NUMBER: **IRB-02822-2012** **INVESTIGATOR:** **Joseph S. Covert**

PROJECT TITLE: **Single-Sex Schooling in a Predominantly Hispanic Elementary School**

DETERMINATION:

This research protocol is **exempt** from Institutional Review Board oversight under Exemption Category 1. You may begin your study immediately. If the nature of the research project changes such that exemption criteria may no longer apply, please consult with the IRB Administrator (irb@valdosta.edu) before continuing your research.

ADDITIONAL COMMENTS/SUGGESTIONS:

Although not a requirement for exemption, the following suggestions are offered by the IRB Administrator to enhance the protection of participants and/or strengthen the research proposal:

(None)

If you make any of these suggested changes to your protocol, please submit revisions so that IRB has a complete protocol on file.

Barbara Gray 5/30/12

Barbara H. Gray, IRB Administrator Date

Thank you for submitting an IRB application.
Please direct questions to irb@valdosta.edu or 229-259-5045.

Form Revised: 05.04.2012

APPENDIX D:

School System Research Application

RESEARCH APPLICATION

I. RESEARCH PROJECT IDENTIFICATION

A. Title: Single-sex schooling in a predominantly Hispanic elementary school

B. Primary Researcher

Joseph S. Covert
School of Education
North Georgia College & State University
Dahlonega, GA 30597
jscovert@northgeorgia.edu

C. Collaborators

1.Major Professor: Dr. Richard Schmertzing, rwschmer@valdosta.edu

2.Co-researcher(s): Danielle Carver, dncarv6266@northgeorgia.edu

3.Sponsor(s): Center for Undergraduate Research and Creative Activities at North Georgia College & State University

D. Date of Submission: April 6, 2012

E. Purpose of the Study:

Action Research: n/a

Dissertation: This is a pilot study for the dissertation of the primary researcher.

Thesis: n/a

Other, explain: Research experience for undergraduate

F. Context for Research:

This research is being conducted as a pilot study for my dissertation through Valdosta State University. Also, the proposed research will be conducted as a part of the Faculty-Undergraduate Summer Engagement (FUSE) 2012 program at North Georgia College & State University.

II. RESEARCH GOALS

A. Summary Statement of Problem

We are proposing to conduct research at a Hall County elementary school that has recently implemented a single-sex approach for the 5th grade classes. We are interested in learning how this implementation has changed the dynamics of the classrooms in question, as well as student performance on high-stakes testing, with an emphasis on science mathematics.

B. Research questions/hypotheses or specific objectives

1. Have single-sex classes had an impact on student behavior and overall classroom management?
2. Have single-sex classes had an impact on student learning outcomes?
    a. Particular emphasis on science and mathematics learning outcomes.

3. What impact does single-sex schooling have on students from a traditionally male dominated culture when the all of the teachers are female?
4. What role did administrators, teachers, staff, students, and parents have in the process of switching to single-sex schooling in the fifth grade?
5. Does the incidence or frequency of code switching vary between all-boys, all-girls, or mixed gender classes?

C. Research design

The proposed study is an ethnographic study of the culture of the classrooms at an elementary school that has single-sex and mixed gender classrooms. The primary and co-researchers are participant observers in this school in their current capacities as university faculty member and student intern, respectively. For this pilot, we would like to make sustained observations of single-sex classrooms in the 5th grade, one male and one female, and one mixed gender 4th grade classroom.

III. DETAILED DESCRIPTION OF PROCEDURES

A. Subjects needed in Hall County School System

The proposed study focuses on Lyman Hall Elementary School; the primary researcher has already discussed this study with Lois Myers, principal of LHES, who has tentatively agreed to allow us access to her school for this study. We propose to make observations of three classrooms at Lyman Hall, based on the guidance of Lois Myers and the consent of teachers in those classrooms. Two of the classrooms will be in the 5th grade and the third class will be in the 4th grade.

B. Approximate dates to begin and end data collection

May 1, 2012 - July 1, 2013

C. Amount of time required of students

No student time will be required. Researchers will make observations of students in context of classroom, hall, lunchroom, and media center. We will not be directly interacting with students in this study.

D. Amount of time required of staff or other participants

The amount of time required of staff members would be minimal. We would like to hold 1-2 informal focus group with teachers in the 5th grade. We anticipate needing no more than 30 minutes of time for each focus group meeting.

E. Instructions, instruments, or apparatus to be used

Below is a list of questions that will be used as a guide for all of our informal interviews with faculty and staff members at Lyman Hall. All conversations with teachers and administrators will focus on details of the implementation of single-sex schooling.

1. How long have you worked at Lyman Hall?
2. What is your experience working with single-sex classrooms?
3. Do you have specific training in working with students in single-sex classrooms?

4. Can you briefly describe the process that was involved in the adoption of the single-sex classroom initiative?
5. What are your observations about the impact of the single-sex classroom initiative?

F. Technology to be used

We will be using laptop computers and video cameras to record our observations will in the classrooms. Additionally, the primary and co-researcher will be using Livescribe pens to record field notes. All video will be stored on password protected computers during the study and at no time will video clips be available to anyone not directly associated with the research effort.

G. Specific activities and person(s) responsible for carrying out each activity

Joseph S. Covert and Danielle Carver will be the field researchers on this project, equally responsible for observing classrooms, recording video of classroom interactions, and subsequent analysis of data.

H. Student Information Needed

1. Access to student records

As with previous research efforts between North Georgia College & State University and Hall County, particularly our joint Math-Science Partnership proposal to Georgia Department of Education in February 2011, we would like to request access to classroom level, or at least grade-level, data for science and math CRCT exams. In either case, we would also like to request the data be disaggregated by gender.

2. Other information

We would like to document any changes in overall number or frequency of discipline referrals that might be related to the adoption of single-sex schooling. For our purposes, we would like access discipline referral data aggregated at the grade-level by gender.

IV. RESULT OF RESEARCH

A. Rationale for the Study

There is an on-going debate in the scholarly literature regarding the efficacy of single-sex education and we hope to contribute to this debate, with particular reference to mathematics and science instruction. Since the reinterpretation of Title IX the number of schools implementing single-sex educational programs has increased, but there has been little study done and reported in the literature on single-sex education programs in public elementary schools, especially so for high poverty, high English Language learner populations.

B. Benefits to the subjects

There will be no direct benefits for the students immediately involved in this study. However, future students participating in single-sex educational

programs might benefit through changed practices related to our potential findings.

C. Benefits to the school(s)/school system

The benefit to the school/school system would be a better understanding of the impact of the implementation of single-sex education at the elementary school level. We will work closely with all interested parties to share the results of our research, as it pertains to improving teaching and learning in Hall County.

D. Use of information gained from the research

The information gained from this study will be used in the following ways: presentation of findings at regional and national educational research meetings, presentation of findings at the NGCSU annual student research conference, as a pilot study for the primary researcher's dissertation, and hopefully as the foundation for a publication on single-sex education.

E. Statement of agreement to forward a copy of the final report to the research committee and willingness to provide service to staff if requested to do so.

The current research team is committed to sharing all relevant and requested findings from our proposed study and will gladly forward a copy of our final research report to the research committee, as well as any other Hall County school representatives.

V. PARENTAL PERMISSION

This work will be paired with our routine observations of NGCSU teacher candidates at Lyman Hall Elementary School.

VI. VITA

See attached vita for primary researcher.

VII. RESEARCH APPROVAL

The research team will send copies of the research proposal to the principal and teachers at Lyman Hall ES.

Signatures

_____ _____

Joseph S. Covert Date
Primary Researcher

_____ _____

Dr. Richard Schmertzing Date
Major Professor

APPENDIX E:

School System Approval Letter

Hall County Schools
Character • Competency • Rigor For All

ELOISE T. BARRON, Ph.D.
ASSISTANT SUPERINTENDENT
FOR TEACHING & LEARNING

711 Green Street, N.W.
Gainesville, Georgia 30501-3368
770-534-1080
FAX 770-535-7404

WILLIAM S. SCHOFIELD
Superintendent

Research Proposal Approval/Denial Form
Hall County School System

May 9, 2012

Dear Mr. Covert:

Your research proposal entitled ***"Single-sex schooling in a predominately Hispanic elementary school"*** has been reviewed by representatives of the Hall County School System. The representatives have agreed on the decision as indicated below. Please contact Dr. Eloise Barron at the Hall County Central Office if you have any questions about this decision.

__X__ Proposal Approved

_____ Proposal Denied

_____ Proposal Approved with Stipulations

Comments/Explanations:

Eloise T. Barron

Eloise T. Barron, Ph.D.
Assistant Superintendent, Teaching and Learning
Hall County Schools
711 Green Street
Gainesville, GA 30501

APPENDIX F:

Consent Form

Consent to Participate in a Research Study

I agree to take part in the study entitled, "Single-sex schooling in a predominantly Hispanic elementary school." I do not have to take part in this study; I can stop taking part at any time without giving any reason and without penalty. I can ask to have information related to me returned to me, removed from the research records, or destroyed.

There are no direct risks or benefits associated with participation in this study.

Any information the research obtains about my participation in this study including my identity will be help confidential. My identity will be coded, and all data will be kept in a secured, limited access location. My identity will not be revealed in any publication of this research.

If you have any questions about this survey, please contact Professor Joe Covert (jscovert@northgeorgia.edu or 706-867-3248) in the Department of Teacher Education or Dr. Teresa Fletcher (tbfletcher@northgeorgia.edu or 706-867-2796) with the Institutional Review Board (IRB) at North Georgia College & State University.

Please sign both copies of this form. Keep one and return the other to the survey administrator.

I understand the procedures described above. My questions have been answered to my satisfaction, and I agree to participate in this survey. I have been given a copy of this form.

_____

Signature of Researcher/Date

_____

Name of Participant

_____

Signature of Participant/ Date