ABSTRACT

Service learning has garnered a great deal of attention as a teaching methodology with the potential to influence students’ development as citizens while providing them rich contexts in which to learn academic material. Many believe that service learning is related to gains in academic achievement, though the mechanisms underlying this relation are not well understood. I argue that service-learning bears investigation regarding its relationship to the development of habits consistent with a state scholars have termed intellectual independence. This document reports on two efforts aimed at understanding the learning outcomes stemming from service-learning participation. First, I studied science majors enrolled in a K-12 service-learning partnership using a quantitative instrument and found that participants’ views about their own learning changed significantly during the program, such that they became more conceptual in their approaches to learning content and began to take responsibility for their own knowledge construction. These changes in learning views have been previously correlated with greater academic success. Second, we attempted to understand learning outcomes related to service-learning participation in a broader sense. This involved qualitative research methods. I found students developed their capacity for intellectual independence, evidenced by their greater
understanding of science content, their increased awareness of metacognitive aspects of learning, and critical consideration of issues pertaining to schooling and society. Perspective of the learner as they approached the service-learning experience was important to the development of the learning outcomes. Implications for service-learning practice are discussed.

INDEX WORDS: Service-learning, Intellectual independence, Metacognition, Learning styles
A SERVICE LEARNING COURSE FOR COLLEGE SCIENCE MAJORS: OUTCOMES
RELATED TO A CLASSROOM BASED EXPERIENCE

by

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A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial
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December 2006
DEDICATION

This work of scholarship, to date the most significant effort I have undertaken professionally, is dedicated to my loving and supportive husband, Trey, and my children, Chip and Katie. It is because of them and for them that I strive to be better. Partly, because I want to set a good example for my children and partly because in becoming a better scholar I become a better wife and mother.

Also, this work is dedicated to my parents, Preston and Katharine Sanders, who never doubted what I could accomplish and frequently reminded me by saying, “Anna, you can do whatever you want as long as you put your mind to it.”

I am a lucky woman in that I am surrounded by a family who loves me, supports me, and believes in me. If I manage to stamp out any ignorance and apathy through my teaching or research efforts, it will be in large part due to these loving influences which have shaped my character, given me the sacred gift of self-confidence, and encouraged my development as an optimist.
I would like to acknowledge the profound influence J. Steve Oliver has had on my development as a scholar. In his role as my mentor he has encouraged, and when appropriate demanded, that I rise to meet his expectations. Meeting those expectations was not always easy, but by communicating to me that he knew it was possible, and by not accepting less than my best, he saw to it that I did. I stand amazed at his sincere and tireless motivation for improving teaching and learning at all levels. He is a gentleman and a scholar, and I would be successful beyond my dreams if I were to have but a fraction of the success he has. I am so glad that I asked him to serve as my major professor, and I am even gladder that he said yes. I hope we will have many years of collaboration.

And to Steve’s lovely wife, Dr. Jenny Penny Oliver, I am thankful for your hospitality. The study in your basement saved me! Free from the distractions of my own house and children, with the help of your cookies, and with Steve’s guidance, I grew tremendously as a scholar. I will always be grateful.
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Chapter 1

Introduction and Literature Review

In January 2002, as the United States began the healing process following the attacks of September 11, 2001, President George W. Bush called for Americans to work together on strengthening their communities and thereby the nation as a whole. In what he termed a “call to service”, the President asked that each American spend a total of 4000 hours, or 2 years of his or her life, working for a greater America (USA Freedom Corps, 2006, ¶ 1). The Corporation for National and Community Service became the center of the flurry of activity which followed. The Corporation includes three programs, AmeriCorps, Senior Corps, and Learn and Serve America. The first two programs help connect Americans who wish to volunteer with others in their community who need their help. Examples of the services involved might include tutoring, meal preparation, and disaster relief. The third program, Learn and Serve America, is unique in that its aim is to mobilize the nation’s students, K-16, to engage in service-learning, an activity that goes beyond volunteering because it requires service accompanied with structured opportunities to learn meaningfully from the experience. Learn and Serve America has enjoyed an increase in activity after President Bush’s call to service (National Service-Learning Clearing House, 2006). Beyond these federally supported efforts, funding opportunities from other public, as well as private, organizations have become increasingly available to support service-learning programs (NCSL, 2002).

The timing of this national recognition of service-learning as a valuable community-building and pedagogical tool, worthy of monetary support, was serendipitous in that it occurred as university professors, K-12 educators, and students became awakened to the tremendous potential of service-learning as an effective teaching method (NCSL, 2002).
Kellogg Foundation contributed to this awakening when it began an initiative called *Learning In Deed: Making a Difference through Service-Learning*. Part of the initiative involved the development of the National Commission on Service-Learning (NCSL), a group of 18 scholars, politicians, and teachers who are charged with making service-learning part of every K-16 student’s education (NCLS, 2002). Indeed, this nationwide initiative is very apparent at our own university, as an Office of Service-learning was recently created to realize the goal of providing students with a more meaningful education while meeting needs of our community locally and globally.

Across the span of more than 15 years, and as a result of this national attention, service-learning has become widely discussed in educational communities apart from academe. It has garnered an increasing amount of attention in literature from both researchers and practitioners (Boyle-Baise, 2002; Butin, 2003; Eyler & Giles, 1999; Moely, McFarland, Mercer, & Ilustre, 2002; Scott, Oliver, & Knauf, 2005; Steinke, Fitch, Johnson, & Waldstein, 2002; Vogelgesang & Astin, 2000). However, this increased attention has not led to widespread agreement as to the definition of service-learning; many operational definitions of service-learning exist. The conception of service-learning which has been used to shape the research reported within this document is a definition provided by the National Service-Learning Clearinghouse (2006). It is as follows: “Service-learning combines service objectives with learning objectives with the intent that the activity changes both the recipient and the provider of the service. This is accomplished by combining service tasks with structured opportunities that link the task to self-reflection, self-discovery, and the acquisition and comprehension of values, skills, and knowledge content” (National Service-Learning Clearinghouse, 2005, ¶ 3). This definition is ideal for the current research for two reasons. First, the definition outlines the array of possible
learning outcomes, not limiting them to those that can be measured using units like GPA or test score, but acknowledges the importance of other types of learning, such as moral development, appreciation of diversity, etc, which may be included in affective outcomes of education. Secondly, the definition is clear regarding how service-learning magnifies its effect through a combination of objectives in both service and learning. This may seem straightforward, but nonetheless it is important that service-learning experiences combine these elements such that both optimal service and learning are achieved.

In this research, we studied a service-learning program entitled FOCUS (Fostering our Community’s Understandings of Science), with the purpose of understanding the college students’ learning outcomes with regard to intellectual independence. In this introduction chapter, we will describe the FOCUS program, our current research efforts, and the organizing structure of the remainder of this document.

The Service Learning Program

Through the program, entitled FOCUS (Fostering our Community’s Understanding of Science), junior and senior year college science majors are paired with partner elementary teachers working in Clarke County, Georgia. The students register for a 3 semester hours of course credit while participating in the program. To earn this credit, they spend approximately 3 hours a week in contact with the teacher and students at the school site, one hour in a reflection session located on the University campus, and in addition, 2 to 3 hours preparing (designing inquiry lessons, gathering supplies, etc) for their teaching time. Each partnership is different, but in general, it can be said that the students serve as content specialists for their partner teachers and work to prepare and implement science lessons in their classrooms (Scott et al, 2005).
The program began at the urging of a parent volunteer at one local elementary school, who is also a practicing microbiologist at a nearby university. She contacted an administrator in the University of Georgia College of Agriculture and Environmental Science (CAES), and made him aware of a need in the local elementary school. Namely, teachers felt under-qualified to teach science, and thus spent very little, if any time on science with their students. Additionally, because the high stakes tests in Georgia currently stress reading and math, teachers felt that science would need to remain on the backburner so they could work to improve students’ scores on tests in those areas. Yet, the teachers did want help in moving science back into the instructional plan in their classrooms. The CAES administrator responded by providing a graduate assistant to recruit students for and coordinate their school placements as a means to help these teachers access science expertise. The program began with 8 students and 8 partner teachers, and has come to be widely celebrated by teachers, parents, and administrators in the schools as well as the students, both elementary and college. Last semester (Spring, 2006) the program boasted 40 students in 4 schools.

The FOCUS program originated in the fall of 2002 as a service for the elementary teachers and their students and was as such labeled as a “community service” program. Quite unexpectedly, the supervising graduate students and faculty began to notice that the University student participants were affected in profound ways too. In their reflective journals and in class discussions, many of our science students discussed how their new role as a teacher was changing how they viewed their own learning. One student described how she’d gotten out the manipulatives she’d used for teaching her 3rd grade students about chemical bonding and used them to study for a test in organic chemistry. “I just decided to teach it to myself the way my professor should have,” she commented. Statements like this one struck us as significant,
because they indicated these students were taking responsibility for their own knowledge construction, rather than expecting a professor to transfer knowledge to them.

**The Current Research Initiative**

This research initiative involved an examination of students’ views of their own learning (including learning strategies, learning regulation, mental models of learning, and motivations for learning) with special emphasis on the phenomenon of learning regulation. Learning regulation, as a concept, operationalizes the degree to which learners believe they can impact the way they learn in formal settings. Learners who are self-regulated have been found to exhibit greater academic achievement than learners who are externally regulated (Findley & Cooper, 1983). With respect to FOCUS, anecdotal evidence suggests that “the participating student makes an impact through the application of their energy and expertise in the community and then returns to the university changed with regard to their knowledge, motivation, and direction” (Scott et al, 2005, p. 227). Specifically, we believe we have seen students develop self-regulatory behaviors, personal interests in learning beyond performance on exams, and generally become constructivists in their approaches to learning. Such change in motivation, direction, and view of knowledge, has been correlated in previous research with greater academic achievement, as measured by traditional means, in university studies (Boyle, Duffy, Dunleavy; 2003).

Furthermore, this change in students’ views and attitudes of their own learning may be a crucial precursor to their development of habits and abilities consistent with intellectual independence (Munby & Roberts, 1998). Munby (1984) defined intellectual independence as the ability of a learner to evaluate knowledge claims independent of an external authority such as the teacher or textbook. We believe developing the capacity for this evaluation is an important goal for a college education experience. Thus, the purpose of this study was to determine how college
science students enrolled in FOCUS view teaching and learning; if they change in regard to their perceptions of their own learning while participating in the program; and what aspects of the program are influential in these changes. Specifically, we have asked the following questions:

1. How do FOCUS students characterize their learning before and after their experiences in FOCUS?
2. What changes do FOCUS students experience with regard to their conceptions of learning, teaching, and schooling? Can these changes be related to aspects of the FOCUS program?

Ultimately, this research provides findings about the capacity of school based service-learning to influence the views of student participants regarding teaching and learning, how these changed views about teaching and learning are associated with academic achievement, and the components of a service-learning course which are significant in bringing about desired outcomes.

**The Lens of the Primary Researcher**

Critical to the first author’s understandings and beliefs about how we come to know and thereby, how we have proceeded in this inquiry, is her journey concerning views of learning and teaching. She is from an upper middle class background, and was always successful in a traditional academic setting. She tested well and earned good grades on her report cards. Her teachers told her parents that she was “a dream to teach” and assured them of Anna’s intellectual capabilities and good behavior during school. She went on to earn a biology degree at a private liberal arts college and, again, performed well academically.

Anna never meant to be a high school science teacher, and literally fell into the profession to fill a surprise vacancy after the school year had already begun. She was not worried about teaching high school biology, because Anna assumed that with her strong performance as an undergraduate biology major, she was perhaps overqualified to teach at the
high school level. She had known several classmates from college who intended to become science teachers, and knew she had taken more credits in science courses than they had, so figured she was walking into an easy job.

Perhaps the biggest surprise of this sudden immersion into the world of public schools and science education was how ill prepared Anna found herself to be in terms of her content knowledge. She realized that though she had performed well on tests; those marks were not a true reflection of her level of conceptual understanding about science. When students asked Anna questions that required linking different areas of biology or linking a science topic with math or another discipline, she struggled to make those connections. Additionally, she was astounded to find that most students did not perform well under the conditions she had always learned science. Anna’s students had strengths, but for most, memorization and test taking were not among them. She began to examine closely her learning strategies and those of her students, and worked to bring her students to science in ways they could appreciate, often abandoning traditional instruction methods. Anna began to view content knowledge through the lens of a teacher, in that she tried to figure out how she could take that knowledge and help students apply it to their daily lives or to their big picture of how the world works. Naturally, to do this, first Anna had to understand science on a conceptual level and use it to make sense of her own daily life. Upon reflection, it became clear to her that teaching science is what made her science learning meaningful and cohesive. She made strides in her metacognitive development, her understandings of science content, and in her understandings of what teaching and learning really involve. This brief description of Anna’s history sets the stage for the epistemological framework which guided these research efforts.
Epistemological Framework

This study is situated within a framework of social constructivist learning theory, metacognitive theory, and pragmatism. Social constructivist learning theory emphasizes the importance of the learners’ active engagement in the process of learning, their social interactions in learning, and the culture in which learning occurs (Bandura, 1986). Indeed, according to social constructivist theory, knowledge construction occurs as a result of learners interactions with each other and with their environment (Kim, 2001). The term reciprocal determinism describes how learners influence their environment and are influenced by it simultaneously (Bandura, 1986). We do believe that learning is an inherently social phenomenon, yet, there is an element which must occur within an individual. In other words, while in a setting where social interaction and new experiences are available to facilitate knowledge construction, an individual must have the tools with which to translate those experiences into learning outcomes.

Metacognitive theory suggests that a learner’s ability to think about use and regulation of strategies in their learning will influence their level of success in knowledge construction (Flavell, 1979). Metacognitive sophistication has been linked to gains in academic achievement (Everson & Tobias, 1998; Schraw, 1998). And finally, educational pragmatism holds that the students’ experiences in education should not be separated from or in preparation for their real lives, but should rather occur in sync with their daily activities and thus be inherently meaningful to the students (Dewey, 1943). While this seems a natural extension of social constructivism, we think it adds an important dimension when considering our research with FOCUS, because participation in this program requires learning within the community outside of the students’ current school environment.
In Anna’s experiences as a young teacher, she realized that the deep conceptual understandings of science which she desired for her students, and which she was developing as a result of teaching, developed as a function of their prior knowledge, their social interactions with each other, their ability to regulate their learning and recognize and employ learning strategies, and the degree to which they saw a connection between what they were studying and their life in a practical sense. This realization happened after Anna was forced to confront her lack of conceptual understanding and study her own learning mechanisms, and it happened in a social, real situation of a public high school science classroom. These elements were critical to Anna’s learning outcomes, and therefore we have assumed that they are significant in the learning outcomes of our research participants.

Our epistemological framework guided our selection of research methodology. We conducted a mixed-methods study. The quantitative portion used the Inventory of Learning Styles by Vermunt (1998) in an attempt to uncover changes in the students’ ideas about their own learning. Because of the significance of Anna’s experience to her research questions as a young teacher, we also interviewed extended participants throughout the process. Reading journals and conducting interviews allowed us a more thorough understanding of the FOCUS program’s impact on our participants than the pre and post quantitative data.

**Overview of the Current Efforts**

This culminating work of this doctoral study will provide a synthesis of our attempts to investigate the research questions outlined above. In investigating the first research question we studied 30 FOCUS participants using quantitative methods. To determine if FOCUS students’ understanding of their own learning changed during their work with FOCUS, a pre and post design was employed with Vermunt’s (1998) 100-item Likert-scale instrument called the
Inventory of Learning Styles (ILS) which asks students to report on four dimensions of their own learning. These dimensions are cognitive processing strategies, motivations for learning, regulation strategies, and mental models of learning.

For the investigation of the 2nd research question, we relied on qualitative data in the form of journal entries from all 30 FOCUS students as well as 3 interviews each with 6 extended participants. In chapter 4, we report on learning outcomes in three domains, resulting from participation in this program. We have termed these domains science content knowledge, metacognitive awareness, and schooling and society. The domain of science content knowledge involves learning or relearning science content in preparation to teach a lesson to elementary students. The domain of metacognitive awareness, involves FOCUS students studying their own approaches to learning science material and modifying those approaches as they come to new understandings of desirable learning outcomes. The third domain, schooling and society, includes learning about the teaching profession, the realities of a test-based curriculum, and other challenges in public education. Critical to this domain is cultural learning in which the participants come to terms with their privileged status and begin to understand the roadblocks impeding success for marginalized children in our society.

In Chapter 2 of this dissertation, we present a review which synthesizes literature from a range of areas and points to the saliency of research outlining the mechanisms by which service-learning can impact university students’ learning in a very real way. Specifically, we argue for research informing the relationship between the development of intellectual independence and participation in service-learning. Chapter 3 consists of a manuscript which reports the methodology, findings, and discussion of efforts to investigate our first research question. Similarly, chapter 4 is a manuscript reporting on the investigation of the second research
question. Finally, in chapter 5, we provide a summary of this document as well as implications for research and practice in service-learning we believe are warranted by our findings.
CHAPTER 2

RESEARCH BASED RATIONALE FOR EXPLORING THE RELATIONSHIP BETWEEN SERVICE-LEARNING AND THE DEVELOPMENT OF INTELLECTUAL INDEPENDENCE

Introduction

In science education, we may quarrel about the desired outcomes of instruction, or how to reach the academic ends we desire, but few would argue that one of our most important aims is to produce scientifically literate individuals capable of critical thinking in a variety of contexts that will contribute to and participate fully in our democracy. Kuhn (1999) commented on this unifying theme in education:

Developing the competencies that enable people to participate fully as citizens in a democracy remains the unifying purpose, and great promise, of public education. Indeed one would be hard pressed to construct a serious counterargument, to claim that we wouldn’t like to see students become careful, rigorous thinkers as an outcome of the education we provide them (p. 16).

Kuhn (1999) described these competencies under the label of critical thinking; other authors use labels such as intellectual development (Eyler & Giles, 1999; McEwen, 1996). Munby (1984) encapsulated the global idea of a type of critical thinking regarding science within the concept labeled “intellectual independence.” The significant point is that each involves students developing abilities to question knowledge claims, evaluate evidence, and ultimately learn to make informed decisions based on a process of disciplined inquiry.

Our interest in the development of these competencies grew out of long term practice as teachers and researchers. Our current project, with a service learning program
through which undergraduate students majoring in science serve as science specialists in the classrooms of elementary schools, has suggested a link between this form of learning (i.e. service-learning) and the development of intellectual independence. The linkage that appears seems to exceed other formal educational activities within our experience. We recognize that the unique characteristics of the service learning program in which we are involved make it imprudent to generalize the apparent linkage to a broader array of service-learning programs. We believe that it is specifically the teaching of science within this program which is primarily responsible for the end results. Thus, this literature review is also directed at understanding how teaching, as an activity within service-learning, may be a means to promote intellectual independence as an outcome for the participant.

This theme or goal, of encouraging learners to develop independent capabilities with regard to the pursuit of science learning, has persisted in science education literature since at least the beginning of the 20th century (Oliver and Nichols, 2001). The pursuit of these competencies as a goal in education, and science education specifically, has resulted in much research into the nature of thinking and into the means to encourage the development of science students’ abilities to act in a manner that could be described as intellectually independent (Munby & Roberts, 1998). Concurrent with this quest to identify approaches to teaching that foster development of intellectual independence, service-learning as a form of pedagogy has become prominent as a means to stimulate meaningful learning in its participants. Service-learning activities are unique in that they amalgamate traditional service objectives within a community or organization with specific goals to also be accomplished by the learner. Though there are examples of service-learning research which have reported student development of intellectual independence (see for example, Eyler & Giles, 1999; McEwen, 1996; Steinke, Fitch,
Johnson, & Waldstein, 2002), the relationship between the two ideas has not been widely investigated. This research originated from the belief that service-learning has promise as pedagogy for developing intellectual independence in science learners in formal education. In this manuscript our aims include:

1. Review the literature which describes the recent development of service-learning research and practice.
2. Review the literature regarding the concept of intellectual independence especially as it relates to science education, and discuss pedagogical methods which have been investigated as possible means to this end.
3. Create a synthesis of these two bodies of literature to demonstrate the synergism between the practice of service-learning and the development of intellectual independence.

Service-Learning

Service-learning is a widely discussed educational innovation within both the national discussion of formal education and more specifically within our own university. The discussion of service-learning has risen to this proportion due to the recognition of its potential benefits to extend beyond the application of human resources to some community, and also because of the benefits of learning accomplishment in the individuals who serve as primary providers of the service. And due to its potential as an innovation to stimulate academic achievement, service-learning has garnered an increasing amount of attention in recent literature for researchers and practitioners alike (Boyle-Baise, 2002; Butin, 2003; Scott et al., 2005). Widespread attention has also resulted in the publication of various conceptions of what constitutes service-learning (Stanton, T., Giles, D., & Cruz, N., 1999). The conception of service-learning guiding these efforts is best described by a definition provided by the National Service-Learning Clearinghouse. It is as follows: “Service-learning combines service objectives with learning objectives with the intent that the activity changes both the recipient and the provider of the service. This is accomplished by combining service tasks with structured opportunities that link
the task to self-reflection, self-discovery, and the acquisition and comprehension of values, skills, and knowledge content” (National Service-Learning Clearinghouse, 2005, ¶ 3). This definition is ideal for the current research for two reasons. First, the definition outlines the array of possible learning outcomes, not limiting them to outcomes that can be measured using units like GPA or test score, but acknowledges the importance of other types of learning, such as moral development, appreciation of diversity, etc, which may be included in affective outcomes of education such as values. Secondly, the definition is clear regarding how service-learning magnifies its effect through a combination of objectives in both service and learning. This may seem straightforward, but nonetheless it is important that service-learning experiences combine these elements such that optimal service and optimal learning are achieved.

Service-learning attempts to bridge the gap between schooling and society by providing learning experiences for students in real world contexts. These contexts might include community service organizations or schools, but might also include service with projects that are needed by the community to deal with a societal problem such as erosion, pollution, etc. Thus, the most obvious beneficiaries of the service are those individuals and agencies which received support in the form of students’ service. But service-learning, in forming the aforementioned bridge produces a variety of positive outcomes for the students too. For example, service-learning has been linked with improved attitudes regarding civic engagement (Scales, Blyth, Berkas, & Kielsmeier, 2000), greater awareness and appreciation of diversity (Jones & Hill, 2001; Jones & Abes, 2004), improved academic learning and performance (Scales et al, 2000; Strage, 2000; Strage, 2004), and gains in ethical development (Boss, 1994; Steinke et al, 2002), and has been touted as a mechanism for bringing schools and communities together (Vogelgesang & Astin, 2000).
This marriage between service and learning can occur in variety of ways. Indeed, some programs are termed service-learning, but may involve activities more accurately termed charity, because students spend time providing a service, perhaps working in a soup kitchen or volunteering at a hospital, but are not encouraged to spend time internalizing the experiences and learning as a result of them. Conversely, other experiences in service-learning may focus much less on service and more on fostering academic learning in participants. As this range of descriptions suggests, service-learning programs are not connected to the curriculum uniformly at whatever educational level they may occur.

Consider an example of how a service-learning experience is created within an academic course. A course in watershed ecology includes a community-based project involving the restoration of a local watershed. Students in the course learn academic concepts related to ecology and specifically watershed ecology, but they also provide on-site efforts to restore a given site. Properly planned, the links between the experience in the field and the academic goals of the course are seen in each aspect of the learning objectives.

Other programs are not so clearly tied to course content. For example, at our own university, within the College of Education, there is a 3 semester hour course, titled Service-Learning, in which students may participate in a variety of service-learning experiences in the community. The participating university students come from an array of majors and spend time weekly discussing and reflecting on their experiences such that a substantial focus is placed on the university students’ meaning making from the experience. This myriad of manifestations of service-learning practice, and the varying ways service and learning may interact in different service-learning experiences makes discourse about service-learning potentially ambiguous. It is
important that when practitioners of service-learning share their ideas and experiences they are clear about how their program accomplishes the merger between service and learning.

Service-learning Perspectives in Practice

In her book, *Multicultural Service-learning*, Boyle-Baise (2002) offers useful descriptions of four distinct orientations to service-learning, each of which has a unique set of “attitudes, aims, and actions” guiding the creation and implementation of service-learning programs (p.16). An examination of these four orientations, which she labels as “charity,” “civic education,” “community building communitarian” and “community building social change”, illustrates how differently service and learning can be paired in designing a service-learning experience.

The charity orientation is described as centering on the planned acts of advantaged citizens giving to or helping disadvantaged citizens. Those engaged in the service feel a need or obligation to help address immediate needs of the recipients, and upon doing so feel satisfaction. Service activities in this orientation might include working in a soup kitchen or sending money to support other such charity service organizations. There is no intent within this orientation for questioning the social structures which may foster social inequities leading to or compounding the need being addressed; rather it is simply a way for those who are privileged in the current social environment to reach out and help those who are not so privileged deal with their unfortunate circumstances. This orientation does not deal with “deficit views” the learners in service-learning are likely to hold of marginalized groups. Programs operating within this orientation do not provide a formal setting in which reflection that might lead to learning can be or is fostered, so while individuals may do this reflection on their own, and learning may occur stemming from the service experience, the service-learning program does not have within its
structure this has a clear goal and thereby does not expend resources attempting to create or maximize such learning. It should be noted that while Boyle-Baise (2002) still terms these activities to be service-learning, they would not be considered as such by our guiding definition.

The civic education orientation Boyle-Baise (2002) described focuses on developing citizenship through service-learning by raising social awareness, promoting civic responsibility, and encouraging students to recognize and employ their own agency to address social problems. There are four important tenets in this orientation, according to Boyle-Baise (2002). They are collaboration with community, reflection, active learning (e.g., the idea that learning is maximized in situations where the learner is dynamically involved), and development of empathy. Service-learning programs operating within this orientation might involve helping the disadvantaged “level the playing field” through tutoring programs for at-risk youth or English instruction for immigrant families (p. 24). These type of projects serve to provide equal opportunities for groups, and even allow for students to help construct solutions to current problems (for example, working to increase the number of translators to facilitate parent teacher conferences at a largely Latino school). Yet, there is little place for questioning or changing the social structure which disadvantages the groups in the first place, or in this example, why the authority doesn’t provide needed translators at the outset. There is a still a strong sense that “we,” the service learners are doing a service for “them,” the recipients, resulting in a deficit model of the marginalized or at-risk group. This orientation of service-learning does provide for and expect participants to reflect and learn in substantive ways during and because of the service experience. This learning could be academic, if in the above examples Spanish students were honing their conversational skills and learning about the culture of the Spanish speakers with whom they work, but it could also include learning skills related to communication (apart from a
2nd language) as students work through appropriate channels to accomplish (in this example, the county Board of Education, perhaps) tasks aimed at providing solutions to the immediate problems faced by the group being served. Additionally, students may begin to recognize their status of privilege, and come to new understandings regarding diversity. Service-learning operating within this orientation will likely provide structured times for reflection through discussion and journal writing. Thereby, the learning component of the experience is evident in the program structure.

Service-learning programs operating within the community-building communitarian view of service-learning, in contrast to the above two, work to involve all stakeholders in developing the goals of the service-learning partnership and the planning to meet those goals (Boyle-Baise, 2002). The emphasis in this orientation is on working cooperatively, so that “…interests of separate groups can harmonize with one another” and the students can learn to mesh their interests with the needs of the larger community (Boyle-Baise, 2002, p. 26). As such, these students begin to adopt broader views as they consider their interests within the framework of their society. Yet, there still may be no place for embracing multiple ideas of “rightness,” such that in this effort to determine a consensus regarding the greater good, diverging views can be marginalized (Boyle-Baise, 2002). Likewise, programs operating within this orientation leave little opportunity for confronting issues of race, power, or inequality. As such, there is not much focus on social change to bring about equality. In this orientation, it is becoming harder to distinguish who is learning and who is serving at any given time. This is because the students and the agency receiving service are working cooperatively as equals. In this type of service-learning, the potential for students to learn about views different from their own is central to the learning experience, and the potential is great because the boundary between the server and
servee is blurred, giving credibility to all the stakeholders’ views. Reflection, discussion, and journal writing are all still likely to be found in this orientation to service-learning, as in the civic education orientation. The substantive difference between the two is that the nature of the service in the community building communitarian orientation provides the students with greater opportunities to learn about and collaborate with individuals who may have views divergent from their own. This type of service uniquely positions students to begin to understand their place in society and that perhaps their privileged status is not a result of hard work, but of a flawed system which favors some societal groups over others.

Conversely, the community building social change view highlighted by Boyle-Baise (2002), is an orientation in which the goals of a service-learning experience are to confront these social forces of race and power, and develop long-term solutions to improve the welfare of disadvantaged groups. Necessarily, this would go beyond working cooperatively with the disadvantaged groups and result in understanding the root causes of problems with inequality and marginalization in our society while creating changes in policy and social structure to help create more equitable communities (Boyle-Baise, 2002). Diversity is celebrated, and marginalized groups are seen as having agency to change their circumstances using their unique strengths and talents. Again, reflection, discussion, and journal writing are stressed as ways to maximize learning outcomes in the students who are serving. But even more than in the community building communitarian view, the demarcation between service and learning is hard to find. This is because the activities students engage in as they are serving are such that they continually require students to come to new understandings regarding communication, diverging views, and where the problems facing the disadvantaged groups come from so that they can seek long term solutions to right inequities.
In the preceding paragraphs, a summary of Boyle-Baise (2002) has described an excellent framework for understanding practical orientations toward service-learning. It is important to note that her framework was constructed to help make meaning from her work of preparing teachers to work in diverse classrooms, and that it is designed to inform the practice of service-learning (Boyle-Baise, 2002). Boyle-Baise (2002) made no assertion that more learning happens at one of these levels than another, but her framework does describe how the intersection of learning and service change across these orientations. And thus, these different orientations provide guidance for individuals to create service-learning programs which can optimize both the achievement of the community oriented service goals as well as the substantive student learning goals.

**Service-learning Perspectives in Research**

In addition to ambiguous discourse about service-learning practice, service-learning research has been criticized for being difficult to interpret and non-transferable (Eyler, 2002). This difficulty of interpretation of research in service-learning stems from the variety in the types of programs which scholars and practitioners are terming service-learning. As we discussed previously, service-learning programs accomplish the necessary marriage of service objectives and learning objectives in many ways. Naturally, this variety of programs leads to an even greater variety in the types of research questions which can be investigated under the banner of service-learning research. Butin (2003) argued that service-learning research, much like its practice, must be clear about aims from the outset. He offered several perspectives to both guide research and reduce ambiguity in its interpretation. For instance, some service-learning research focuses on the effects of service-learning on students who participate in it. These effects might be cognitive, affective, or social. For example, Strage (2004) studied the long-term academic
benefits for students who participate in service-learning. In this study, Strage (2004) hypothesized that in general, the academic advantages conferred upon the students in a service-learning section of a child and family development course would serve the students in later upper level course work as well as in the course currently being taken. Her sample had 477 student participants and results were compared using one-way ANOVA analysis of students’ grades in courses within their major taken in semesters subsequent to the service-learning experience. Strage found that there was no significant difference between those who had participated in the service-learning section of the course and those who did not. Strage’s study is an example of what Butin (2003) termed a technical perspective of service-learning research. This means that the researchers are focused on the technical aspects of a program (in this case, outcomes) they are evaluating, and are not concerned with determining the legitimacy of the program or questioning its assumptions. Instead, this research places service-learning as an accepted educational innovation which only needs further research and refinement. Research conducted under the technical perspective, according to Butin (2003), is guided by questions of “…efficacy, quality, efficiency, and sustainability of both the process and the outcome of the innovation” (p. 1679). Eyler (2000 cited in Butin, 2003), commenting on the importance of research motivated by the technical perspective, wrote “…we know that service-learning has a small but consistent impact on a number of important outcomes for students. Now we need to push ahead to empirically answer questions about improving the academic effectiveness of service-learning” (p. 1680).

Butin (2003) also described a cultural perspective for service-learning research. Questions posed within this domain of research involve meaning making by participants and are concerned with “acculturation, understanding, and appropriation” as individuals engage with
others different from themselves (Butin, 2003, p. 1680). As such, placement in a setting for service-learning where the recipients of the service represent individuals who are significantly different (e.g., in terms of race, gender, religion, etc.) from the participant-students is necessary for such learning to occur. One example might be the work of Jones and Hill (2001). They discussed how service-learning helped their undergraduate students come to a more “complex understanding of diversity.” They found that their students who worked either with an AIDS service organization or a food shelter became aware of their own stereotypes and assumptions, developed an understanding of life situations which they had never been exposed to, and gained new knowledge about the social issues their assigned organization was designed around (Jones & Hill, 2001).

In another example of Butin’s (2003) cultural perspective, Jones and Abes (2004) studied the same students who participated in the service-learning opportunities as described by Jones and Hill (2001). Jones and Abes (2004) found that years after the students had participated in the particular service-learning activity they still viewed the experience as having been an important part of their “self-authorship” and identity construction. With regard to multicultural education specifically, the authors discovered that their students felt that this experience was the first time they “unearthed their privilege in relation to others” (Jones & Abes, 2004, p. 152). The students talked most openly about discovering their privilege in terms of economics, but in addition made some progress in terms of “heterosexuality privilege” and “race privilege” (Jones & Abes, 2004, p. 153). Each of these studies involves the description of meanings made by the students in the context of their service-learning experiences, and thus are empirical examples of Butin’s (2003) cultural perspective.
Butin (2003) articulated a third lens through which service-learning may be studied. He labeled this the political perspective. This perspective is very closely related to the cultural perspective described above, yet, in addition to new understandings of one’s own privilege, participants are challenged to also deal with issues of power. For example, students participating in service-learning organized under the political perspective begin to question whose voices are heard, whose are silenced, and who is responsible for perpetuating the inequity of the status quo (Butin, 2003). Research conducted in this orientation specifically seeks to answer questions of if and how student participants begin to see the status of the marginalized group with whom they are working as an artifact of the current political environment. Indeed, there is evidence that students participating in service-learning programs working with individuals who have been diagnosed with AIDS, or individuals who are homeless, begin to evolve in their understandings of where such problems come from and how they are perpetuated as a function of society (Eyler & Giles, 1999). At the start of their service-learning experience, they typically view such problems as clear-cut and easily fixed, and as they near the end of their experience, they realize that social problems are ill-defined and finding long term solutions for them requires significant changes to the status quo, complete with political ramifications they had not previously considered (Eyler & Giles, 1999).

The fourth perspective Butin outlined is labeled under the heading of the poststructuralist perspective. In the poststructuralist perspective, the validity of a service-learning program is not assumed, but rather its very assumptions and foundations are questioned. In practical terms, this means that research findings concluded within this orientation may warrant serious changes to or even dissolution of the service-learning program being studied, if it is discovered that the service-learning program is unintentionally contributing to the oppression of the disenfranchised
group the program was designed to help. Research conducted within this perspective questions how the service-learning program “…constructs, reinforces, or disrupts particular unarticulated societal norms of being and thinking” (Butin, 2003, p. 1683). Researchers investigating within this framework are usually interpretavists, as they assume there is no single, objective truth, and that our identities are constructed in the “mess of society” (Butin, 2003, p. 1683). It has much in common with Boyle-Baise’s (2002) social change view, but her conceptions are more aligned to practice, while Butin’s (2003) are aligned with research.

What follows is an example of an empirical study of the poststructuralist perspective of service-learning found in the science education literature. Barton (2000) explored service-learning in science teacher education as a mechanism for preparing teachers to teach in diverse classrooms. Her teacher education students spent time teaching science at homeless shelters. The study was guided by three questions:

- In what way does involving pre-service teachers in community-service-learning influence their views on multicultural science education, in theory and practice?
- Which qualities of community-service-learning make multicultural science education a realistic objective?
- How might service-learning be utilized for our collective understanding of what an inclusive and liberatory multicultural science teaching practice could be?

The first two questions may be considered stemming from the technical and cultural perspectives on service-learning. It is Barton’s (2000) third question which makes her study uniquely poststructuralist according to Butin’s (2003) characterization. In this question, there is a clear aim to use understanding gained in service-learning practice and research to revisit the social structures, in this case the norms and values in traditional science classrooms, and work to change them to reduce alienation of marginalized groups.
Barton’s (2000) pre-service teachers began to realize the students they were working with at the homeless shelters had little use for traditional school science, and so began to question mandated curricula and the lack of teacher autonomy with regard to choosing topics or projects which might engage at risk students. Additionally, the pre-service teachers involved in the service-learning program set about modifying the very structure of the service-learning program, to make their science instruction inclusive and meaningful to the students with whom they worked at the homeless shelter. This third question of Barton’s (2000) also ties the worth of service-learning as an innovation to its potential for encouraging scrutiny of borders between genders, races, and social classes, and thus indicates that she does not take for granted the legitimacy of the program. For these reasons, Barton’s (2000) study is clearly an example of a poststructuralist perspective on research in service-learning.

Butin (2003) made a very convincing case that as long as service-learning programs and service-learning research deal with very different goals; practices, and questions, discourse about service-learning within the literature will be challenging to interpret. He argued that researchers need to be clear, just as Boyle-Baise (2002) suggested for practitioners, about what type of orientation guides their inquiry such that readers will be more easily to assess issues of applicability and generalizability to their own pursuits regarding service-learning (Butin, 2003). Given the levels of ambiguity in written discourse about service-learning practices and research, it is not surprising that faculty not involved in service-learning are often skeptical about benefits it may hold for student learning outcomes and unsure of how to construct meaningful service-learning experiences for their students (Abes, Jackson, & Jones, 2002). This issue is compounded by researchers being hard pressed to find definitive, consistent research linking specific outcomes of service-learning with specific program attributes. Yet, we are aware of one
example of research which clearly ties service-learning program attributes to a range of specific outcomes. In the example which follows, researchers were not able to establish the significance of the relationship between service learning and intellectual development. However, their results do give reason to think that there is a link between some of the individual activities of a service learning program and the student outcome of intellectual development.

In their study of service-learning predictors and outcomes in higher education, Steinke, Fitch, Johnson, and Waldstein (2002) described specifically how characteristics of service-learning experiences are linked with improvement in five commonly desired outcomes by faculty involved in such programs. The five outcomes they studied were: cognitive or academic learning; civic engagement; spiritual and ethical development; community impact; and intellectual development. Progress in each of these has been reported as a result of service-learning (see for example Eyler & Giles, 1999; Boss, 1994; and Vogelgesang & Astin; 2000), and in their meta-analysis of service-learning programs from 12 universities Steinke et al. (2002) worked to associate these outcomes observed in the student participants with aspects of service-learning experiences they identify as predictors. The predictors they used included reflection, placement quality, community engagement, diversity, and student voice. They collected data via pre-test and post-test instruments which contained items, and that were analyzed within subscales, which were designed to measure each predictor and outcome. The intellectual development outcome was measured using an open-ended essay type instrument called the Measure of Intellectual Development (MID) created by Knefelkamp and Widick (as cited in Moore, n.d.). Multiple regression analyses indicated student outcomes in cognitive learning, spiritual and ethical development, and civic engagement could be predicted using the regression model involving the five predictors.
Though the regression equation for predicting intellectual development was not significant, there were significant correlations between outcomes in intellectual development and specific individual items on the predictor scales. For instance, students who gave presentations or speeches, met community needs through their project, interacted with community members, and became comfortable with diversity through the experience did show gains in intellectual development on the MID. This finding is noteworthy because these individual items are linked to activities which would be emphasized in service learning programs where the students were engaged in teaching. Beyond that, this example serves as additional evidence that supports the belief that service learning programs with a strong teaching component merit special consideration in the examination of the relationship between service learning and intellectual development. (Steinke et al., 2002).

One of the goals of intellectual development as encouraged by schools is the accomplishment of independence as a learner. This independence might be viewed as a product of intellectual development. One label applied to learner independence is intellectual independence (Munby, 1984). Thus far, within this manuscript, we have addressed the first of the aims we stated in the introduction. Namely we have reviewed service-learning literature regarding both practice research. Next, we will present a discussion of the concept of intellectual independence as a persistent goal in science education followed by a call for research illuminating how service-learning pedagogy may be used to help meet that goal.

**Intellectual Independence**

To set the stage for the inclusion of intellectual independence as a learning outcome related to service learning, this section will begin with a discussion of three issues. First we present a definition of intellectual independence. Second we examine the long history of this idea
in education and examine how the lack of realization of this goal is a persistent thorn in the side of many educators. Third, we articulate what we believe is a potentially important link between service-learning and intellectual independence.

Our definition of intellectual independence can best be described by an ideal offered by Munby and colleagues (Munby, 1984; Munby & Roberts, 1998). They contended that “An individual judging the truth of a claim on the basis of all assumptions, evidence, and arguments necessary for the judgment is exercising intellectual independence” (p. 102). Key to their definition is their assertion that a student “could learn to assess the truth and reasonableness of knowledge claims and explanations; a student does not have to remain intellectually dependent on a teacher for such assessments” (Roberts, 1998; Munby & Roberts, 1998, p. 102). To begin to examine the history of this idea in education, consider the work of John Dewey.

The work of the philosopher and educator, John Dewey, effectively communicated as scholarship what effective teachers had witnessed. Specifically, he outlined the significance of what later was labeled as intellectual independence. His work was not specific to science education, but his writings have impacted science education perhaps more than those of any other author (Oliver & Nichols, 2001). Oliver and Nichols (2001) credit him with “setting the stage” for the 20th century quest for intellectual independence as a goal of education (p. 50). Dewey (1902) was also unwavering that this goal could not be reached through didactic methods alone, but that the activities used in instruction of the curriculum must be tuned to a child’s everyday existence. In Dewey’s world, this was the means by which meaningful learning occurred. Dewey (1902) realized that the goals for the education of the child and the school curriculum were in conflict due to the nature of the curriculum being a reflection of adult thinking rather than the thinking of children. In Dewey’s (1902) essay, *The Child and the*
Curriculum, he wrote of this issue focusing specifically on fostering children’s growth and development of habits of mind which encourage logic:

It is the failure to keep in mind the double aspect of subject-matter which causes the curriculum and child to be set over against each other… The subject-matter … has no direct relationship to the child’s present experience. It stands outside of it. The danger here is not a merely theoretical one. We are practically threatened on all sides. Textbook and teacher vie with each other in presenting to the child the subject-matter as it stands to the specialist. Such modification and revision as it [the subject matter] undergoes are a mere elimination of certain scientific difficulties, and the general reduction to a lower intellectual level. The material is not translated into life-terms, but is directly offered as a substitute for, or an external annex to, the child’s present life. Three typical evils result (pp. 23-24).

Dewey described these three evils in some detail. The first evil is that the “lack of any organic connection with what the child has already seen and felt and loved makes the material purely formal and symbolic” (p. 24). The second evil according to Dewey (1902) is a lack of motivation which results from no “craving, no need, no demand” when material is presented in the “form of a lesson to be learned as a lesson” rather than as an extension of the present [or activities in the child’s real life] activities (p.24). The third evil Dewey (1902) discusses seems to foreshadow the discussions in the future literature about goals of education, specifically science education, and the place in these goals specifically characterized within intellectual independence. This evil is that …even the most scientific matter, arranged in most logical fashion, loses this quality, when presented in external, ready-made fashion, by the time it gets to the child. It has to
undergo some modification in order to shout out some phases too hard to grasp, and to reduce some of the attendant difficulties (p. 26).

Dewey (1900, 1902) was clear that approaching education as a system which gives students information that has been distilled and simplified, and thus taken away from the messy intellectual activity in which it was created, will be detrimental to the development of reasoning powers which might render the child capable of responding to an experience and constructing knowledge of their own accord. Furthermore, he argued that building a bridge between the curriculum and the world in which children live is a critical step toward motivating them to look for such connections and understand the importance of their lessons to their everyday life (Dewey, 1900; 1902).

In practical terms, the work of John Dewey relates to the current notion of intellectual independence because he advocated students’ developing competencies in logic and reason. Dewey (1902) was clear that the development of such competencies should be the most important goal driving the practice of education. With regard to science education specifically, Dewey (1902) described formal education as an activity that should mirror the practice of science. Science, as a discipline, is unique in that as a student is learning to do science, he must be prepared to substantiate his own knowledge claims. In other words, he must be prepared to answer the question, “How do you know?” This type of evaluation of one’s own knowledge claims is a central tenet to the modern day notion of intellectual independence as well as science. It is also important to note Dewey (1902) argued that these habits of intellectual independence should not be used only in the classroom, but that ultimately the student’s work in the classroom should prepare him/her to effectively use logic and reason in his/her existence outside of the school. Dewey (1902) believed that school curriculum situated in the child’s daily life was the
best preparation for developing reasoning capabilities which would transcend the boundaries of the classroom. He encapsulated his philosophy of education in a term he called the unity of knowledge. For Dewey, knowledge was “inseparably united with doing” (Menand, 2001, p. 322).

**Teaching for Intellectual Independence: The Critical Role of Metacognition**

As intellectual independence has long been a goal of education whether by that name or some other, likewise have teachers and researchers worked to understand how to bring it about. While learning in an educational environment drawing its curriculum from real experiences of the child rather than learning in a formal and traditional environment is clearly important (Dewey, 1902), ultimately habits consistent with intellectual independence (such as constructing knowledge and evaluating knowledge claims) rely heavily on a learner’s use of metacognition. Encouraging outcomes such as these must involve the examination of one’s own and others’ thinking. While this may seem intuitive, it is important to articulate the magnitude of metacognition as a necessary precursor to achieving intellectual independence. Beyond this point, metacognitive development during service-learning could be an important piece of the relationship existing between service-learning and development of intellectual independence.

Metacognition, often defined as thinking about thinking, consists of two important components (National Research Council, 2005; Schraw, 1998; Shaffer, 2000). The first, knowledge of cognition, encapsulates what an individual knows about his or her thinking and thinking processes in general (Schraw, 1998). Knowledge of cognition includes three types of metacognitive awareness, declarative knowledge, procedural knowledge, and conditional knowledge (Schraw, 1998). Declarative knowledge involves knowing what factors may influence one’s level of success in learning. Procedural knowledge includes knowing how to
accomplish learning tasks, for example, chunking new information. Conditional knowledge refers to knowing when and why to use the other two types of metacognitive awareness, declarative knowledge and procedural knowledge (Schraw, 1998).

The second component of metacognition is regulation of cognition (Schraw, 1998; National Research Council, 2005). Regulation consists of activities that learners apply to help their own learning progress. The three strategies included in all literature reporting on regulation are planning, monitoring, and evaluating (Schraw, 1998). Planning refers to a learner’s selection of strategies to successfully accomplish a learning task. Monitoring involves continually being aware of the status of the learner’s current performance. Evaluation refers to evaluating the efficiency of one’s learning processes (Schraw, 1998).

Metacognitive prowess in both knowledge of cognition and regulation of cognition has been linked with academic success, as measured by GPA (Everson & Tobias, 1998) and also with deeper conceptual understanding of learning objectives (National Research Council, 2005). Interestingly, metacognitive ability has not been found to be linked tightly to I.Q., which indicates that advances in metacognition may help students with lower I.Q.s perform as well as individuals with higher I.Q. scores (Schraw, 1998). As such, many researchers feel that helping students develop metacognitive skills is an important part of effective teaching. Some pedagogical methods touted for increasing metacognitive capabilities in students include teachers’ modeling of their own metacognitive processes, explicitly asking students to track the use of their learning strategies via a strategy evaluation matrix, and providing time for students to reflect on and discuss with each other their learning strategies (Schraw, 1998). Another notable method is reciprocal teaching, pioneered by Palincsar and Brown (1984). Reciprocal teaching involves students working with each other to aid learning of content or of a process like reading.
Activities involved in reciprocal teaching require students to think about their own thinking as well as the thinking of the students with whom they are working in order that they can be sure all parties are reaching desired learning outcomes (Palincsar & Brown, 1984). This kind of awareness is essential before a learner is able to evaluate learning claims of others, a central tenet to Munby’s (1984) conception of intellectual independence. This is another reason we believe service-learning experiences involving a teaching component deserve special attention in the study of the relationship between service-learning and intellectual independence.

Intellectual independence requires being able to construct knowledge as well as evaluate the knowledge claims of others (Munby & Roberts, 1998). Both constructing knowledge and evaluating knowledge claims require the examination of ideas within one’s own cognitive framework, thereby employing both knowledge of cognition and regulation of cognition components of metacognition. Indeed, a century ago, Boole (1904) made the point that this examination of information that has been learned is critical to developing an independent mind. She argued that what was most important for the children to learn was not “what is the last new theory about where herrings are hatched, but how to extract the truth from a series of impressions and statements, each of which is only partially true” (p.20). She specifically addressed issues of what we now term metacognition (Flavell, 1979) as key for developing a scientific or intellectually independent mind. Students must learn to keep information which they get from a variety of sources (observations, testimony from others, and theories) “apart in the mind till the lid is shut down, so to speak, on the outer world, and the process of thinking has begun” (p. 30). For Boole (1904) this compartmentalization of the sources of information was the key ingredient in intellectual independence, or mental scientific action:
A man is not reliable as a discoverer in science unless he can say; “Such-and-such a fact I
myself observed; such another I read about and afterwards verified by my own
observation; such-and-such statements I have read, but have not yet verified; such
another I have read but my own observation points to the contrary opinion.” This is not a
mere question of priority, of who deserves the honour of a discovery: we do not trust the
scientific qualities of one who does not feel quite differently about a fact which he
himself observed from the way he feels about something he as read or heard. And even if
he is making this distinction, it does not follow that he has performed any scientific act of
mind. Not till he has thought in silence, not till different kinds of knowledge derived
from various sources combine to form a mental impression, can true scientific action be
said to have taken place (p.30-31).

More recently, Kuhn (1999) contributed a comprehensive description of metacognition which
linked metacognition to critical thinking and also discussed the inherent difficulties faced in
attempts to understand and achieve critical thinking as a goal of education. Kuhn’s (1999)
construct of critical thinking also involves being able to independently evaluate knowledge
claims, and thus we conceptualize it as extensively related to intellectual independence. She
points out that there is no agreed upon definition of critical thinking which transcends
disciplines, and also that students who learn to think critically in one domain (in this case,
science class) are not likely to transfer that ability to different domains. Kuhn (1999)
conceptualized critical thinking in terms of metacognition, which she discussed in three
categories. The first two categories mirror the labels used within the other literature of
metacognition. But the third category represents a unique contribution by Kuhn and through it
makes the closest link to intellectual independence.
The first category, metastrategic metacognition describes the actions of selecting and monitoring strategies that are applied during thinking. The second category, metacognitive knowing “operates on one’s base of declarative knowledge.” (For example, what do I know and how do I know it?) The third category provides a means to best understand the relationship of metacognition and intellectual independence. This category labeled epistemological meta-knowing involves an even broader understanding of knowing. (For example, how does anyone know, what do I know about my own knowing and others’ knowing?). And it is this final type of knowing which Kuhn (1999) suggested was decisive for the development of critical thinking. Some individuals never develop this type of knowing at all. Of those individuals who do, Kuhn has described three ordinal levels that can be reached within epistemological meta-knowing. These three levels of epistemological meta-knowing form a heuristic that can be used to understand the degree of progress that a learner has made toward the goal of intellectual independence. At the first level are those individuals labeled as absolutists who believe that the locus of control of knowledge remains in the external world. These people can always find an answer from observation of authority and will not question what they see or those they ask. The second level, or multiplists, can best be described as extreme relativists, because they have learned that they are 1000 or more right answers, and thus don’t attempt to find the “most right” one. Finally, those who develop an evaluative epistemology understand that all opinions, explanations, and ways of knowing, may not be equivalent and that to choose the “most right for me” answer, undergo a process of evaluation and judgment. The most significant difference between those individuals with evaluative epistemologies and those with multiplist epistemologies is that the evaluativists are successful at integrating the subjective and objective ways of knowing.
Kuhn’s (1999) description of critical thinking as a product of metacognitive functions offered a powerful heuristic, much like Piaget (2003) offered, which gives teachers, researchers, and even parents a tool for understanding how thinking ability progresses, and what a truly independent thinker should be capable of—not just in one domain, such as science class, but in real world situations in which thinkers need to function.

Munby and Roberts (1998) discussed the intellectual climate of a classroom, which might foster intellectual independence in the pupils. They suggested that the teacher must communicate to the students that a student “could learn to assess the truth and reasonableness of knowledge claims and explanations; a student does not have to remain intellectually dependent on a teacher for such assessments” (Roberts, 1998; Munby & Roberts, 1998, p. 102). The manner of teaching in which such a climate would be sustained must allow for addressing issues of power and authority within explanations offered by teachers or textbooks (Roberts, 1998). Knowledge claims offered in a classroom must not be taken for granted or thought to be true only because the “teacher said so” (Munby & Roberts, 1998). Furthermore, powers of reason, evaluation, and judgment, must be cultivated in students such that they will be able to exercise intellectual independence. Naturally this dictates that power in a classroom must be shared between teachers and students, resulting in students having authority to question what is taught (Munby & Roberts, 1998). This questioning should allow students to realize their capabilities in evaluation, while affording practice in their skills of reasoning, evaluating, and judging.

**Realizing Intellectual Independence within a Real World Context**

In recent research, the potential for developing habits consistent with independence in real life situations has become prevalent. For example, Hung (1999) used the 1964 work of Michael Polanyi to shed light on learning “hidden rules of the art” in situational context and
activity. He called this epistemological appropriation, which is learning beyond that of participatory appropriation or the mere learning of explicit tasks. He described important self-regulatory behaviors necessary for the learner to engage in epistemological appropriation. These behaviors are submitting, mirroring, and constructing. This means the learner recognizes his epistemic dependence on the master, mirrors the master, and constructs knowledge about the craft. Likewise, the master or teacher in this situation is responsible for regulatory behaviors that foster this learning. These are scaffolding (providing the student with an infrastructure to accomplish a task he/she would not be able to accomplish alone), modeling (offering a behavior for imitation), and coaching (providing feedback throughout the learning experience), and their relative necessity in the master-apprentice relationship will begin to decline as the apprentice develops independence, in that they eventually no longer need the master (Hung, 1999). At this point, the apprentice has learned to effectively regulate his or her own thinking processes, such that he or she can make decisions sans the master, even when unexpected events arise during the completion of tasks.

In an empirical study of Hung’s (1999) theories, researchers found that his conceptions of learning in a situational context were helpful in understanding the learning of Denise, a student interning at a dental practice who over the course of a semester developed a large degree of independence in her work (Chin, Bell, Munby, & Hutchinson, 1999). In the beginning Denise totally submitted to the authority of the individuals in charge of her training, and toward the end of the experience, began doing things before she was asked. They were clear to point out that the regulatory behaviors mentioned above, did not occur discretely, but rather overlapped with each other and that different instances of learning were happening simultaneously (Chin et al, 2004).
These studies involving situational learning and mastery are important because they provide evidence that learners can become intellectual independents as a result of engagement in real world contexts. In science education this would likely look very much like the science labs and experiences advocated by Dewey (1902). Yet, experience can take many forms, and a significant part of service-learning is learning in context rather than in a traditional classroom. It is very possible that service-learning experiences, and other non classroom learning experiences, could involve the epistemological appropriation described by Hung (1999) when students are mentored by a competent master, in that students would begin to think critically about issues they had not questioned before.

Service-Learning and Intellectual Independence

Research indicates that service-learning is linked to a plethora of positive outcomes, such as new understandings of diversity (Jones & Abes, 2004; Jones & Hill, 2001; Good, 2005), a stronger commitment to school work (Strage, 2000; 2004), and increased sense of civic responsibility (Scales, et. al., 2000). However, service-learning is a broad notion, including a wide range of activities, and research in service-learning spans many perspectives (Butin, 2003). The result is that evidence supporting the benefits of service-learning is often contradictory, and thus, not easy to interpret. However, intuition tells us that service-learning can be a valuable mechanism for reaching educational goals. Specifically, we contend that service-learning as a teaching methodology can be structured such that it fosters within students the habits consistent with intellectual independence and furthermore, that once these habits are developed they are not limited to the students’ content domain, as Kuhn (1999) fears, but that they can be generalized to other areas of a student’s life which impact their thinking and learning across disciplines, thereby having a profound influence on their thinking as society members. The fundamental element of
service-learning which lends itself to this cause, is that the habits of intellectual independence are cultivated in a real world context, rather than in conjunction with a textbook or artificial setting. Indeed, in these authentic real-life scenarios, students are allowed to focus their learning on instances and areas they choose, apart from their teacher. They are allowed, and perhaps even forced, to observe discrepancies between their own theories of the world and reality, and they bear witness to the importance of their own education that reaches beyond the level of the GPA or the diploma, as they learn how their education can increase their own agency.

Meaningful learning in real life contexts is not a new idea in education. Indeed, Dewey (1902, 1943) argued that for students to learn meaningfully, they had to have the need and motivation which comes only from learning in a context intimately related to their lives. Consider his words from *The School and Society*:

The difference that appears when occupations are made the articulating centers of school life is not easy to describe in words; it is a difference in motive, spirit, and atmosphere. As one enters a busy kitchen in which a group of children are actively engaged in the preparation of food, the psychological difference, the change from more or less passive and inert recipiency and restraint to one of buoyant outgoing energy, is so obvious as fairly to strike one in the face (p. 15).

Our schools have failed our students, according to Dewey (1943), by keeping the lives of the children and their lives at school separate. The chief problem then is that students see no necessity in school studies and thereby have no desire to waste time mastering them:

From the standpoint of the child, the great waste in the school comes from his inability to utilize the experiences he gets outside the school in any complete and free way within the school itself; while on the other hand, he is unable to apply in daily life what he is
learning at school. That is the isolation of the school—its isolation from life. When the
child gets into the schoolroom he has to put out of his mind a large part of the ideas,
interests, and activities that predominate his home and neighborhood. So the school,
being unable to utilize this everyday experience, sets painfully to work, on another tack
and by a variety of means, to arouse in the child an interest in school studies (p.75).
Service-learning connects learning to students’ real lives just as Dewey (1943) suggested. For
example, Pate, Nichols, and Tippins (2001) argued that service-learning in science teacher
preparation may better prepare science teachers for working in classrooms which they conceived
as “microcosms of cultural diversity” (p. 10). In their study, they followed how two pre-service
teachers’ views about multicultural education changed as they work in a diverse environment
aiding in-service teachers in their science teaching. The authors presented service-learning
during teacher education as a promising tool to help prepare teachers to work in diverse settings,
because it allows the student teachers to “gain an understanding of culture as the way groups of
people socially negotiate their everyday living circumstances in local settings” (p. 15). They also
argue that service-learning in science teacher education can (a) provide a more authentic
representation of the nature of science, (b) promote critical reflection about culture as it relates to
science and (c) develop sensitivity toward students’ cultural backgrounds and how these
influence science learning.

Although the relationship between the potential multicultural aspects of service-learning
and intellectual independence are perhaps only indirectly related, it is significant that these
students have begun to think critically in domains where their ideas and judgments were
previously taken for granted, and that this thinking did not occur in a traditional classroom
setting, but rather in situation very much like the ones these teachers were training to work in.
Implications

We argue that service-learning research needs to focus on how service-learning programs can foster the development of intellectual independence in its participants, and that this research should represent programs in each of Boyle-Baise’s (2002) characterizations of practice (charity, civic education, community building communitarian, community building social change). Furthermore, Butin’s (2003) research perspectives (technical, cultural, political, poststructuralist) should each be represented, such that the result is a thorough body of research describing the aspects of service-learning programs and how they contribute to the development of intellectual independence in science, in culture, and in politics. Critical to this growing body of knowledge will be studies which link activities within service-learning programs to outcomes such that practitioners can clearly elucidate critical components of service-learning programs for bringing about their desired outcomes. Additionally, these learning outcomes are important at all levels of education, from elementary school to professional development courses, so research regarding growth in the area of intellectual independences should consider each of these stages of learning. In science education, specifically, service-learning outcomes need to be examined from a K-16 standpoint and include teacher education experiences like those of Pate, Nichols and Tippins (2001) and Barton (2000).

Additionally, given Munby and Roberts (1998) description of a classroom environment which promotes intellectual independence, and the study linking reciprocal teaching to metacognitive development (Palincsar & Brown, 1984), we believe service-learning experiences with a significant teaching component on the part of the student merit special attention in the research studying the relationship between service-learning and intellectual independence. When teaching, service-learning students should become privy to classroom power which before
may not have been accessible to them. They have some role in determining which concepts are taught and how they are delivered. They are expected to evaluate the knowledge claims offered in the instructional aids prior to using them in their teaching. This allows them to critically consider the content knowledge they are charged with teaching, as well as how appropriate it is in the current instructional setting. This type of shared authority and evaluation are critical to Munby and Roberts (1998) depiction of a classroom environment fostering intellectual independence. The notion of reciprocal teaching offered by Palincsar and Brown (1984) allows for shared power and evaluation as well, and as been implicated in metacognitive development.

It is clear that as early as 1900 many philosophers, educators, and scientists were in agreement about what the aims of education, especially science education, should be; critical thinkers able to construct knowledge and participate in society constructively (Dewey, 1900; Forbes, 1903; Newell, 1902; Oliver & Nichols, 2001; Saunders, 1902). It is reasonable to assert that this aim is still a driving force in educational practice and research today (Kuhn, 1999). This aim has spurred much research which seeks to understand what thinking really is and how its development can be fostered such that it will be a tool students use in many contexts, rather than just within a discipline where they have first learned thinking skills (Chin et al, 2004; Hung, 1999; Kuhn, 1999; Piaget, 2003; Vermunt, 1998).

We believe, and argue here, that the next logical step in terms of educational practice involves tipping the scales of current instructional methods. Specifically, we need to tip the scale toward real world learning experiences in which students can develop thinking skills while recognizing how necessary they are for daily life, and tip it away from traditional classroom instruction in which the teacher transfers knowledge to students outside of a meaningful context. We contend that situational learning, as described by Hung (1999) and Chin et al (2004), and
service-learning, as described by Pate et al (2001) offer much potential for our society’s progression toward the goal of an intellectually independent populous, because they provide opportunity for students to develop their thinking in meaningful situations.
CHAPTER 3

EXAMINING THE IMPACT OF SERVICE-LEARNING ON COLLEGE STUDENTS’ VIEWS OF THEIR LEARNING

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Abstract

Service learning has garnered a great deal of attention as a teaching methodology with the potential to influence students’ development as citizens while providing them rich contexts in which to learn academic material. Many believe that service learning is related to gains in academic achievement, though the mechanisms underlying this relation are not well understood. We studied science majors enrolled in a K-12 service learning partnership using a quantitative instrument and found that participants’ views about their own learning changed significantly during the service learning program, such that they became more conceptual in their approaches to learning content and began to take responsibility for their own knowledge construction. These changes in learning views have been previously correlated with greater academic success.

Introduction

The land-grant university’s threefold mission of teaching, research, and extension is one of its significant strengths. The history and value of this mission are incorporated into undergraduate teaching programs in colleges of agriculture, and frequently undergraduate students conduct research as part of their college experience (Kardash, 2000; Knauff, 2006; Seymour et al., 2004). Meshing extension or outreach activities with teaching has been more difficult. The recent development of service learning as a teaching methodology has provided a framework for faculty to include outreach components in their courses, effectively combining the teaching and extension missions.
Service Learning

Service learning has garnered an increasing amount of attention in the literature from researchers and practitioners alike (Boyle-Baise, 2002; Butin, 2003; Scott, et al., 2005). Our conception of service learning is best described by a variation of the definition provided by the National Service-Learning Clearing House (2006). It is as follows: Service-learning activities combine service objectives with learning objectives with the intent that the activity fosters change in both the recipient of the service and the provider of the service. This is accomplished by combining service tasks with structured opportunities that link the tasks to self-reflection, self-discovery, and the acquisition and comprehension of values, skills, and knowledge content.

Research has indicated that service learning programs can foster positive attitudinal outcomes in students who participate in them. It has been reported that service learning programs aimed at helping marginalized groups in society (e.g., college students participate in a project to ameliorate poverty) may lead to an appreciation of diversity and a sense of civic responsibility for the students involved (Barton, 2000; Good, 2005; Jones and Abes, 2004; Jones and Hill, 2001). There have been some reports in the literature of service learning positively influencing students’ academic achievement as measured by traditional means (e.g., GPA, course grades, exams), but evidence in this area is conflicting (Butin, 2003; Michael, 2005; Strage, 2004). We feel the relationship between service learning in higher education and college students’ academic performance needs to be investigated if service learning is to be considered an effective instructional methodology by academics and not just viewed as soft teaching designed to improve university and community relations. Additionally, if service learning has the capacity to positively influence college student’s academic success, understanding the mechanisms by which this occurs is important so that programs can be designed which foster this
development. In this manuscript, we will briefly describe our current initiative in service learning and explain our research which attempts to clarify the effects of the program on undergraduate science students’ learning.

**Service Learning in Science**

Four years ago, we created a university-based service learning program with the goal of exposing local elementary school children to the range of science activities conducted in our college of agriculture. At the same time, the program provides support for elementary school teachers and gives university students an opportunity for service learning. We named the program FOCUS (an acronym for Fostering our Community’s Understanding of Science), and through it we pair upper division college students, primarily science majors, with partner elementary school teachers in schools of a county which also contains a large southeastern university. To participate, students must enroll in a 3-semester-hour course that is graded on an A-F scale. Requirements in the course include spending at least 3 hours per week in the elementary school working with a teacher and his or her students and participating weekly in an hour-long reflection session led by a science education graduate student. FOCUS participants also spend additional time in preparation (designing inquiry lessons, gathering supplies, etc.) for their teaching role in the schools.

Each pairing of student and teacher within this partnership is different, but in general, it can be said that the students serve as content specialists for their partner teachers, and work to prepare and implement science lessons in the teachers’ classrooms (Scott et al., 2005). The reflection sessions serve as a means to assist students in understanding elementary school science pedagogy, provide ideas and simulation of lessons and activities, and provide students opportunities to discuss their experiences working in education.
The FOCUS program began at the urging of a local elementary school parent volunteer, who is also a practicing microbiologist at a nearby university. She indicated that the elementary school teachers felt ill-qualified to teach science, and thus spent very little, if any, instructional time on science with their students. Additionally, high stakes elementary school tests in our state currently stress reading and math. Teachers felt that science would need to receive less emphasis so they could spend more time working to improve students’ scores on reading and math tests. Yet, the teachers wanted help in providing science instruction in their classrooms. The FOCUS course has been offered fall and spring semesters for the last four years. Typically 40-45 students enroll in the class. Including the fall 2006 class, over 350 students have participated, providing 14,000 hours of additional science instruction in the local school system. Nearly 7500 children have participated in science lessons through this partnership.

**Learning Regulation and Academic Outcomes**

FOCUS began as a tool to expose young people to science disciplines related to agriculture, to give university students a chance to work in the community, and as a service for the elementary teachers and their students. Quite unexpectedly, the supervising graduate student and faculty at the university began to notice additional advantages of the program for our college science students. In their reflective journals and in class discussions, many of our science students discussed how their new role as a teacher was changing how they viewed their own learning. One student described how she’d used manipulatives for teaching her 3rd grade students about chemical bonding and realized she could use them herself to study for a test in organic chemistry. “I just decided to teach it to myself the way my professor should have,” she commented. Statements like this one struck us as profound, because it suggested students in this class were taking responsibility for their own knowledge construction and regulating their
learning, rather than passively expecting a professor to transfer or give knowledge to them (Scott et al., 2005).

**Operational Definitions**

We conceptualize learning regulation as occurring either within the learner or outside of the learner. If a student is a self-regulated learner, then they accept responsibility for their own knowledge construction, and choose and engage strategies in their learning which serve to further their understanding in their course studies (Vermunt, 1998). Additionally, they do not rely solely on external measures of their success in understanding material. For example, a self-regulated learner might realize that even though they made an A on a course test involving recall of learned material, they may not necessarily have a firm grasp of the covered content on a conceptual level (Vermunt, 1998). Conversely, if a student is an externally regulated learner, then they wait for some external source (professor, textbook, etc) to transfer knowledge to them. This puts the action of learning outside of the learner. If an externally regulated learner makes an A on a recall test, then they make the assumption that they have mastered the material because of that performance on an external indicator (Vermunt, 1998).

Self regulation of learning is a metacognitive phenomenon, in that it involves the examination of the status of ideas within ones own cognitive framework and is a necessary first step toward becoming a critical thinker (Kuhn, 1999; Piaget, 2003). Our observations suggest that experiences in FOCUS encourage students to evaluate their own and others’ thinking, thereby taking steps toward becoming more critical thinkers.

**Purpose**

Our current research initiative involves an examination of the influences on learning regulation which accompany participation in this service learning activity. We hypothesized that
changes in the participants’ views on the regulation of learning might serve as an indicator of how students in a school-based service learning course change their understanding of and approach to learning in a broader sense. Anecdotal evidence suggested that “the participating student makes an impact through the application of their energy and expertise in the community and then returns to the university changed with regard to their knowledge, motivation, and direction” (Scott et al, 2005). Such change in motivation, direction, and view of knowledge, has been correlated in previous studies with greater academic achievement, as measured by traditional means, in university studies (Boyle et al., 2003). The purpose of this study is to understand the effect of FOCUS on the learning regulation of the college science majors who participated in the program.

**Methods.**

In an empirical attempt to “increase integration of existing models of student learning” Vermunt (1998) created an instrument, the Inventory of Learning Styles (ILS). In this study, we have used the ILS to measure how FOCUS students’ self-report of their own learning styles changed during their participation in this service-learning course. This questionnaire was designed to assess students’ learning styles and consists of 100 Likert-type items with responses ranging from 1 (I do this seldom or never or I disagree entirely) to 5 (I do this almost always or I agree entirely). The learning styles are characterized by weightings in a factor analysis of self-report scores of the four learning components to which his synthesis of the literature most specifically pointed. These four components are cognitive processing, metacognitive regulation, mental learning models, and learning orientations.
The Inventory of Learning Styles (ILS)

In his ILS, Vermunt (1998) developed scales and subscales to assess the four learning components. For the cognitive processing strategies, or the methods students use to process material while they learn, he uses three scales; Deep Processing, Stepwise Processing, and Concrete Processing. These scales represent levels of sophistication in processing, with Deep Processing being the most sophisticated processing strategy, and Concrete Processing being the least sophisticated. Students who process matter deeply are likely to look for connections between topics and critically assess claims made by the teacher or the textbook. Students who process material in a stepwise fashion are likely to memorize material and study using a detail by detail approach, rather than looking for relationships between topics. Students who process material concretely pay attention to aspects of the course which have practical utility.

The Deep Processing scale consists of two subscales. These are Relating and Structuring and Critical Processing. The Stepwise Processing scale also consists of two subscales; the Memorizing and Rehearsing subscale and the Analyzing subscale. It is important to note, that while Vermunt (1998) uses the term subscale in his instrument, the subscales are not scalar in the true sense of the word. Rather, the subscales simply represent multiple ways students may exhibit the characteristics of the scale.

The regulation strategies students use in their learning are assessed on the ILS using three scales, Self Regulation, External Regulation, and Lack of Regulation. Again, these represent a continuum of sophistication in regulation, with Lack of Regulation being the least sophisticated approach and Self Regulation being the most sophisticated approach. Students who regulate their own learning are likely to test their own progress using questions they write during their studying and are likely to use material beyond the course text as they learn. Conversely,
externally regulated students are likely to learn material exactly as it is presented in the text, and rely on external measures, such as test scores, to determine their level of mastery in a subject. Furthermore, students who utilize no regulation strategies, find it difficult to assess whether they have mastered content, are not clear on what they need to remember in the course, and have an insufficient understanding of course objectives. The Self Regulation scale consists of two subscales. These are the Learning Processes and Results subscale and the Learning Content subscale. The External Regulation scale also consists of two subscales, the Learning Processes subscale and the Learning Results subscale. Again, Vermunt uses the term subscale to represent different ways a student may exhibit Self or External regulation.

Learning orientations, or motivations, are assessed on 5 scales. Vermunt (1998) labels these scales as Personally Interested, Certificate Directed, Self-test Directed, Vocation Directed, and Ambivalent. Again, the scales represent a continuum of sophistication in terms of motivation. Students with a Personally Interested orientation are genuinely interested in the material they are studying and enjoy their work in courses related to their major. Students with a Certificate Directed orientation see the diploma as the main reason for pursuing their studies. Students who are Self-test Directed are motivated by proving their proficiency in their coursework. Students with a Vocation Directed orientation are motivated by preparing for a chosen profession. Finally, students with an Ambivalent orientation are unsure of their purpose in pursuing education.

Students’ mental models of learning, or their ideas about how learning occurs, are assessed using 5 scales on the ILS. These 5 scales are Construction of Knowledge, Intake of Knowledge, Use of Knowledge, Cooperation, and Stimulating Education. Students with a Construction of Knowledge model of learning work to construct their own knowledge and
insights and may consult references beyond the course requirements of their own accord. Students with an Intake of Knowledge model of learning believe knowledge is provided by the elements of their education such as the professor and the textbook. Students with a Use of Knowledge model of learning believe learning occurs when material encountered can be used in everyday life. Students with a Cooperation model of learning place a lot of value on studying with other students and sharing learning. Finally, students with a Stimulating Education model of learning believe the teacher or text should stimulate learning in them.

In his research using the instrument, Vermunt (1998) consistently found four learning styles; undirected, reproduction-directed, meaning-directed, and application-directed style. Vermunt (1998) used four-factor principal component analysis to uncover the learning styles based on the four components we’ve just discussed. In other words, learning styles are characterized by certain patterns of responses along the fore mentioned scales. For example, the undirected style had high loadings of lack of regulation, an ambivalent learning orientation, and cooperation and stimulating education models of learning. The reproduction style had high loadings of ILS subscales memorizing and rehearsing, analyzing, external regulation of learning processes, and learning results. Additionally, the style was characterized by an intake of knowledge model of learning and certificate and self-test-directed learning orientations. The application directed learning style has high loadings of concrete processing, use of knowledge as a mental model of learning, and vocational and certificate-directed learning orientations. Finally, the meaning-directed learning style is characterized by high loadings of relating and structuring, critical processing, self-regulation of learning processes and learning contents, a construction of knowledge learning model, and a personally interested learning orientation. Boyle et al. (2003) found that students self report using the ILS could predict academic performance as measured in
a traditional sense (GPA). Specifically, Boyle, et al. (2003) report that students who identify with Vermunt’s (1998) meaningful learning style, characterized by self regulation and constructivist views of learning, exhibit better academic outcomes than those who are externally regulated and have an intake view of learning. Sample items from the ILS are listed in Table 3.1. A concise explanation of the relationship between responses on the ILS and the learning styles describe by Vermunt (1998) are listed in Table 3.2.

Anecdotally, we have seen our students change in their approaches to learning and adopt strategies and models consistent with Vermunt’s (1998) meaning-directed learning style, while exhibiting fewer behaviors and attitudes consistent with the reproduction-directed learning style he outlines. Because we believe we have seen students change along the four components Vermunt (1998) uses to explain his learning styles, the ILS was the logical instrument for us to use as we attempted to uncover the ways the FOCUS experience influences learning styles in our college students.

Data Collection

We asked students enrolled in FOCUS to complete Vermunt’s (1998) Inventory of Learning Styles (ILS, Vermunt, 1998) at our second weekly meeting in spring semester 2006. They had one week to complete the inventory and returned it to us at our third class meeting. The inventory was completed prior to any significant experience in the elementary classrooms or in our reflection sections. We will refer to this ILS as the pre-FOCUS data. Thirty students, 8 males and 22 females, completed the ILS. This inventory, consisting of 100 Likert-scale items, provided us with information regarding the students' views about their own learning regulation prior to their work in our program. During the last week of classes in spring semester, we had the students complete the ILS again. We refer to this iteration as the post-FOCUS data. We
analyzed the data in the SPSS-X statistical package (Green and Salkind, 2005). To insure adequate reliability of each scale, items were removed from subscales if their deletion made the Cronbach alpha rise. We performed a paired item t-test for each subscale, comparing the pre and post means from the ILS.

**Results and Discussion**

Our findings indicate that after participation in FOCUS, students’ responses on the ILS reflect some differences in their views regarding learning and are summarized in Table 3.3. Three areas showed significant change at \( \alpha \leq .05 \). Specifically, the means significantly decreased in the analyzing subscale of the stepwise processing scale and the results subscale of the external regulation scale. The mean of responses for the use of knowledge scale significantly increased. At \( \alpha \leq .10 \), the mean of responses on the vocation directed scale increased.

We hypothesized that students enrolled in FOCUS would report an increased level of self-regulation in their learning after this experience and were surprised to find no significant change in the Self Regulation scale of Vermunt’s (1998) ILS. However, our findings indicate that participation in FOCUS does impact student self-reports on three other scales of the ILS, and we believe these changes are indications that FOCUS has the capacity to influence students in ways that lead to more meaningful learning and potentially greater academic success. Specifically, after participation in FOCUS college students report themselves as less externally regulated in their learning. The decrease in the mean value on the results subscale of the External Regulation scale indicates that FOCUS students are less dependent on their professor or their textbook for determining when they have reached mastery of material. This is important, because research suggests that decreasing dependence on external regulators is a necessary step toward accepting responsibility for one’s own learning (Kuhn, 1999; Munby and Roberts, 1998).
Further, accepting responsibility for one’s learning has been shown to predict gains in motivation and academic success (Findley and Cooper, 1983).

Our findings also indicate that after FOCUS students are less likely to report using the analyzing strategy on the Stepwise Processing scale. We believe this is a positive outcome of participation in our program, because a decreased tendency to study items in a chapter or lecture detail by detail likely precedes a tendency to assimilate material more meaningfully and integrate it into a cognitive framework. Such integration requires metacognitive ability, in that a student must evaluate the status of their own ideas, the ideas they are encountering in their studies, and work to bring those sets of ideas into a useful construct (Kuhn, 1999).

Additionally, students reported being more inclined to look for practical applications of material they encountered in their courses, after participation in FOCUS. This is another change which has been previously associated with increases in motivation and academic success (Findley and Cooper, 1983). We believe this may result from our students working in an elementary setting, where science is generally taught in a more concrete manner than it is in a college science course. For example, when our students teach a unit about electricity and magnetism, they draw on daily experiences the elementary students will be familiar with, such as turning on a flashlight. In a lesson about plant parts, elementary students might see a salad made with roots, stems, and leaves. In this way, our university students are bringing their own science knowledge into concert with daily life to help make it meaningful for the elementary students with whom they work. It is not surprising that when our students repeatedly turn abstract science concepts into concrete examples for their students, it leads our students to cultivate the habit of looking for such practical applications of material to further their own understanding.
Service learning as pedagogy is becoming increasingly popular as a component of university courses and as a means to improve university-community relations, but naysayers still have concern about the effectiveness of service learning as a tool for meaningfully impacting college students’ progress in a traditional classroom setting. During participation in FOCUS our college students view science instruction from the perspective of a teacher as they refresh their content knowledge, outline goals for lessons, struggle with engaging students with different learning styles, and otherwise work to help students become successful in science. In this quantitative study, we found service learning participation improved the methods students used to learn subject matter in other courses. Our findings allow us to glimpse how a school based service learning course has the capacity to influence college students’ own academic achievement by improving approaches to their own learning. We feel these results add concrete examples to the perceived value of service learning in university courses and may demonstrate a means for other instructors to measure the potential positive impact of service learning for university students.

Acknowledgement

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Table 3.1. Sample items from Vermunt’s (1998) Inventory of Learning Styles.

<table>
<thead>
<tr>
<th>Learning Component</th>
<th>ILS Scale</th>
<th>ILS Sub-Scale</th>
<th>Sample Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Processing Strategies</td>
<td>Deep Processing</td>
<td>Relating and Structuring</td>
<td>I try to see the connection between the topics discussed in different chapters of textbook.</td>
</tr>
<tr>
<td></td>
<td>Deep Processing</td>
<td>Critical Processing</td>
<td>I compare my views of a course topic with the views of the authors of the textbook used in that course.</td>
</tr>
<tr>
<td></td>
<td>Stepwise Processing</td>
<td>Memorizing and Rehearsing</td>
<td>I repeat the main parts of the subject matter until I know them by heart.</td>
</tr>
<tr>
<td></td>
<td>Stepwise Processing</td>
<td>Analyzing</td>
<td>I work through a chapter in a textbook item by item and I study each part separately.</td>
</tr>
<tr>
<td>Concrete Processing</td>
<td>Self Regulation</td>
<td>Learning Processes and Results</td>
<td>I pay particular attention to those parts of a course that have practical utility.</td>
</tr>
<tr>
<td>Metacognitive Regulation</td>
<td>Self Regulation</td>
<td>Learning Content</td>
<td>To test my learning progress, I try to answer questions about the subject matter which I make up myself.</td>
</tr>
<tr>
<td></td>
<td>External Regulation</td>
<td>Learning Processes</td>
<td>In addition to the syllabus, I study other literature related to the content of the course.</td>
</tr>
<tr>
<td></td>
<td>External Regulation</td>
<td>Learning Results</td>
<td>I test my learning progress solely by completing the questions, tasks, and exercises provided by the teacher or the textbook.</td>
</tr>
<tr>
<td>Lack of Regulation</td>
<td></td>
<td></td>
<td>I notice that I have trouble processing a large amount of subject matter.</td>
</tr>
<tr>
<td>Learning Orientations</td>
<td>Personally Interested</td>
<td></td>
<td>I do these studies out of sheer interest in the topics that are dealt with.</td>
</tr>
<tr>
<td></td>
<td>Certificate Directed</td>
<td></td>
<td>What I want in these studies is to earn credits for a diploma.</td>
</tr>
<tr>
<td></td>
<td>Self-test Directed</td>
<td></td>
<td>I want to prove to myself that I am capable of doing studies in higher education.</td>
</tr>
<tr>
<td></td>
<td>Vocation Directed</td>
<td></td>
<td>The main goal I pursue in my studies is to prepare myself for a profession.</td>
</tr>
<tr>
<td></td>
<td>Ambivalent</td>
<td></td>
<td>I wonder whether these studies are worth all the effort.</td>
</tr>
<tr>
<td>Mental Learning Models</td>
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<td></td>
<td>If I have difficulty understanding a particular topic, I should consult other books of my own accord.</td>
</tr>
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<td></td>
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<td></td>
<td>To me, learning is making sure that I can reproduce the facts presented in a course.</td>
</tr>
<tr>
<td></td>
<td>Use of knowledge</td>
<td></td>
<td>To me, learning means acquiring knowledge that I can use in everyday life.</td>
</tr>
<tr>
<td></td>
<td>Cooperation</td>
<td></td>
<td>I have a need to work together with other students in my studies.</td>
</tr>
<tr>
<td></td>
<td>Stimulating Education</td>
<td></td>
<td>When I have difficulty understanding something, the teacher should encourage me to find a solution by myself.</td>
</tr>
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<td>Vermunt’s Learning Styles</td>
<td>Weightings of Scales and Subscales in Vermunt’s (1998) factor analysis</td>
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<td></td>
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<tr>
<td>--------------------------</td>
<td>---------------------------------------------------------------</td>
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<td>Undirected</td>
<td>• Lack of Regulation</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>• Ambivalent Learning Orientation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cooperation and Stimulating Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meaning Directed</td>
<td>• Relating and Structuring</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Critical Processing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Self Regulation of Learning Processes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Self Regulation of Learning Content</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Construction of Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Personal Interest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reproduction Directed</td>
<td>• Memorizing and Rehearsing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Analyzing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• External Regulation of Learning Processes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• External Regulation of Results</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>• Intake of Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Certificate Learning Orientation</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• Self-test Directed Learning Orientation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application Directed</td>
<td>• Concrete Processing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Use of Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Vocational Directed Learning Orientation</td>
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</tr>
<tr>
<td></td>
<td>• Certificate Learning Orientation</td>
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</table>
Table 3.3 Results of the paired item t-tests comparing the pre FOCUS and post FOCUS means along each scale and subscale of the ILS.

<table>
<thead>
<tr>
<th>Measured Learning Component</th>
<th>Scale</th>
<th>Subscale</th>
<th>$\bar{X}<em>{pre} - \bar{X}</em>{post}$</th>
<th>df</th>
<th>t</th>
<th>p</th>
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<td>Cooperation</td>
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*Sig. \(\alpha \leq .10\), *Sig. \(\alpha \leq .05\)
Chapter 4

SCIENCE MAJORS TEACHING SCIENCE IN ELEMENTARY SCHOOL:
UNDERSTANDING COLLEGE SCIENCE STUDENTS’ LEARNING OUTCOMES OF A
K-12, CLASSROOM-BASED SERVICE-LEARNING EXPERIENCE

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Abstract

Service learning has garnered a great deal of attention as a teaching methodology with the potential to influence students’ development as citizens while providing them rich contexts in which to learn academic material. We studied college science students enrolled in a service-learning course with the purpose of understanding the learning outcomes associated with participation in the program. We found that as a result of their service-learning involvement, students increased and improved their content knowledge of science, developed metacognitive awareness, and critically considered issues of schooling and society. Implications for service-learning practice are discussed.

Introduction

In January 2002, as the United States began the healing process following the attacks of September 11, 2001, President George W. Bush called for Americans to work together on strengthening their communities and thereby the nation as a whole. In what he termed a “call to service”, the President asked that each American spend a total of 4000 hours, or 2 years of their lives, working for a greater America (USA Freedom Corps, 2006, ¶ 1). The Corporation for National and Community Service became the center of the flurry of activity which followed. The Corporation includes three programs, AmeriCorps, Senior Corps, and Learn and Serve America. The first two programs help connect Americans who wish to volunteer with others in their community who need their help. Examples of the service involved might include tutoring, meal preparation, and disaster relief. The third program, Learn and Serve America, is unique in that its aim is to mobilize the nation’s students, K-16, to engage in service-learning, an activity that goes beyond volunteering because it requires service accompanied with structured
opportunities for the students who serve to learn meaningfully from their experience. Learn and Serve America has enjoyed an increase in activity after President Bush’s call to service. Beyond these federally supported efforts, funding opportunities from other public as well as private organizations have become increasingly available to support service-learning programs.

The timing of this national recognition of service-learning as a valuable community-building and pedagogical tool, worthy of monetary support, was serendipitous in that it occurred as university professors, K-12 educators, and students became awakened to the tremendous potential of service-learning as an effective teaching method (National Commission on Service-Learning, 2002). The W. K. Kellogg Foundation contributed to this awakening when it began an initiative called Learning In Deed: Making a Difference through Service-Learning. Part of the initiative involved the development of the National Commission on Service-Learning, a group of 18 scholars, politicians, and teachers who are charged with making service-learning part of every K-16 student’s education (National Commission on Service-Learning, 2002). Indeed, this nationwide initiative is very apparent at our own university, as an Office of Service-learning was recently created to realize the goal of providing students with a more meaningful education while meeting needs of our community locally and globally.

Across the span of more than 15 years, and as a result of this national attention, service-learning has become widely discussed in educational communities apart from academe. It has garnered an increasing amount of attention in literature from both researchers and practitioners (Boyle-Baise, 2002; Butin, 2003; Eyler & Giles, 1999; Moely, McFarland, Mercer, & Ilustre, 2002; Scott, Oliver, & Knauft, 2005; Steinke, Fitch, Johnson, & Waldstein, 2002; Vogelgesang & Astin, 2000). However, this increased attention has not led to widespread agreement as to the definition of service learning; many operational definitions of service-
learning exist. The conception of service-learning which has been used to shape the research reported within this document is a definition provided by the National Service-Learning Clearinghouse (2006). It is as follows: “Service-learning combines service objectives with learning objectives with the intent that the activity changes both the recipient and the provider of the service. This is accomplished by combining service tasks with structured opportunities that link the task to self-reflection, self-discovery, and the acquisition and comprehension of values, skills, and knowledge content” (National Service-Learning Clearinghouse, 2005, ¶ 3).

In this research, we report on our study of a university service learning program entitled FOCUS (Fostering our Community’s Understandings of Science) which involves university science majors teaching science lessons in elementary school classrooms. The purposes of our study were to understand the university students’ learning outcomes resulting from participation in FOCUS and to determine which elements of the program structure were implicated in the development of desirable outcomes. Specifically, we sought to answer the following questions:

1. What changes do FOCUS students experience with regard to their conceptions of learning, teaching, and schooling?
2. Can these changes be related to aspects of the FOCUS program?

In this manuscript, we will offer a brief review of current research in service-learning, a description of the service-learning program involved in the current effort, and report our research methodology and findings from the study. Finally, we will discuss our findings and provide implications for both service-learning practice and research. It is important to note here that we began this research with a strong focus on understanding learning outcomes that could be tied to academic achievement, and while we will report on those findings, we also report other significant learning outcomes the students shared with us.

**Research in Service-Learning**
Scholars and practitioners alike are speaking of the positive outcomes service-learning has for students. Experts generally agree that opportunities to engage with communities through service learning result in a matured sense of civic responsibility (Boss, 1994; Moely et al, 2002; National Commission on Service Learning, 2002). Additionally, there is mounting evidence that service-learning in which the service targets marginalized groups in society can foster awareness and appreciation of diversity in student participants (Barton, 2000; Good, 2005; Jones & Hill, 2001). College students who have participated in service-learning activities helping individuals very different from themselves (in this example, working with AIDS patients in a free clinic) credit the experience with transformative affects on their own identity development (Jones & Abes, 2004). Furthermore, students who work in the community and interact with citizens whose circumstances are very different from their own come to new understandings of the country’s social structure and its implications for others’ success in school, work, and their family life (Rockquemore & Schaffer, 2000).

Along with these desirable affective outcomes, researchers have reported service-learning activities positively influence academic achievement. For example, Strage (2000) found that the undergraduates enrolled in an Introductory Child and Development course that completed 20 hours of service learning within a school setting out performed students who took the course without the service-learning component. She attributed this difference to the rich context within which the students who participated in service-learning could make sense of the theory they were exposed to in the lectures (Strage, 2000). Yet, in a later study Strage (2004) hypothesized that students who had participated in service-learning early in their major would demonstrate greater academic achievement (as measured by GPA) in upper level courses than students who had not participated in service-learning. However, this second study yielded no significance difference
between the service-learning participants and the other students. These two studies provide a good illustration of the ambiguous findings regarding the relationship between service-learning and academic achievement (Butin, 2003). Several studies have found positive correlations between successful service learning participation and grade point average, but often in these studies it is difficult to pinpoint the direction of causation (Eyler, 2002). It seems equally plausible that students who are successful in school are more likely to engage in service learning as it does to assume that service learning leads to improved GPA. What’s more, GPA tends to increase as the students moves toward the completion of the degree and thus we will always expect and upward trend in GPA across time within undergraduate degree programs (Hu, 2005).

One issue complicating the interpretation of research linking service-learning to academic achievement is the wide array of activities labeled as service-learning (Boyle-Baise, 2002) and their relationships to traditional curricula and course objectives. For example, students in a watershed ecology course may engage in a service-learning project that results in the reconstruction of a community watershed. The objectives of the service learning aspects of the course are clearly tied to the overall science learning objectives. It seems straightforward to study the effects of the experience on students’ understandings of course subject matter content. These types of experiences stand in contrast to other service learning experiences that stand alone from traditional courses, perhaps as a course all their own, and thus their effects on participants’ learning in subject matter content courses is indirect if present at all. The lack of direct connection makes it difficult to assert that these types of experiences contribute in any significant way to learning across the traditional academic curriculum.

We believe further investigation of the relationship between service-learning and academic learning is a necessary first step toward acceptance of service-learning as effective
teaching, rather than “soft teaching” aimed at improving university-community relations. Indeed, in this study, we have examined learning outcomes with regard to university students enrolled in FOCUS, and paid special attention to how those outcomes may influence more traditional academic learning. Next, we will briefly describe the service-learning program central to our current investigation.

The Service Learning Program: FOCUS

For several years our university has been involved in a partnership with local elementary schools. At its heart, the partnership is designed to improve science instruction at the elementary school level. This partnership began at the urging of a parent volunteer at one local elementary school, who is also a practicing microbiologist at a nearby university. She contacted an administrator in our university's College of Agriculture and Environmental Science (CAES), and made him aware of a need in the local elementary school. Namely, teachers felt under-qualified to teach science, and thus spent very little, if any time on science with their students. Additionally, because the high stakes tests in Georgia currently stress reading and math, teachers felt that science would need to remain on the backburner so they could work to improve students’ scores on tests in those areas. Yet, the teachers did want help in moving science back into the instructional plan in their classrooms. The CAES administrator responded by providing a graduate assistant to recruit undergraduate science students for their school placement as a means to help these teachers access science expertise. The program began with 8 students and 8 partner teachers, and has come to be widely celebrated by teachers, parents, administrators in the schools and the university, and students, both elementary and college. The last semester (spring, 2006) the program boasted 40 students in 4 schools.
Through the program, entitled FOCUS (Fostering our Community’s Understanding of Science), 3rd and 4th year college science majors are paired with partner elementary teachers working in a small county of a southeastern state. The college students register for a 3 semester hour course while participating in the program. To earn this credit, they spend approximately 3 hours a week in contact with the teacher and students at the school site, one hour in a reflection session located on the University campus, and in addition, 2 to 3 hours preparing (design inquiry lessons, gather supplies, etc) for their teaching time. The weekly reflections sections were largely unstructured. They were characterized by open ended discussion among the students about their experiences in the schools. However, in the latter half of the experience, the students made more formal best lesson presentations to each other. These presentations involved teaching the lesson to the other FOCUS students as well as submitting a formal write up of the lesson plan to the instructors. This served to allow that each student’s most effective lesson was shared in a way which made it accessible for other students to use. These lessons ultimately become part of the collection of best lessons made available to students enrolled in future iterations of FOCUS, and also to teachers via the FOCUS website. Early in the semester, the instructors attempted to accomplish certain goals we felt necessary for students to feel prepared as they moved into the classroom. Specifically, we gave them tools to use in classroom management efforts and lesson planning. For example, with regard to classroom management we encouraged them to minimize their students’ idle time, learn the pupils’ names, and practice positive reinforcement. With regard to instruction and lesson planning, we provided an example instructional model and discussed the importance of tapping multiple intelligences in their delivery. The organizational calendar which outlines topics of discussion for the reflection section is found in Table 4.1.
Each partnership is different, but in general, it can be said that the students serve as content specialists for their partner teachers, and work to prepare and implement science lessons in their classrooms (Scott, Oliver, & Knauf; 2005). We should note that this 3 hour course titled Service-Learning is not tied to specific, collegiate science objectives, but rather is separate from the traditional college science courses.

The FOCUS program originated as a service for the elementary teachers and their students and was as such labeled as a “community service” program. And then quite unexpectedly, the supervising graduate students and faculty began to notice academic related results of the program in terms of our college science students. These advantages included the students’ recognition of their new role as a teacher, and how that role was influencing the students’ own learning in their university studies. One student described how she’d gotten out the manipulatives she’d used for teaching her 3rd grade students about chemical bonding and used them to study for a test in organic chemistry. “I just decided to teach it to myself the way my professor should have,” she commented. Statements like this one seemed profound, because they implied that these students were taking responsibility for their own knowledge construction, rather than expecting a professor to transfer knowledge to them. This type of realization, in which students begin to understand that they are in control of their own learning, has been correlated previously with greater academic achievement (Boyle, Duffy, Dunleavy, 2003; Neber & Schommer-Aikins, 2002; Shanahan, 2006; Zimmerman, 2002).

The current research initiative involves an examination of students’ views of their own learning styles and processes, with special emphasis on the phenomenon of learning regulation. Learning regulation is the concept which operationalizes the degree to which learners believe they can impact the way they learn in formal settings, and it serves as an indicator of how
proactive students are with their own learning (Shanahan, 2006). With respect to FOCUS, evidence has suggested that “the participating students make an impact through the application of their energy and expertise in the community and then return to the university changed with regard to their knowledge, motivation, and direction” (Scott et al, 2005, p.227). Specifically, we believe that our students are changing in how they feel their learning is regulated, in that they are recognizing that the locus of control with regard to their knowledge construction is internal rather than in the external world. Furthermore, we believe this change in students’ views and attitudes regarding their own learning may be a crucial precursor to their development of habits and abilities consistent with intellectual independence, or a state in which learners become motivated to and able to evaluate knowledge claims independent of outside authorities like the teacher or the textbook (Munby, 1984). Most agree that this type of independence, called by some critical thinking, is a desirable outcome of schooling (Kuhn, 1999).

**Theoretical Framework and Researcher Bias**

This study is situated within a framework of social constructivist learning theory, metacognitive theory, and pragmatism. Social constructivist learning theory emphasizes the importance of the learners’ active engagement in the process of learning, their social interactions in learning, and the culture in which learning occurs (Bandura, 1986). Indeed, according to social constructivist theory, knowledge construction occurs as a result of learners interactions with each other and with their environment (Kim, 2001). The term reciprocal determinism describes how learners influence their environment and are influenced by it simultaneously (Bandura, 1986). We do believe that learning is an inherently social phenomenon, yet, there is an element which must occur within an individual. In other words, while in a setting where social interaction and new experiences are available to facilitate knowledge construction, an individual
must have the tools with which to translate those experiences into learning outcomes. Metacognitive theory suggests that a learner’s ability to think about use of strategies and employment of regulation strategies in their learning will influence their level of success in knowledge construction (Flavell, 1979). Metacognitive sophistication has been linked to gains in academic achievement (Everson & Tobias, 1998; Schraw, 1998). And finally, educational pragmatism holds that the students’ experiences in education should not be separated from or in preparation for their real lives, but should rather occur in sync with their daily lives and thus be inherently meaningful to the students (Dewey, 1943). While this seems a natural extension of social constructivism, we think it adds an important dimension when considering our research with FOCUS, because participation in this program requires learning within the community outside of the students’ current school environment.

In the first author’s experience as a young teacher, she realized that the deep conceptual understandings of science which she desired for her science students, and which she was developing as a result of teaching, developed as a result of the response to many stimuli. Development was a function of the students’ prior knowledge, their social interactions with her and with each other, their ability to regulate their learning and recognize and employ learning strategies, and the degree to which they could see a connection between what was collectively studied in class and their individual lives. This realization happened after she was forced to confront her own lack of conceptual understanding and study her own learning mechanisms. What’s more this realization happened in a social, real situation of a public high school science classroom. These elements were critical to her learning outcomes, and therefore this research was conducted under the assumption that they are significant in the learning outcomes of our FOCUS students.
Methodology

Participant Selection

The FOCUS class from Spring 2006 consisted of 32 students. There were 9 males and 23 females enrolled. Two females declined to participate in the research study being reported here. There were six students who were not first time participants in the program. Thirty students agreed to be participants and indicated this agreement by signing a consent form the first week of class. This form requested permission for us to use their weekly journal entries as data, and also gave us permission to pursue a subset of the students as extended participants for a series of 3 interviews.

Of the 30 students who agreed to be participants, there were 2 African-Americans, 1 Indian, and 1 Asian-American. The remaining 26 were Caucasian. Consistent with our University’s profile, all of the students from this semester characterized themselves as upper middle class via journal entries and/or interviews. Of the 30 students who agreed to participate in the study, 6 also agreed to be extended participants in that in addition to providing journals as data, they each also allowed us to interview them 3 times.

The extended participants in this study represent a maximum variation sample with regard to learning styles (Bogden & Biklen, 2003). We limited these extended participants to science majors for one simple reason. Science is our specialty. We are interested in how the results of service learning in science translate into science learning for the participants. With regard to the maximally varied learning styles, we wanted our sample to be representative of college science students, rather than represent a narrow scope of learning styles. However, as this was the first time we had engaged with these students, we had virtually no information regarding their learning habits. Naturally, this made choosing a maximally varied sample
challenging. In another aspect of this study, we administered Vermunt’s (1998) Inventory of Learning Styles (ILS) during the second week of class. We used the ILS as a diagnostic to identify 4 participants who would represent maximum variation with respect to responses on the ILS within the current population of FOCUS students.

The ILS is a 100-item Likert scale instrument which asks students to provide a self report regarding their approaches to learning across 4 domains of cognition. These domains include cognitive processing strategies, metacognitive regulation, learning orientations, and mental models of learning and are measured by scales and/or subscales within the ILS. For example, students’ metacognitive regulation is measured using 3 scales; Self-regulation, External Regulation, and Lack of Regulation. The Self Regulation scale is subdivided into two subscales, namely, self regulation learning processes-results and self regulation learning content. Likewise, the External Regulation Scale is divided into two subscales termed external regulation processes and external regulation results. It is beyond the scope of the current report to thoroughly dissect the ILS, but we do want to make clear how we chose these extended participants. Vermunt (1998) found that there was a strong positive correlation between the self-regulation learning processes subscale of the metacognitive regulation component of learning and the construction of knowledge scale of the mental models of learning component. In pursuit of our maximum variation sample, we decided to choose participants who reflected Vermunt’s predictions (i.e. showed a strong positive correlation between self-regulation and construction of knowledge measures) as well as those who did not. While the ILS has been useful in uncovering relationships and trends between learning components and learning styles, as is true of all predictive statistics, it does not explain the variance in learning styles for everyone. We believe there is value in looking beyond Vermunt’s (1998) predictive model, such that our data will be
inclusive of individuals who do not mesh with his model. Later in this manuscript, we will introduce each of our extended participants thoroughly, but for now we will offer that Kiesha and Neal exhibited the strong positive correlation between their scores on the scales of self-regulation learning processes and results and construction of knowledge (Pearson’s $r = .868$). Indeed their means for the two were identical, each at 3.5 (the Likert-item responses range from 1 to 5). Nate’s mean score on the self regulation of learning processes and results subscale was 1.233 less than his mean score on the construction of knowledge scale, and his scores were less correlated than Kiesha’s and Neal’s ($r = .612$). Conversely, Rita’s mean score on the self regulation learning processes and results was greater by .5 than her mean score on the construction of knowledge scale. Her response on the two scales showed no discernable correlation (Pearson’s $r = 0$). There was another student whose construction of knowledge mean score was less (a greater difference than exhibited by Rita) than his mean score on the self-regulation learning processing and results subscale, but he declined participation in the interviews due to scheduling conflicts.

In addition to these four extended participants, we wanted to be certain to interview repeating FOCUS students. We felt that their more extensive participation with the program would allow them valuable insights into the effects of the program on their personal development and learning habits. Therefore, we chose the only two science majors who were “repeating” participants, Dale and Breanna, to be included as extended participants.

**Data Collection**

FOCUS students submitted weekly journal entries as an assignment for the course in which they were registered. These entries provided the students a forum to share with the instructor issues they were facing in the classroom. They used this journal to report about what
lessons they were teaching, but also as a place to ask questions and offer ideas about issues in education which they felt were effecting instruction. Frequently, students wrote about grouping of students by ability level, issues of socio economic status, and race. Most important for this research effort were the two more extensive journal entries the students completed. One of these they completed at the start of the semester, and the other they completed during the last week of class. At the start of the program, before the students had even met their partner teacher, they wrote their first journal entry which was guided by a series of questions provided by the researchers. These questions were designed to give the researchers insight into how these students characterized the processes of teaching and learning, not just in society, but also within their own studies. For example, we asked the students to respond to the following question:

*How do you know when you have really learned [subject matter] material? Provide an example.*

This question was specifically targeted to the students’ conceptions of their own learning. We also included a question which was meant to unearth the students’ ideas about the learning of others when we asked: *Think of a student you have encountered in past classes who you didn’t consider to be successful academically. Why do you believe this was the case?* For a full list of the questions which guided the first journal entry, see Table 4.1.

The summary reflection, which students completed during the last week of class, was also guided by questions provided by the researchers. With these questions, we wanted students to communicate to us how they felt they had been affected by their participation in this program. As such, we included questions like this one: *Describe a moment in this experience when you felt you learned something significant about yourself. If you feel you didn’t learn anything about yourself, explain why.* As we were very interested in the specific effects that teaching within this program had on the college students’ learning, we also asked them to answer the following
question: Has participation in this program influenced your work in your own studies? Why or why not? For the full list of questions which guided the summary reflection, please see Table 4.2.

In addition to the 2 journal entries which informed our study as sources of data, we also interviewed each of our 6 extended participants 3 times. The first interview took place during the first month of their experience in the schools. The second interview occurred at approximately the midpoint of the semester, and we conducted the third interviews during the last week of university classes. These interviews were semi-structured and typically 1 hour in duration. These interviews were meant to provide information about how the extended participants were changing with regard to their ideas about teaching, learning, and schooling. Again, we asked questions about their own learning as well as about what they were witnessing in their elementary school classroom and in their college science courses in terms of learning by others.

The first interview, like the first journal entry, served to provide the researchers with information about who the participants were with regard to ideas about teaching, learning, and schooling at the start of the experience. For example, we asked them Why do you believe education is important? in order to understand their views about schooling. We also asked the students to describe their best professor, such that we could gain insight into how their ideas teaching translate into practice. For a list of the remaining questions which guided the first interview see Table 4.3.

The second interview was designed to begin unearthing any relationship between experiences in the program and changes within the students’ thinking about teaching, learning and schooling. This aim is best exemplified by the following sample question: Has there been
an instance or a moment in your FOCUS experience when you felt like you have learned a lot about yourself? Schooling? Teaching? Learning? Science? Please describe that moment. The interview protocol for the 2nd interview can be found in Table 4.4.

The third interview was the most significant data source for answering both the research questions. Specifically, we asked the extended participants to reflect on their time with FOCUS and describe how their efforts within FOCUS had impacted their development, if at all. Additionally, we asked the participants to reflect on how their views about themselves as a learner had changed, if at all. The interview protocol for the final interview is found in Table 4.5. Although each of the data sources contributed to the results presented later, the relative importance of data sources for answering each of the research questions is shown in Table 4.6.

Data Analysis

The two journal entries which served as data sources were analyzed using an approach described by McCracken (1988). The five steps within this approach included 1) initial sorting of important from unimportant data 2) examination of the data for logical relationships 3) confirmatory review of initial documents; 4) description of general themes; 5) determination of how themes may be used to construct theses. The interviews were audio-taped, transcribed, and analyzed using constant comparative analysis (Glaser & Strauss, 1967). Specifically, this means each interview was analyzed using McCracken’s (1988) above outlined procedure, before the questions were developed for the subsequent interview. In this way, preliminary analysis helped determine the process of data collection. After each interview, we provided a synopsis of our interpretation of their comments to each participant for member checking (Bogden & Biklen, 2003). Additionally, at the close of data analysis, the first author emailed a summary of the
findings to each of the participants and asked for them to comment. None of the participants
challenged our interpretation of their contributions to the data or the findings from the study.

**Introduction of Extended Participants**

*Dale*

Dale (all names are pseudonyms) is a 20 year old, White, male, rising senior who
presents himself as very self assured. Obvious characteristics related to this assessment include
his being articulate, assertive, goal oriented, and motivated. He believes education is a means to
getting a good job and “being successful.” He defines success as a “comfortable living”
complete with access to good healthcare and sufficient income. He plans to attend medical
school upon graduation and then pursue a career in global health.

Dale spent the summer prior to his work in the FOCUS program in Thailand teaching
English. It was his experience in Thailand which spurred him to pursue global health rather than
a career in private practice. He was struck by the inequity of healthcare between the U.S. and
Thailand, and decided to devote his career to helping the world gain access to the quality of
healthcare available in this country. Dale, himself, described the situation as follows:

...*I went to Thailand and I volunteered at a clinic there and taught English. So I
was teaching English two days a week in a secondary school and three days a
week I was at a rural hospital. Really seeing that and seeing this barrier between
what we have here and there definitely made me for certain s what I was going to
do. So I want to go to MED school, but I really want to learn global health.
Personally I have no interest to practice here as much as go somewhere else.*
*(First Interview)*

At the time that data was being collected for this research, he was planning his summer trip to
Uganda, where he would be conducting a study with the Centers for Disease Control concerning
cost effective methods of disposing of biohazardous materials.
Dale’s background is upper middle class. His hometown is a very wealthy area northeast of Atlanta, and his high school is well known for consistently having the highest average SAT scores in Georgia. He was in gifted programs beginning in elementary school, and entered college with many course credits from Advanced Placement and Joint Enrollment courses. Dale has had many experiences working with children, and spoke often of how much he enjoys helping kids. He has worked in tutoring programs which teach reading, and he taught Sunday school in his hometown. He was especially excited about working with FOCUS because the program allows him to share his love of science with youth. The semester we collected data was Dale’s second semester with the program. He spent both semesters working with the same 5th grade class at the elementary school where he was placed.

Breanna
Breanna is a 22 year old, White, female, senior who describes her background as upper middle class. She attended private school from kindergarten until 2nd grade and then attended a public school with a “good reputation” near Augusta. Beginning in 8th grade she attended a magnet school for the fine arts.

Breanna believes education is vital in helping students discover their unique strengths and how they may use those strengths to contribute to society.

Breanna: I think it [formal education]) is important because you—I feel like we all have strengths maybe in—like certain educational areas that you don’t necessarily get to... express if you don’t get a full education – if it is not well-rounded. I think – I feel like you need to experience the full range [to] discover what is out there so that you can find out what it is you are interested in or you know what you are really good at. I think that is just important. I mean fundamentally for everyone to know that they have something to contribute, some worth something of value to society to. I mean, even if it is just to your family you have some sort of skills—you know or your friends – just something that something that somebody says you know – hey that is really great that you can do that. Something that somebody feels like is a big accomplishment or they couldn’t do that – somebody’s got to do it.
Researcher: Right. You’re uniquely gifted at a thing.

Breanna: Right. I mean it is just also self-esteem too. I feel like everyone needs to know that they have something they can do. I mean – it doesn’t really matter you know how insignificant but you know just something that –that’s their thing and they can do well. (First Interview)

Breanna is another student who has participated in FOCUS multiple times. Her first FOCUS experience was in a 1st grade classroom and the semester data was collected for this research, she was in her 2nd semester in a 5th grade classroom. When Breanna first enrolled in FOCUS, she was struggling with decisions about her career. Her major was biology, and she was confident that she no longer wanted to be a physician. During her first semester of FOCUS, she asked to meet me for coffee and she confessed she was considering a career in teaching, and felt that FOCUS had proven to be the ideal way to explore that field. Ultimately, Breanna attributes her decision to begin her Master’s degree in Early Childhood Education to her time in the FOCUS program.

Rita

Rita is a 21 year old, White, female. She is a 1st semester senior. She is majoring in Biology, and enrolled in FOCUS because she decided to become a teacher and thought FOCUS would allow for valuable learning experiences regarding teaching, especially about effective classroom management. She feels education is important to ensure a good job and a comfortable living.

Rita attended a private, Christian secondary school prior to her college work at the university. She comes from an upper middle class background. She is lively and engaging, and seemed to enjoy talking about her work in the FOCUS program and in her own studies. We were interested by her admission that she knew she wanted to be a teacher earlier than she declared her intentions to her parents and advisor. She was
hesitant to make that decision, and share it, because she felt like her parents might think she was too bright for a career in teaching.

*Rita:* Like I use to think that like it was like really important that if I graduate like with a biology degree or something I would do something like you know...it’s a hard major and I worked so hard, that I might as well do something...more people are like Oh she is really smart...you know...like I know that is stupid but I wanted people to think that....

*Researcher:* I think it is pretty common though.

*Rita:* You know like ‘she is a biology major she is a genius she should be doing a smart job’ you know. Whereas I was kind of like teaching ...a lot of people....my friends at least are like elementary ed because they just want to be a Mom so they will just do that until they graduate you know.

*Researcher:* Just to get their degree.

*Rita:* Yeah. [referencing her friends who are in an elementary education certification program] “Cause you know my parents want me to go to school, but I just want to get married and have kids. So I will just get an elementary ed degree,” and so you know it was kind of like I didn’t want to do that because that wasn’t like the smart thing to do or whatever. So that has changed and...

*Researcher:* So now by that change do you mean that you think it is okay now? To be a teacher?

*Rita:* Yeah. I’m like if that is what I want to do and I feel passionate about it, I might as well do something that I’m going to like doing instead of doing something because I think people will think I am smart for doing it...you know?...That’s kind of a stupid reason to do something for the rest of your life. *(Third Interview)*

Rita credits FOCUS with providing her with valuable lessons in teaching as well as increasing her understanding of her science content as she worked to prepare lessons for the elementary students. She credits the program with all this even though she felt her partner teacher was not strong in management or instruction. She confided that she had felt she had learned a lot about what not to do when she becomes a teacher. For example, she felt that her partner teacher was not consistent with her management plan, and Rita
credited that inconsistency with a great deal of the behavioral issues with which the
teacher was dealing. Rita claimed that from this experience, she learned that she would
be consistent with regard to behavioral management when she became a teacher. Rita
worked in a first grade classroom and at the time of data analysis, was planning to
participate in the program for the 2\textsuperscript{nd} time.

\textit{Neal}

Neal is a 22 year old, male, who is an Indian national. He participated in FOCUS
during his last semester of his senior year at the university. He plans to take one year off
after graduation and then attend medical school. Neal has a sincere love of learning,
especially in science, and he has enjoyed his university course work. He is very
articulate and perhaps more mature than most college students his age. He enrolled in
FOCUS because he thought teaching science would be fun due to the strength of his
subject matter knowledge in this area. He also said he wanted to see how the kids learned,
because he thought he might learn something to help in his own studies. He describes the
situation in the following way:

\textit{Neal: See I always think that like I ..... That it might be interesting to like teach
somebody especially if you know the subject and then it is not really that hard. So
I thought it might be good experience... I also wanted to know how the kids learn.
So like I can do something better with ...my own studying and just to see like what
methods they used in the elementary school and how they like pick up the
information that might help me in studying my other subjects. (First Interview)}

Neal attended school in India until age 15, when he and his family relocated to the
United States. He had only one year of English instruction in India, so learning the
language was his first hurdle after he began schooling in this country. Neal was amazed
by the difference between elementary instruction in the U.S. and in India. In India,
elementary school teaching felt like high school teaching in the States, because teachers were subject specific and taught exclusively through lecture.

Neal worked with a 4th grade classroom at his assigned elementary school. Prior to this experience he reported that he had felt considerable anxiety when speaking in front of his university courses, but teaching the 4th graders several times a week helped him to overcome that feeling.

*Kiesha*

Kiesha is a 21 year old, African American, female who was in her last semester of an undergraduate degree when she participated in FOCUS. She characterizes her upbringing as upper middle class in a wealthy community. She is bright, energetic, and friendly. After college, she plans to become a physician. She believes education is important for her, because she wants “a career and not just a job.” Specifically, she articulated that her work at the university was a necessary step toward her goal of attending medical school. She enrolled in FOCUS because she enjoys doing community service. She seemed to really enjoy our interviews, and her enthusiasm for her work with FOCUS was obvious in reflection sessions.

One of the most significant issues Kiesha faced in the 1st grade classroom in which she was placed was the glaring difference between the home lives of the students and her own privileged upbringing. This awakening caused Kiesha to feel that her primary role in the classroom was to serve as a role model, especially to the African American students. Consider her words from the 2nd research interview:

*Researcher:* Okay. When you are working with elementary students in FOCUS and you are doing science lessons. What are your goals for your students?

*Kiesha:* I guess my long time goals would be I want... them to have a role model. I want to be like, when they are in high school, I want them to be able say you
know I was in first grade and like, there was this teacher, Mrs. Kiesha, and she was like so excited and I really enjoyed her lessons in first grade, and because of her I decided to just see what this science is about. Like to just see if I can do it...or to just see if I can make it in college or if I can even graduate from high school or whatever. I just want to motivate them to be better. It’s pretty much my...like not just science because I do want them to get science too, because I feel like the first day I was there. The first day I was there I just...the children...were talking about their parents and they were like debating about whose dad did the word crime [both fathers were in prison]. Yeah, they freaked me out. I was like “Oh My God.” So from that I was just, like you know, I want them to get science but if they can just see that look...this girl [Kiesha] is successful and I want to be like her then that would be enough for me. (Second Interview)

She credits her experience with FOCUS with opening her eyes to a world very different than the one she was sheltered in by her parents. Specifically, she felt that she witnessed poverty for the first time and encountered racial tension among students, both of which she has no recollection of experiencing in her own education.

Nate

Nate is a 20 year old African American, male, sophomore. He plans on pursuing a career in medicine. He is polite and articulate. His father is an emergency room physician and his mother is nurse who now owns a medical supply store. Nate describes his family’s lifestyle as very comfortable. Nate believes education is necessary for getting a good job and ensuring the comfortable living he enjoys with his family, and he says he just wants to keep learning.

Nate enrolled in FOCUS, because he felt he needed to be doing community service, and he heard a classmate talk about her experience with the program. As he spoke about his reasons for participating, we inferred that he viewed community service experience as necessary for his application to medical school, though he never said as much.

Researcher: So the first question is: Why did you decide to participate in Focus?
Nate: Well I just figured like I haven’t really done a lot of community service kind of things... and I really need to do something.

Researcher: So why did you feel like you needed to do something in the community?

Nate: Because I haven’t been involved at all and I really need to be. (First Interview)

Nate attended public school when he was young, but his secondary schooling was private. He was surprised at the level of activity involved in science instruction in the 3rd grade classroom in which he was placed. He remembers science instruction from his own schooling experience as involving reading, sitting quietly, and answering the section review questions. Nate credits FOCUS with improving his presentation skills and refreshing his science content knowledge. Nate was continually surprised at his own influence over the elementary students, and he liked the way they responded to him and thought he was “cool”. As I am writing, Nate is registered to participate in FOCUS again. He has asked for and has been requested by his former partner teacher.

**Results and Discussion**

In this section, we will present the results from this research effort. At its conclusion, a summary section will provide a synthesis of these different results as well as implications for future service learning practice and research. The data analysis revealed that FOCUS participants had a variety of learning outcomes as a result of their experiences and that this learning occurred within three domains. These domains are labeled as science content knowledge, learning processes, and schooling and society and will be discussed separately in the following sections.
FOCUS Students Learn Science Content

Nearly every student who participated in FOCUS reported learning science content as they prepared to teach science to their elementary students. In most cases this was, more correctly, “re-learning.” At its outset, we did not expect that this program would result in significant science learning on the part of the college students who participated. Conventional wisdom holds that college students would have mastered elementary science topics well before entering their science major. Yet, we found that students increased their knowledge of science content in two ways. First, the FOCUS participants often taught topics for which they did not recall having had formal instruction. Second, and somewhat related to this first issue, those individuals in FOCUS came to reevaluate what they believed it meant to possess mastery of a science concept. The first issue, no formal instruction, is illustrated by situation described by Rita. She described how her lessons in earth science required her to learn about the types of clouds:

Researcher: …Has there been an instance or moment when you felt like you learned about…something about science that you didn’t know?

Rita: I didn’t know the three types of clouds and Mrs. Smith sent me an e-mail. “We are going to talk about clouds and we are going to talk about how they are made by rain and stuff like that”, and she was like “Can you talk about the types of clouds?”. And I went “There are types of clouds? Like white or gray?” I mean I didn’t know, and so yeah….

Researcher: Have you ever learned that before do you think?

Rita: Not that I could remember, no. So I’m like well good then they’re learning it in the first grade and I’m learning it when I am twenty-one. We will learn it together. Good. (Second Interview)

Others had similar incidents. Breanna had experience teaching 1st grade and 5th grade in her time with FOCUS, and she stressed that working with the elementary students challenged her to learn
content. She was continually surprised that she was unable to answer questions from the elementary students. She believed the questions the elementary students were posing were “basic” questions, and that being a science major she should know the answers. She offers an example involving earth science content.

Researcher: Has there been an incident or a moment in this experience where you feel like you have learned... science content?

Breanna: Well, I guess... like every semester I come across information that should be really basic.

Researcher: That you felt like you should know it?

Breanna: Right, and it has actually caused me to sit down and learn it. Maybe even more so in first grade than in fifth grade [referring to the grade in which she was placed during FOCUS].

Researcher: Can you give me an example?

Breanna: Yeah. Clouds. A lot of like weather. We did a lot of weather when I was in the first grade class. You know...Why does it rain? Why does it snow? What is hail? Kind of simple questions, but man, I didn’t know the answer.

(Second Interview)

These comments by Breanna and Rita are representative of the students who taught content with which they were unfamiliar. It is not surprising that this interface with material led to their learning science content. Naturally, when a student interacts with concepts in science for the first time (at least that they remember) learning will occur. This is a desirable outcome of the program, and though we were pleased to discover it, it is not this means to learning science content which most encouraged us regarding the capacity of the program to influence the participants’ university based learning. Rather, we were most encouraged by the students who described reconsidering their own level of mastery in their current science major as a result of their lesson preparation and delivery to the elementary students. For example, Duane, a first time
FOCUS participant and biology major, commented in his final journal entry about how this experience cemented his content knowledge in areas of biology as a result of his preparation of lessons and struggling to answer questions from 5th grade students.

*I’ve written a lot about learning so far, but I don’t think I’ve mentioned that I learned a ton about science in this class, too. Like we’ve said before in class, having a fifth grade knowledge of life and all its facets can be quite useful. A moderately embarrassing example: I’m a biology major, and I still had to go online and re-learn the functions of Golgi bodies and endoplasmic reticulum before including them in my cell activities. I also had to seek the wisdom of my physiology textbook when Erin and Corinne [elementary school students] gave me the Spanish inquisition on the various diseases caused by liver malfunction as we went over the different body systems. (Duane, final journal entry)\n
Duane’s journal entry provided an illustration of the type of significant realization many of these students had as they were teaching science during FOCUS. Duane realized that despite successful completion of a college course on cellular structure and function, that his learning was constrained to the context of the college course. In other words when it was time for Duane to use that knowledge in a setting not affiliated with the university he found the challenge to be difficult and not at all in keeping with his original acquisition. He was disconcerted by this, and even a bit embarrassed to admit it in his journal entry. But as was true for many students how came to this type of realization, Duane reported feeling that just as he confronted his deficiency, through preparation and delivery of lessons, he began to correct it. In general for FOCUS students, this happens as they look at the content through the lens of a teacher, rather than that of a student, and recognize that their own proficiency with the science content should be reflective of their expectations for the learning of the elementary students with whom they work.

For example, Neal commented that he found preparing for lessons really amounted to effective studying. It was not studying in an effort to increase rote learning,
but rather studying in an effort to reach a truly conceptual understanding of material; the kind of understanding he hoped the elementary students who he was teaching might reach. He later recognized this lesson preparation as an effective study method for his Medical College Admission Test (MCAT).

Researcher: Okay. You mentioned circuits already, something that you brushed on and you were teaching it. Was there anything else ... you sort of ... felt like you refreshed your own learning?

Neal: This semester like we covered those four topics and that’s... sound, electricity, circuit and magnetism and light.

Researcher: Okay. So you had a physics semester. Okay.

Neal: Yes. Once like when you are studying for a test you are, like, more stressed out by... doing bad on the test and not actually focusing on the material, but how you would do on the test.... You are actually like when you are trying to study something to teach somebody you are actually focused on like learning the material really well, so you can explain to somebody. ... you are actually focusing ... really concentrating on the material. That is what is different.

Researcher: Almost because you try to anticipate questions.

Neal: Yeah, like you are actually forming the question that the student might ask to you and have you answer them at the same time. So that is like a way of studying. (Third Interview)

Although when this program originated, we did not foresee that science content learning would be a significant outcome, here we have described two mechanisms which did result in increased and improved science content knowledge as reported by the students participating in FOCUS. First, students encountered some science concepts for the first time as they taught lessons in the elementary school. As a result of the subsequent preparation to teach these science concepts, the students increased their content knowledge. Second, and most pertinent to our interest in understanding how this service-learning program impacts academic learning, is the deeper level of
comprehension in science content that FOCUS participants report achieving as a result of their efforts in science teaching. The teaching in which our FOCUS students are engaged equates to an effective form of studying as described by Neal. Each week, FOCUS students are learning or relearning science concepts in preparation to teach their elementary students. They are not learning these concepts in an effort to correctly answer multiple-choice or matching questions on an exam, but rather are learning such that they can effectively explain and often demonstrate via some hands-on activity, the concepts to a classroom of curious elementary students and respond adequately to the challenging questions the elementary school students might ask.

This novel way of interfacing with science material may best be understood when presented within the framework of the learning styles offered by Vermunt (1998). These four learning styles, which emerged from Vermunt’s (1998) analysis of multiple administrations of the ILS, he termed Undirected, Meaning Directed, Reproduction Directed, and Application Directed. These learning styles are based on a synthesis of self-report data along 4 components of learning; namely, cognitive processing strategies, metacognitive regulation, mental models of learning, and learning orientations. The meaning directed learning style is characterized by self regulation, sophisticated processing of material (i.e. relating and structuring new content rather than memorizing and rehearsing material to be learned), a personal interest in learning (rather than learning for the sake of the degree or test score), and the belief on the part of the learner that knowledge is constructed within an individual rather than existing in the external world (Vermunt, 1998).
In the instance of the FOCUS participants, we have seen a shift in how students approached learning science content. Specifically, the processing strategies they employed became more sophisticated as they began to graduate from strategies focused on memorization and rehearsal to those which would help them develop a meaningful conceptual framework which they could share with their students. Additionally, with regard to learning orientations, the students matured in that rather than studying the content they were teaching to secure a good grade on a test, they were learning material because they desired to teach it and teach it well. These desires represent one manifestation of a more personal approach to learning. Perhaps most notable, was that students’ realized that just because they had earned a good grade in a science course, that it did not mean they had really mastered the material. In terms of regulation, this is significant because it translates to the learner (in this case, the college student) taking responsibility for determining when satisfactory learning had taken place, independent from the assessments of the teacher or textbook. On the ILS, this aspect of self regulation is measured using the self regulation of learning processes and results subscale, and it is a significant component of Vermunt’s (1998) “meaning directed” learning style. These changes in processing strategies, learning orientation, and regulation taken together indicate FOCUS students’ approaches to learning progressed toward a more meaning directed learning style in the context of this experience. This is important, because this learning style has been linked with greater academic achievement (Boyle, Duffy, & Dunleavy, 2003; Vermunt, 1998).

Much has been written about the importance of service learning activities being closely tied to academic course material (National Commission on Service Learning,
In designing the FOCUS experience, this goal seemed unrealistic; this course stands alone and is not specifically tied to a content course. Yet, there were gains with regard to science subject matter knowledge. In light of the self report of advances in science knowledge for FOCUS participants as shown in journals and interviews, it seems there is real value in working in the role of a teacher with elementary science content. The FOCUS students work to prepare thorough lessons and respond to challenging questions from elementary students they teach, and in so doing come to new understandings of their college course work.

**FOCUS Students Develop Metacognitive Awareness**

Nearly all the FOCUS students reported coming to new understandings of learning processes and the highly personal nature of learning styles. Several were surprised to find that the elementary students for whom they prepared lessons did not approach the material as they predicted. This awareness demonstrated gains in both knowledge of cognition and regulation of cognition, the two main tenets of metacognition (Schraw, 1998). Sometimes this awareness pertained to their cognition, and sometimes to the cognition of the students with whom they worked. For example, one FOCUS student described trying to teach an elementary student about multiplication, and having to progress through a series of methods of instruction to help her understand.

*My own experience that sticks out the most in my head was when I helped a first grader with her math class work. I took this student into the hallway and I helped her finish her multiplication class work. First I asked her to explain to me how she would solve the problem and she struggled to do so. She actually was kind of lost and didn’t know what to do, so I knew I was going to have to teach her. I begin with the simple direct approach of showing her how to multiply the numbers in her head and write down the correct numbers, but she had a hard time with this. I then drew pictures of the items that were discussed in the problems and showed how multiplication affected the final outcome; again she had a hard time comprehending this. Finally, I used my hands as physical examples of the*
items and showed her how multiplication affected the amount of fingers I would hold up. She caught on to this and used her hands and was able to answer the questions on her own with a little of my assistance. I learned that each student has a best way of learning that clicks the most with them. There are many approaches that can be taken and many can be incorporated into the same lesson plan in order to reach as many students as possible. (Anthony, final journal)

This type of experience was nearly universally reported by this class of FOCUS participants, and seems like an insignificant learning outcome of the program. Yet, during interviews with extended participants, it became clear that this realization was an important first step for some of the participants, in that this realization of the individual nature of learning styles led some to become introspective of their own approaches to learning. A few of the extended participants found that this introspection resulted in better understanding of their learning style. For example, Rita described how she began to understand that the way she wanted to teach the 1st graders with whom she worked was reflective of her preferred learning style. Consider this interchange between Rita and the researcher:

Researcher: Has there been an incidence or moment in this experience so far where you’ve felt like you have learned a lot about learning?

Rita: Yes…I think just through it all I’ve been….I think that it is interesting to see that the way…I talked to Mrs. Kimball about this one time. That I have had to realize that the way I teach…like the way I want to teach something is the way that I would like to learn them. Like I’m more of a visual person, I like to see things written down. …But I found that the way that people teach and the way that reflects a lot on the way that they like to learn. Like normally you present your ideas to others reflects a lot on the way you would like ideas presented to you. (Interview2).

Breanna also reported examples of introspection about her own learning as she prepared and delivered lessons to the 5th grade class with which she was paired. Her reflection shows that she made a connection between the teaching she engaged in the elementary school and her learning in university coursework. Specifically, she felt that the elementary students needed to understand the “big picture” about the material they
were presented in science, rather than focus on memorizing lists of details, just as her professors needed to foster a more conceptual approach to learning. In this account, she made a clear link between her experiences teaching elementary science and the appreciation of one of her professor’s tactics.

Researcher: Okay. Was there an instance or a moment in the experience where you felt like you have learned a lot about learning?

Breanna: Yes. I guess when I am teaching something I try to like formulate a big picture.... I guess you take for granted that you had to learn the smaller pieces and get that before you could have the big picture, and so when I’m learning something or even when I’m teaching something you know... you know you have to understand it in terms of the big picture but then you know to help somebody else learn it you’ve got to get all the little bits and pieces...you know...break it down so that you can really get it and that’s something...since the last interview I have a new developmental [referring to her developmental biology class] professor and that’s something that he does a lot more...is kind of break stuff down. .... He kind of....well he kind of helps....you know sort of pulls it together, but the other teacher it wasn’t clear what she was saying. Most of the time she [referring to her developmental biology professor from the first part of the semester] would just have these little details on something...who knows what...it meant all together (Interview #2)

Rita and Breanna both exhibit an emerging awareness of their preferred learning processes as a result of their teaching experiences. Breanna took this awareness one step further in that this new awareness led her to modify her own learning practices in her college course work. She describes how she began to try to put her professor’s words into her own, so that she could reach a “big picture” understanding of the content.

Being in this program has helped me to better understand my own learning. I came to fully appreciate knowing details and being able to piece them together in the big picture. When themes or details are left out of a lecture, I tend to notice more often now. In the classroom, I saw that my word choice as a teacher is important. I began to realize that putting ideas into my own words is important for me to understand lecture material, as it is for my students. So in my own classes, I began to put ideas in simpler terms or altogether reword them myself if the professor’s word choice did not suit me best. I have also become more conscious of the relative importance of lecture material. Now I am a little
better at deciding which material is most likely to be tested in great detail. Some types of information are easy targets for studying, but that does not necessarily mean that that information will be heavily emphasized on a test (Breanna, Final Journal Entry).

Other students also expressed that their experiences with FOCUS impacted the way they thought about and behaved in their university courses. Breanna conveyed that she was better able to understand the relative importance of elements of course material and that she began altering her activities in her university coursework to match those she recommended the elementary students use. Additionally, Breanna made clear connections between her teaching and that of the university professors. Another FOCUS student, Carrie, made a similar connection between her learning through FOCUS and her appreciation of an anatomy professor’s teaching methods. Consider this excerpt from Carrie’s final journal entry:

Participation in FOCUS has influenced my own studies. It has influenced my work, but it has primarily changed my thought process behind doing work; in other words, it gave me a better attitude. For example, my anatomy class has been one of the more intense classes I have had here at UGA. I never understood why Dr. Wall did not just test us, but she had us write case studies, and answer quiz questions in class daily; these activities seemed like busywork and it seemed like a ridiculous workload. When I was writing one of my journals, I read a little bit about active learning, and I realized that Dr. Wall is not trying to make my life miserable, she was employing almost every form of active learning. Because anatomy is a hard class with lots of minute details to absorb, Dr. Wall was trying to get me to learn the information in many different ways. She wanted me to understand the material and not just memorize it. In order to do that, she makes me write about the information I was presented and take interactive quizzes. In doing this she is engaging different parts of my mind and intriguing different interests so that hopefully I will be able to grasp the information more fully…It represents a pretty big turn-around in the way that I have viewed my schoolwork. (Carrie, final journal entry)

Carrie’s comments in her final journal entry are representative of the awareness of learning processes and strategies that many of the FOCUS students reported developing
as a result of their teaching. In her final journal entry, it is evident that Carrie has changed
with regard to her understanding of the motives driving her professor’s methodology.
This new understanding stemmed from Carrie’s independent inquiry into theories of
learning which she pursued as a result of her desire to prepare effective lessons for the
elementary students. The quotes from these three individuals show a progression of
understanding with regard to what is involved in an effective teaching process. They also
demonstrate differing levels of influence this awareness has on their own learning
approaches.

Neal, one of the extended participants in our study, described very clearly how he
felt teaching science to elementary students had the capacity to influence in his own
efforts in learning in his university coursework. Specifically, he described how teaching
the elementary students made him aware of strategies he could use in his own learning,
especially areas of science or other disciplines which were difficult for him.

Researcher: [Can you provide] an instance where ... you came to a new
understanding to what it means to learn something; in your own learning, the kids
learning, any of these are okay.

Neal: Yes. ...I was able to realize how I learned differently from them
[elementary students] now. I never think about science as a difficult subject for
me, because it has always been easy for me, but like I learned for some of the
students it is really hard to get some concept of science. They are not able to see
what I can see or how....like for me it’s like it has always been easier. So I never
thought about the learning process itself, but now I have. I have learned some
strategies like....like if I had a hard subject....if I had to learn something new
beside science then I would be able to apply the skills that I actually learned or
actually watch these kids apply in their own learning. So I will be able to use
those skills...those same skills to try to learn something different or something
harder in science that I don’t understand....Like there are some sciences that are
really easy for me, but when I have to study history or something I just can’t do it.
It’s like a difficult part. And classes like that I can use my knowledge that I
actually learned from the FOCUS students, the elementary students, so I can use
those skills in my classes for history of philosophy or something...
Researcher: What kind of skills do you see them using?

Neal: Okay. First of all, like some students...go through the basic text of like finding the vocabulary word and then the repetitions of the same word and stuff like that to get the better....or just memorize it or something like that, that I often don’t do because I get it, because I understand the science part like really well, but they spend so much time reading things over and over different ways. To me that was a better skill. I mean like Mr. Rogers, for example, in math, first they ... define the vocabulary that are in the book and just read what that short paragraph in the text book and then they do some of the problems in the book, and then Mr. Rogers would do some of the problems and they will work on it as a group and that way, and also Mr. Rogers will explain what the different things that can apply it.

Researcher: So then you might use a similar strategy when you are trying to teach yourself history or something else, or a subject that you don’t have an affinity for. Like you do for science?

Neal: Yes. (Second Interview)

This type of metacognitive learning was experienced in varying degrees by the participants. It is identified as metacognition because students explicitly describe coming to new understandings of cognition including strategies which can be used to regulate it. Recognition of these aspects of their learning does have the potential to be a significant learning outcome in that for some FOCUS students it impacted the learning processes in their university course work. For instance, nearly all of the students became aware of multiple ways of learning information and acknowledged that the students for whom they prepared lessons were using different strategies than they themselves employed.

This new awareness demonstrated growth in two areas of metacognition described by Kuhn (1999). Specifically, students engaged in meta-strategic metaknowing, because they became aware of their ability to consider, use, and adapt learning strategies, in addition to examining what he/she knows and how he/she knows it (i.e., meta knowing). These types of metacognition became evident in Breanna, Rita, Carrie, and Neal, as they
began to rethink their approaches to learning in the courses they were taking as students, because of their experiences teaching science. This is significant within this study because metacognitive skill has been linked with greater academic achievement and deep learning outcomes, (Everson & Tobias, 1998; Schraw, 1998; Vermunt, 1998). The accomplishment of metacognition is also a component of a meaning-directed learning style (Vermunt, 1998). Those individuals who pursue a “meaning-directed” learning style are those who seek to understand rather than simply acquire knowledge as a result of formal educational environments. Understanding is a primary learning goal to which most educational institutions aspire. And further, the accomplishment of aspects of metacognition by FOCUS participants provides evidence of the potential of this service-learning program to connect community service learning with meaningful development in metacognitive awareness.

FOCUS Students Critically Consider Issues of Schooling and Society

For these FOCUS students, the experience of working both with a teacher and as a teacher was the first time they’ve viewed formal education from a perspective other than a student’s. It is important to note that FOCUS students represent the most successful university students and the students who typically come from affluent backgrounds. As such, the elementary classrooms within which they are placed are very different from what they remember about their own elementary schooling experience. The county within which they work has a high rate of free and reduced lunch (67%) and a drop out rate of 35.6% (Governor’s Office of Student Achievement, 2006). It is not surprising then, that the FOCUS participants were taken aback by issues pertaining to schooling and society. Specifically, as a result of their participation in the program,
FOCUS students reported learning that: (1) Teaching is a difficult, undervalued profession; and (2) All children do not enjoy the life of privilege they have experienced. It is perhaps true that for the FOCUS participants these two outcomes were more related than they may, on the surface, appear. But part of what made these individuals view teaching as both difficult and undervalued derives from the educational issues which arise from working with students who have not lived a life of privilege. Following is a discussion of each of these learning outcomes.

Teaching as a Profession

Nearly all the FOCUS students reported beginning this experience with the idea that teaching science for a few hours a week would be an easy A [course grade]. They reported being amazed at the talent, patience, and dedication they witnessed in their partner teachers. For example, Duane wrote extensively about this in his final journal entry, including a “play” to articulate what he learned about teachers.

I could start this essay off by saying I learned how to be a better disciplinarian through teaching in a fifth grade classroom. I could say I learned to establish my authority from day one and was quick to reward as well as reprimand. On the subject of reward, I could say I learned the value of positive rather than negative reinforcement. I could preach the virtues of The Button System and its successor, The Money System, all day long. I could say I learned that individual attention—when it can be practically implemented—is infinitely more effective than large group learning. While all of these statements are true, none of them adequately answer the question of how I learned the most about teaching.

The most important thing I learned about teaching had nothing at all to do with the word in its verb form. Rather, what I learned most about teaching has to do with what it means to be a teacher, or a person with the weighty responsibility of shaping the young minds of the world. Before I figure out how to state it clearly, I’ll relate how all this came up in conversation through the medium of a brief one-act play:

ACT 1, SCENE 1.
[Duane and Jean, the teacher, are seated at the latter’s desk in a classroom full of students. Jean has been sneezing fitfully all day.]
DUANE: Are you feeling okay, Jean?
JEAN: Not really. I was in bed with a fever last night. I think the boyfriend got me sick this weekend.
DUANE: Don’t you think you should take a day off?
JEAN: Believe me, I’d love to. But I can’t.
DUANE: Why not? Aren’t you allowed a certain number of sick days?
JEAN (pointing to Jasmine Kelly): That one right there. That’s why I have to be here today.
DUANE: I don’t follow you…
JEAN: What’s she going to do if I’m not here? She won’t learn anything, that’s for sure. She needs me. Most of these kids need me. Maybe not Erin or Jane or Jimmy, but most of these kids need me here today.

So that’s what I learned most about teaching. You don’t devote your life to it because it’s just another job. You certainly don’t do it for the money, either. You do it because the kids need you. If not you, then who? Someone less loving and less qualified? We should remind ourselves of this when we have our own kids to put through school. Teachers are needed. Teaching isn’t about a transfer of information; it’s about playing a significant part in the development of a human being. (Duane, final journal entry)

Duane’s comments specifically addressed the dedication of teachers to their students. And his comments were not unique; many others made similar statements, though usually lacking the theatrical component. Other FOCUS students commented on the difficulty of successfully teaching elementary students about the subject matter of science. Consider this entry in which a FOCUS student described his transformed perceptions of the teaching profession.

This has been one of the most valuable experiences I have had in my college career. I used to have the impression that those who can’t do, teach. I am now regretting that I ever thought that, I actually feel like I am the one who can’t do. Teachers need to be respected more and education needs a closer look by everyone, because it is so important. ...I was able to critical (sic) analyze students’ behaviors and educational materials, which I enjoyed because I like to devise my own opinion about things that go on around me. I got to see how hard it is to be a great teacher and all the mess that comes with the job title that they didn’t ask for. (Anthony, Final Journal)

Anthony’s statement shows evidence of both analysis and growth within his ideas. He regrets feeling as he did about teaching (e.g., being a career for individuals who could not
do other things), but he also began to analyze the events he witnessed and use this analysis to understand how difficult it would be to become very accomplished at teaching.

Collectively this was also an issue across the group of FOCUS participants. In one of the weekly reflection sessions, the students questioned why teaching as a profession gets such little respect. We compared careers in teaching to careers in medicine, and talked about the professionalization of teaching movement. One student, Ashley, commented on how that conversation coupled with her experience in the elementary school classroom changed her view of the profession of teaching.

This has most definitely been a valuable experience for me. Other than falling in love with every kid that I had, I gained so much more respect for teachers. In high school, I thought that being a teacher was the easiest thing in the world, but boy was a wrong! I never knew the behind the scenes things that all the teachers had to go through. They are very, very hard workers and are very unappreciated. If I could go back and see all my old teachers again, I think that I would hug every one of them and tell them “thank you” for putting up with me and all my stupid friends. We said in class that teachers are not looked at the same way as doctors are, but now I think that I do look at them the same way. Doctors save lives, while teachers build them. If there were no teachers, there would be no doctors. (Ashley, Final Journal)

While the FOCUS students did begin to value teachers and the act of teaching differently, their praise for teachers was not without condition. In the excerpt from Anthony’s journal, we see that he is referring to “great teaching” as if to distinguish it from ineffective teaching. Likewise, in this excerpt from Nathan’s final journal, we see that he understands that good teaching is not a given, and that complacency is the enemy of innovative teaching.

I feel that the difficulty of the teaching profession is dependent upon the teacher. It can be an easy thing to do for some but I believe that a good teacher would always consider their position to be difficult. One has to be careful when labeling good teachers and bad teachers but I just feel that complacency can be a negative thing. In most situations teachers find themselves faced with various
complicating challenges but sometimes in the absence of direct challenges some may find that their job has become fairly routine. I attended predominantly white suburban schools kindergarten through high school and I believe that from time to time I came across teachers who had reached a plateau in their careers. Once again, not that they were bad teachers, just that I fear over time they had maybe lost some passion. (Nathan, Final Journal)

Very few of the students enrolled in FOCUS were planning to become teachers at the start of the semester. We should mention here that unintentionally, this program has served as a notable tool for teacher recruitment in that each semester between 15%-20% of the student participants decide to pursue teaching as a career, and begin taking steps in that direction, such as applying to certification programs or graduate programs in education. Even those students who didn’t decide to pursue teaching as a career, gained valuable insight into the world of public education. This insight is important because as voters the FOCUS participants have the power to impact educational policy in a significant way. As such, this type of learning about teachers is an important outcome of this program. This learning outcome resulted from examining the profession as they became part of it during their activities with FOCUS. In that vein, this learning is not dissimilar from the learning which occurred when the FOCUS students taught science content with which they were unfamiliar. That is, the learning stems from the novelty of the experience.

Realizing their Life of Privilege

The students who participate in FOCUS typically come from affluent families. For many, this experience, or perhaps the reflective products which they produce as a result of this experience, is the first time they acknowledged the level of privilege they have enjoyed and the efforts their parent’s used to shelter them from unpleasant realities in society. For example,
Kiesha, was shocked by comments about parents serving time in jail and by one little boy’s openness about being taught about racism.

_This experience has been invaluable to me. Not only have I learned things about teaching, learning and myself, I have also learned about children and society. I believe that I have lived a pretty sheltered life, and working with some of these children has totally solidified that fact. With one of my first visits to the school, I overheard a group of children bickering over whose father when to jail for the worst crime. This was very shocking because when I was little, I remembered boasting to other children about my parents’ professions and the positive things my parents accomplished. It never once dawned on me that there were other children who were less fortunate than I. Through this experience I realized that poverty and ‘dysfunctional’ families are real, not just issues in some other world, but that they coexist in the very same world that I live in. …Another issue that I learned was still in existence, was racism. I know that it still exists, but I have never first hand experienced it. One of the children in my class was obsessed with the confederate flag. Without fail, each class period he would ask me why Black people did not like the flag or why can’t we learn about the rebel flag or General Lee. I tried to explain to him that this was science class and that that subject was irrelevant. Of course, none of this offended me, but I can only imagine the things he is being taught at home about confederacy and Black people. I just pray that no matter what he is being taught at home—or lack thereof—that he remembers ‘Ms. Kiesha’ and he will not judge a person based on ethnic background. This student never said anything negative about black people to me; he was just seeking an explanation. (Kiesha, Final Journal Entry)._ 

Indeed, in her interviews, she credited these experiences with defining how she perceived her role in the classroom. Specifically, it was listening to young African-American boys argue about whose daddy was the most dangerous that fostered Kiesha’s decision that her role should be that of an African-American role model.

_Researcher: Okay. When you are working with elementary students in FOCUS and you are doing science lessons. What are your goals for your students?_

_Kiesha: I guess my long time goals would be I want….the biggest thing….I just want them to have a role model. I want to be like when they are in high school, I want them to be able say you know I was in first grade and like there was this teacher, Mrs. Kiesha, and she was like so excited and I really enjoyed her lessons in first grade and because of her I decided to just see what this science is about. Like to just see if I can do it…or to just see if I can make it in college or if I can even graduate from high school or whatever. I just want to motivate them to be better. It’s pretty much my…..like not just science because I do want them to get_
science too, because I feel like the first day I was there. The first day I was there I just…the children like I wrote down in the journal where they were talking about their parents and they were like debating about whose dad did the worst crime.

Researcher: Oh yeah, they were in jail.

Kiesha: and I was like. What?

Researcher: You did write about that in your journal, and I was like “holy smokes”.

Kiesha: Yeah, they freaked me out. I was like Oh My God. So from that I was just like you know what I want them to get science but if they can just see that look….this girl is successful and I want to be like her then that would be enough to me. (Second Interview)

Interactions with the elementary students were the most significant influence on this type of learning. Nearly every FOCUS student reported coming to new understandings of the inequities which permeate our society as they interacted with children whose socioeconomic backgrounds were very different from their own. Ashley described getting to know one little girl and demonstrated how that relationship gave her a glimpse at a difficult childhood.

There was this one little girl who was having a rough time at home with her father and she would always say to me that she hated her life, so I took her outside for about an hour and we read all kinds of books. She did not want to play. She just wanted to read. She was having fun and not even thinking about home. When we had to go inside, she hugged me and said thank you. It was so overwhelming. Some of them do not have very good lives at home, so school is somewhere where they can do anything, and they actually like being. I learned that the small things really count in the lives of children. They do not care about money, or power, or prestige, they just want to be noticed and heard. (Ashley, final journal)

Beyond this original awareness of the differences between their own privileged childhoods and the difficult circumstances facing the elementary students with whom the worked, many FOCUS students reported that they changed in the ways they viewed aspects of society. Rita described this issue as being the most significant in all of her experiences with FOCUS in its effect on her development. She provided a very clear
contrast between the home lives of her students and the childhood she remembers, and then asserted that her new awareness of the harsh realities facing many school age children caused her to develop a lesson on personal hygiene, to compensate for what she viewed as an apparent lack of instruction in hygiene happening in one of the elementary student’s home life. Consider her statements from our last interview:

_Researcher_: Okay. Consider all of your experiences that you’ve had with the program. What do you think or has there been any effect on who you are or on your development?

_Rita_: I think that like working with a lot of the kids in my class because a lot of them are definitely from very low income families. ...Because one little boy in my class who obviously never brushes his teeth and they are just like rotting away. So I was like, I couldn’t handle it anymore and she [Rita’s partner teacher] was like at the end of the semester she was like, “Do the lesson on whatever you want.” So I did a lesson on how to brush your teeth, how to take care of your teeth. I thought maybe if I do this he will at least start thinking about it...you know. I mean my parents, even if I was like...I don’t want to brush my teeth when I was six years old. My parents would have gone like alright I will strap you to the table and I will brush your teeth for you.

_Researcher_: Right.

_Rita_: You can do it for yourself or I’ll do it for you kind of thing. But I mean...and his teeth are falling out and ...it’s so sad, but I think there are several kids in the class that are like, Like not their teeth specifically, but there are different things like you can tell that ...

_Researcher_: That they are being neglected?

_Rita_: Yeah. So I think that I learned a lot about like...especially growing up going to private school...like when you have to pay ten thousand dollars a year to go to school there, there is only a certain like a caliber of people who can go to school there kind of thing. You know...only people who have an extra ten thousand dollars a year for their kids can send them there kind of thing. ... but I know that if I was in that class, like taken out of my private school in first grade and put into this school classroom. I would have just felt like...that’s weird...you know, you need to brush your teeth...Like it’s just I know I’ve learned a lot about how your environment and your schooling really like...not only shape how you work but how your are as a person. The different kind of people you are exposed to. (Third Interview)
Rita was shocked by how different her own childhood the experiences were from the 1st graders with whom she worked. This type of realization is important for both college students and the populace as a whole. Informing citizens about inequities in our society is a logical first step toward convincing those citizens to use their agency (perhaps their vote, or their occupation) to improve the status quo. Indeed, Kiesha, wanted her presence to help level the playing field for the elementary students with whom she worked by providing them with a successful African-American role model. Ashley wanted to provide one of her students with much needed attention that the little girl wasn’t receiving at home. Ashley even spoke of the need for school to be a place where students can accomplish anything. Rita best exemplified how this new awareness of social inequity within the public school changed her mind about her obligations as a teacher. Specifically, she commented that she had planned on a teaching career in private education, but after seeing how needed she was in public education, she felt that she would pursue a teaching career in a public school setting, and furthermore, that she felt an obligation when she became a parent to send her to children to public schools so that her children would not be unaware for the stratified nature of our society with regard to socioeconomic status. Ultimately, this indicated that though Rita came from a privileged background, during her experience in FOCUS she realized that her surroundings had led her to believe an illusion about the conditions of the majority of our society’s children. As a result, she made the decision not to subject her own children to that same illusion.

Anna: Okay. Is there anything else that you want to tell me about how you think working with this program has affected you?

Rita: Well this was one of the things. When I first started thinking about teaching, I wanted to teach in a private school and now I like look at it and I’m like the way I learned ...I was so limited in my like exposure...like what I do...who I knew...like the type of people. So I think I now definitely want to teach in a public school, and not like a public school in North Metro Atlanta you know
where it is all still like… I feel like even in Atlanta, North Atlanta it is very… One type of people go to school there… so, I would like to teach somewhere like in [the county where she participated in FOCUS] or something like where there are... different types of people and students.

Anna: One day if you have kids, where are you going to send your kids? Public or Private School?

Rita: Yeah. Right now, I say that ... like I’m pretty sure about that... like I just... I grew up thinking that I was going to get a car for my sixteenth birthday and because all of my friends got a car for their sixteenth birthday and you know everybody lived in nice houses. Because it was what I knew, and I want my kids to realize that regardless of what size of spectrum my kids are, I want them to know that there are people that aren’t in that spectrum. Because I feel like, especially in private education... like it represents only one type of people. ... Your friends are from school because they are the people that you play sports with; they are the people that you are with all day, and so and then maybe also other people who are in your neighborhood. But usually those people are in like the same socioeconomic status that you are because they live next door to you and most of those kind of neighborhoods like houses are similar and stuff like that. So I definitely want to send my kids to public schools. (Third Interview)

The learning the FOCUS students experienced with regard to realizing their life of privilege can be understood when viewed through a cognitive map offered by Rockquemore and Shaffer (2000). They described a stage theory of engagement through which students progressed as participants in service-learning activities. The first stage, termed Shock, is the stage in which students began to understand the differences between their sheltered perceptions of reality and the lives of real or marginalized people of the world (Rockquemore & Shaffer, 2000). Our students began their learning about this other reality as they acknowledged the glaring differences between their life of privilege and the lives of the students with whom they work. Kiesha, Ashley, and Rita all described noticing these differences and being shocked by their presence. “This shock stage of service-learning is important because it provides a sharp emotional and psychological jolt to students’ perceptions of reality” (Rockquemore & Shaffer, 2000, p. 16).
The second stage of engagement, which is important to the process of learning through service-learning, Rockquemore and Shaffer (2000) termed Normalization. During this stage of learning, service-learning participants become comfortable within their role in the community placement and understand that the marginalized individuals are not unlike themselves, and that their difficulties are largely products of a disadvantaged upbringing. Ashley, Kiesha, and Rita each describe recognizing and embracing their role within their assigned classroom. Ashley felt her role was to provide students with opportunities to rise above their unfortunate home experiences within school. She wanted to make school a place where anything was possible for these students. Kiesha realized her role was to provide a strong, African-American role model for the children with whom she worked. Rita claimed as her role, using curriculum to compensate for inequities in the home lives of children.

Rockquemore and Shaffer (2000) offered a third and final stage within their cognitive map, namely, Engagement. During this stage service-learning participants began to ask the hard “how” and “why” questions about the inequities they have witnessed in the community. Specifically, during this stage, the learner makes attributions about what they are seeing. They either decide that the marginalization of the disadvantaged groups is a result of a deficiency within the individual (perhaps they are lazy or not talented) or a result of a deficiency within the structure of society which perpetuates the status quo (Rockquemore & Shaffer, 2000). The FOCUS students, with respect to the elementary school children with whom they worked, recognized that the children were not to blame for their difficulties, and realized that an important part of their function in the school setting was to construct a school experience which was
liberatory from oppression, rather than allowing the school experience to be a perpetuating influence with regard to their state of disenfranchisement.

Summary

The findings from this qualitative investigation of the impact of FOCUS on the college student participants ultimately points toward the three issues described in the preceding sections. First, FOCUS impacted these college students by making them aware of deficiencies in their science knowledge. Each of the participants discussed in this section had a strong formal education in a science area. But each found that they had deficiencies when it came to relating this science knowledge to elementary school students. Each of the findings (science content, metacognitive awareness, schooling and society) we presented here were evident as significant learning outcomes stemming from the FOCUS experience. Yet, we realize that the magnitude of the learning was very different for each student. Next in this manuscript, we will describe the differences we encountered with regard to the personal nature of these learning outcomes. Then we will close our manuscript with a discussion of implications we believe our study warrants in the field of service-learning.

Conclusions and Implications

For the most part, all of the FOCUS participants in this research reported that teaching science helped them develop new understandings of science subject matter content and in some cases caused them to learn science that they had not studied previously. Similarly, nearly all students reported gaining new respect for the teaching profession. Most reported making an effort to find or even construct different learning strategies as they prepared and delivered lessons to the elementary students. Finally, the FOCUS participants recognized their own life of
privilege and how it positioned them to be successful as compared to many of the students with whom they worked. Specifically, these individuals came to understand that the lives of students can vary greatly from their own, and that for some of these students, their lives at home provide a very significant hindrance to their likelihood of being able to successfully move through the public school system.

Even though these learning outcomes seemed universal, we noticed that students internalized the experiences in varying degrees. For example, while nearly every FOCUS participant reported becoming aware of different learning strategies, only a select few detailed how this new understanding significantly altered their own learning strategies. These students, Rita, Breanna, and Neal were all clear that their experiences with FOCUS impacted their own studies in meaningful ways. And yet, other students, though exposed to similar experiences within a formal learning environment, did not connect that exposure to their learning within their university course work.

These findings beg the question “Why did some participants exhibit deeper learning outcomes than others?” The answer, we argue, lies within the perspective of the service-learning participant when he/she began the program. Rita and Breanna enrolled in FOCUS because they wanted to be teachers. The both stated that they felt participation in this program would be a valuable way to study the processes of teaching and learning to inform their own practice as future teachers. Neal also approached FOCUS as a student of education in the U.S. He wanted to know how elementary students experience schooling in this country, and what learning involved for them. With regard to the goals that they had for participating in FOCUS, these three students approached this experience as learners. Dale approached his FOCUS participation already in the Engagement stage outlined by Rockquemore and Shaffer (2000). His
experiences in Tunisia contributed to his considerable maturity with regard to understanding societal inequity. While he did feel that teaching science refreshed his content knowledge, he was very clear that he believed his own learning style was “very advanced” and thus, he was certain he did not learn about learning from his teaching efforts. His perspective was unique and though he was selected as an extended participant, he didn’t contribute to answering our research questions simply because he was so atypical from the other FOCUS students.

Others approached FOCUS as service providers, and were also not expecting to learn substantively with regard to either science or their own learning. As such, they were exposed to circumstances very different from their own and they did learn from these circumstances, but these individuals did not internalize this learning in ways comparable to those who participated in FOCUS because they wanted to learn. Nate is perhaps the best example of this “service provider” perspective. He was clear from the start that he enrolled in FOCUS because “he needed to do some community service” and not because he hoped to experience significant learning outcomes. In interviews with Nate, as well as within his journal entries, we found that while he enjoyed his time with FOCUS, and learning did occur, he failed to internalize the experience such that his learning resulted in change within his views of society or his learning processes.

Kiesha, at the start of this experience, seemed to also be FOCUS participant strictly involved to provide service. She enrolled in FOCUS because her participation would look great on her applications to medical school. Yet, early in the semester, she witnessed a situation which changed her perspective as a participant in the course for the remainder of her time with FOCUS. When Kiesha witnessed the young African-American boys in their argument about their fathers and their respective capabilities with regard to “being dangerous,” she became personally
connected to the experience as a learner. It was that moment that she realized she could learn substantively from the program about issues in schooling and society, and thereby, went on to do just that. This profound personalization never materialized for Nate.

The findings from our study are consistent with those of Sperling, Wang, Kelly, and Hritsuk (2003) who found that participants’ individual characteristics and reasons for doing service learning were the most significant mitigating factor with regard to learning outcomes. Specifically, the students with the “charity” perspective, who approached the experience intent on serving, exhibited more shallow learning outcomes than those who approached the service-learning activity intent on learning from it.

We must be clear that service learning was still a good experience for Nate. He refreshed his content knowledge, and he became aware of other learning strategies and harsh realities facing marginalized youth, all while performing a valuable service in his assigned classroom. His accomplishment was linked to two issues. First, he was a conscientious participant in FOCUS. Second, in the absence of prior teaching experience, Nate gained a perspective and thus had a different learning experience than in his daily university life. The elementary school in which he served was quite different from the one for which he has memories. The experience would not have been as effective, even for Nate, had he returned to the school he remembered. The learning outcomes did not shake the foundation of his approach to learning, and thus these outcomes were not as significant as those for others. Service-learning experiences should accomplish optimal service and maximal learning.

Our findings indicated that the perspectives of the learners, whether the FOCUS participant came to the experience seeking to be a service provider or a learner, are important in the development of the learning outcomes, or those learning outcomes which are transformative
in that they lead the FOCUS students to change. Korthagen (2001) articulated the problem of change within education. He argued that there are two very different ways we can use the word change as a verb in an educational context. The transitive use, as in “I wish to change this teacher/student,” implies external pressure on the individual doing the changing. Conversely, the intransitive use of the verb, as in “Student A changes,” implies a very self-directed or internally regulated effort on the part of the individual doing the changing (Korthagen, 2001). His model focused on change in the context of teacher education, and he argued that a real change in an individual can only take place when it is truly desired by him or her. With regard to FOCUS, we have seen students change with regard to how they perceive their own learning takes place as well as with regard to their understanding about societal inequality, and these changes occur by their own volition, and are not coerced by the instructors.

In this study with regard to the service perspective of the participants, we believe we are seeing different levels of readiness to learn from the experience. Dale, for instance, gained an affirmation of his previous learning, but he is an outlier. Breanna and Neal view the service learning as if they were apprentices because they were planning a career in teaching. Nate and Kiesha enrolled in the program primarily to perform a service rather than to learn. And yet Kiesha was able to become a student of the experience due to an incident that propelled her to look at the experience from a new perspective.

Most significant among the implications is that instructors of service-learning must be cognizant of the readiness of each of their service learning participants and thus provide opportunities for them to proceed to the next level of accomplishment. For Kiesha, this was a discrepant event as she went to the school expecting to find one context in which these experiences would take place, and in fact she found something quite different, and so the
opportunity to become a learner appeared in the location where she was placed. Yet, for others, like Nate, such a discrepant event did not occur, so it is important that the instructors foster the change in perspective of the participant such that learning can be optimized. Next, we describe our final implication regarding this idea.

Key to maximizing the learning outcomes of this service-learning experience may be helping the FOCUS participants realize their experience in the schools affords them the opportunity to achieve significant learning outcomes. In other words, we argue that our study calls for explicit discussion with service-learning students about the goals for the learning component of the service-learning experience. For example, within FOCUS, we now explicitly talk with students during the first reflection session about the types of learning we hope they experience during the program. Thus far, it seems this discussion encourages students to view the experience from the perspective of a learner and not just a server, as evidenced by their depth of reflection and introspection in journals.
<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Holidays</th>
<th>Journal</th>
<th>Reflection</th>
<th>Teacher Eval</th>
<th>Notes and Reminders</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1/9-</td>
<td></td>
<td></td>
<td>Getting to Know You-Syllabus, etc</td>
<td></td>
<td></td>
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<td></td>
<td>1/13</td>
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<tr>
<td>2</td>
<td>1/16-</td>
<td>1/16—MLK Day</td>
<td></td>
<td>Getting them to listen and to learn! Crash Course in Classroom Management</td>
<td></td>
<td>Initiate contact with your teacher</td>
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<td></td>
<td>1/20</td>
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<tr>
<td>3</td>
<td>1/23-</td>
<td></td>
<td></td>
<td>Sample Inquiry Lessons and Introduction to Multiple Intelligences</td>
<td></td>
<td>Meet your teacher, observe for 2 hours, discuss plans for teaching next week</td>
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<td></td>
<td>1/27</td>
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<tr>
<td>4</td>
<td>1/30-</td>
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<tr>
<td>5</td>
<td>2/6-</td>
<td></td>
<td></td>
<td>#4 Due</td>
<td></td>
<td>Discussion</td>
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<tr>
<td></td>
<td>2/10</td>
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<tr>
<td>6</td>
<td>2/13-</td>
<td></td>
<td></td>
<td>#5 Due</td>
<td></td>
<td>Discussion #1 due</td>
</tr>
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<td></td>
<td>2/17</td>
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<td>7</td>
<td>2/20-</td>
<td>2/20—planning days BSES, WDES,</td>
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<td>No Journal</td>
<td></td>
<td>No Session This Week</td>
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<tr>
<td>8</td>
<td>2/27-</td>
<td></td>
<td></td>
<td>#6 Due</td>
<td></td>
<td>Discussion</td>
</tr>
<tr>
<td></td>
<td>3/3</td>
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<td></td>
<td></td>
<td></td>
<td>Begin planning best lesson presentation</td>
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<tr>
<td>9</td>
<td>3/6-</td>
<td></td>
<td></td>
<td>#7 Due</td>
<td></td>
<td>Work on Best Lesson</td>
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<tr>
<td></td>
<td>3/10</td>
<td></td>
<td></td>
<td>Grade Level Small Group Discussion</td>
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<td>10</td>
<td>3/13-</td>
<td>SPRING BREAK</td>
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<td>No Journal</td>
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<td>No Session This Week</td>
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<tr>
<td></td>
<td>3/17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Work on Best Lesson</td>
</tr>
<tr>
<td>11</td>
<td>3/20-</td>
<td></td>
<td></td>
<td>#8 Due</td>
<td></td>
<td>Have Best Lesson ready by this reflection!!</td>
</tr>
<tr>
<td></td>
<td>3/24</td>
<td></td>
<td></td>
<td>Grade Level Small Group Discussion</td>
<td></td>
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<tr>
<td>12</td>
<td>3/27-</td>
<td></td>
<td></td>
<td>#9 Due</td>
<td></td>
<td>Finish UGA presentations this week—turn in flier or brochure to your TA</td>
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<td>3/31</td>
<td></td>
<td></td>
<td>#2 due</td>
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<tr>
<td>13</td>
<td>4/3-</td>
<td></td>
<td></td>
<td>#10 Due</td>
<td></td>
<td>Best Lesson Presentations</td>
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<td></td>
<td>4/7</td>
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<tr>
<td>14</td>
<td>4/10-</td>
<td>4/14-planning CSES</td>
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<td>No Journal</td>
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<td>No Session This Week</td>
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<td>4/14</td>
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<tr>
<td>15</td>
<td>4/17-</td>
<td>4/17-4/21-intercession, CSES</td>
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<td>#11 Due</td>
<td></td>
<td>Discussion</td>
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<td></td>
<td>4/21</td>
<td>4/21-holiday WDES, BSES</td>
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<tr>
<td>16</td>
<td>4/24-</td>
<td></td>
<td></td>
<td>No Journal</td>
<td></td>
<td>Evaluations, Loose Ends, etc</td>
</tr>
<tr>
<td></td>
<td>4/28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>#3 due</td>
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<tr>
<td>17</td>
<td>5/1-</td>
<td>5/1, Last class day UGA</td>
<td></td>
<td>Final Summary Reflection Due—remember guiding questions</td>
<td></td>
<td>5/1 Last Day Teaching Grad/Honors projects and summary reflections due 5/4</td>
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<tr>
<td></td>
<td>5/5</td>
<td>5/2, reading day UGA</td>
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</tbody>
</table>
Table 4.2. Guiding questions for first journal entry

These responses should be conversational in tone and should provide evidence of reflective thought. Each answer should be explained thoroughly and supported by anecdotes and examples. These responses typically span 3-4 pages.

1. Do you believe teaching is a difficult profession? Explain your answer.
2. What qualities make a good teacher? Explain your answer.
3. Think of a student you have encountered in past classes who you didn’t consider to be successful academically. Why do you believe this was the case?
4. Do you plan on pursuing a career in teaching? Why or why not?
5. How do you know when you have really learned material? Provide an example.
6. What do you believe should be the goals of science instruction? How do you think a teacher should go about reaching those goals?

Table 4.3. Guiding questions for Summary Reflection.

These are usually between 5 and 6 double-spaced pages. Please submit electronically.

1. Describe the moment you learned the most about teaching during this experience. You can refer to time in the classroom, conversations with your teacher or peers, journaling, or the reflection sessions—anything involved with this course. If you don’t feel you learned about teaching, explain why.
2. Describe the moment you learned the most about learning during this experience. Again, draw from any part of this experience. If you don’t feel you learned about learning, explain why.
3. Describe a moment in this experience when you felt you learned something significant about yourself. If you feel you didn’t learn anything about yourself, explain why.
4. Has this been a valuable experience for you? Why or why not?
5. Has participation in this program influenced your work in your own studies? Why or why not?
6. Briefly comment on your partner teacher. Would you recommend placing another student in their classroom?
Table 4.4. Interview Protocol for Interview 1

1. Why do you believe education is important?

2. Describe a student you are working with in FOCUS who you consider very successful. Why do you think this student is successful? Does this student seem motivated by internal factors like ambition and curiosity, or does he/she seem motivated by the teacher?

3. In the last month or so, when preparing for a project or an exam, did you consult resources beyond the professor of the course or the textbook?

4. Is there a recent academic situation in which you felt particularly unsuccessful (lost in lecture, bad score on a test, etc) or successful? Why do you believe you were either unsuccessful or successful (b/c you worked hard, b/c your teacher was good/bad...etc).

5. When you encounter material in a course you don't understand, how do you approach it?

6. In your course work, who do you view as responsible for your knowledge construction?

7. Describe the best professor you've had, and explain why you think he/she was the best.

8. What does it mean to you to really understand information? What does that involve?

9. When you prepare for an exam, what does that preparation involve?
Table 4.5. Interview Protocol for 2\textsuperscript{nd} Interview

1. In the last month or so, when preparing for a project or an exam, did you consult resources beyond the professor of the course or the textbook?  

2. In general has your preparation involved any new strategies? Please describe those.  

3. Is there a recent academic situation in which you felt particularly unsuccessful (lost in lecture, bad score on a test, etc) or successful? Why do you believe you were either?  

4. (B/c you worked hard, b/c your teacher was good/bad...etc).  

5. When you are in a science class in college, do have goals for yourself? Describe those goals.  

6. Now describe the goals you have for the elementary students you work with in FOCUS. Are the similar or different from the ones you hold in your own studies? Why?  

7. Has there been an instance or a moment in your FOCUS experience when you felt like you have learned a lot about yourself? Schooling? Teaching? Learning? Science? Please describe that moment.  

8. How would you define learning?  

9. How would you define teaching?  

10. How would you define knowledge?
Table 4.6. Protocol for 3rd Interview

1. In the last semester, do you feel you’ve changed at all? Describe those changes. They can be social, academic, etc. Why do you think these changes have happened?

2. In the last month or so, when preparing for a project or an exam, did you consult resources beyond the professor of the course or the textbook?

3. What does your preparation for final exams involve?

4. When you are presenting information to the elementary students, what do you hope they are doing with it? How is this reflection of your own learning practices?

5. In general has your preparation involved any new strategies? Please describe those.

6. Is there a recent academic situation in which you felt particularly unsuccessful (lost in lecture, bad score on a test, etc) or successful? Why do you believe you were either?

7. (B/c you worked hard, b/c your teacher was good/bad...etc).

8. Has there been an instance or a moment in your FOCUS experience when you felt like you have learned a lot about yourself as a teacher? As a learner? About Science? Please describe that moment.

9. Consider all your experiences with FOCUS. What effect has this program had on you and your development?

10. Is there anything else you want to tell me about your experiences with FOCUS this semester and how it has affected you?
Table 4.7. Relative Importance (1 is most important) of Data Sources Informing our Research Questions

<table>
<thead>
<tr>
<th>Research Question</th>
<th>1st Journal</th>
<th>Final Journal</th>
<th>Interview 1</th>
<th>Interview 2</th>
<th>Interview 3</th>
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</thead>
<tbody>
<tr>
<td>#1</td>
<td>C*</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>#2</td>
<td>C*</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>3</td>
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</tbody>
</table>

*Served to provide context for researcher, but did not explicitly inform research questions.*
Chapter 5
Summary and Implications

Introduction

FOCUS is a celebrated, successful, service-learning program which places college science students in elementary school classrooms to aid in science instruction. In our association with the program prior to this study, we witnessed how college students participating in FOCUS reaped significant benefits from the experience. Specifically, anecdotal evidence suggested that FOCUS students changed with respect to their approaches to learning. These new approaches to their university coursework were instrumentally related to the element of teaching in the FOCUS experience.

Most notable was our observation that this change involved the participants’ views about the regulation of their own learning. As the FOCUS participants worked as teachers they began to view the role of the learner as central to knowledge construction, rather than viewing learning as what occurs when a teacher or professor passively transfers information to them. One student described how she’d gotten out the manipulatives she’d used for teaching her 3rd grade students about chemical bonding and used them to study for a test in organic chemistry. “I just decided to teach it to myself the way my professor should have,” she commented. Statements like this one struck us as significant, because it seemed like these students were taking responsibility for their own knowledge construction, rather than expecting a professor to transfer knowledge to them.

Such self-directed learning has been shown to result in improved academic achievement and deeper learning outcomes (Shanahan, 2006; Vermunt, 1998). Literature suggested that such self-regulation of learning is a necessary first step toward achieving a state of independence in which
students are actively engaged in evaluation and judgment of knowledge claims made by teachers and textbooks and other such authorities (Piaget, 1964; Kuhn, 1999; Vermunt, 1998; Munby, 1984; Munby & Roberts, 1998). As such, we set about empirically studying the effects FOCUS participation had on the college science students with whom we worked.

Prior to initiating our empirical investigation, we grounded our understanding of service-learning outcomes in the existing research. We found that positive outcomes stemming from service-learning had been extensively reported. Successful service-learning participation has been correlated with improved attitudes regarding diversity (Barton, 2000; Jones & Hill, 2001; Jones & Abes, 2004), an enhanced sense of civic engagement (Boss, 1994; Moely, McFarland, Miron, Mercer, & Ilustre, 2002) and improved academic outcomes (Strage, 2000; Scale, Blyth, Berkas, & Kielsmeier, 2000) though evidence supporting this last outcome has been conflicting thus far (Butin, 2003; Eyler, 2002). This conflicting evidence regarding academic achievement has been implicated as a deterrent to faculty in higher education employing service-learning as a pedagogy (Abes, Jackson, & Jones, 2002). Indeed, faculty have reported that utilizing service-learning as pedagogy is overwhelming considering they don’t feel that they can be sure it is effecting students’ learning outcomes in the traditional curriculum (Abes, et al, 2002).

Practical experience with FOCUS suggested that learning outcomes of this program were noteworthy, and furthermore had the capacity to positively influence academic achievement in the traditional curriculum. We felt this relationship needed to be understood for two reasons. First, it is important to comprehend outcomes related to this program, so that positive ones can be fostered in future semesters. Second, the relationship between service-learning program and meaningful academic outcomes was one we felt needed clarification before service-learning could be viewed as real pedagogy rather than an exercise in improving community relations. It
is for these two reasons we set about investigating the learning outcomes related to participation in FOCUS. In the concluding chapter of this dissertation we aim to:

1. Summarize the major themes reported in Chapters 2, 3, and 4, which illuminate the murky issue regarding the relationship between service-learning and academic outcomes while contributing to the overall literature regarding learning outcomes and service-learning participation.
2. Articulate implications for service-learning practice and research warranted by our findings.

Summary

Chapter 2. Before we began our study involving FOCUS, we sought to inform our research questions with existing literature. At the start of this study, we were most interested in the relationship between service-learning experience and the development of habits consistent with intellectual independence. This coupling of service-learning and intellectual independence within our research questions required that we synthesize two distinct bodies of scholarship to determine the nature of the relationship between these guiding ideas. The 2nd chapter of this document is representative of that effort.

This literature review was challenging, because the literature regarding service-learning is often ambiguous due to multiple conceptions of what is and what is not service-learning (Eyler, 2002). Additionally, a plethora of orientations guide service-learning practice (charity, civic-education, community building communitarian, and community building social change) as well as research (technical, cultural, political, poststructuralist) (Boyle-Baise, 2002; Butin, 2003). Immersing ourselves in scholarship pertaining to service-learning allowed us to accomplish 3 important tasks. First, we delineated the definition of service-learning which has guided our practice and inquiry. It was as follows: “Service-learning combines service objectives with learning objectives with the intent that the activity changes both the recipient and the provider of the service. This is accomplished by combining service tasks with structured opportunities that
link the task to self-reflection, self-discovery, and the acquisition and comprehension of values, skills, and knowledge content” (National Service-Learning Clearinghouse, 2005, ¶ 3).

Second, we aligned our practice and research in service-learning with orientations outlined in the literature. We did not report these in Chapter 2, because we do not substantively address FOCUS in that chapter. We do feel it is important to articulate here that in preparation of this document, largely as a result of our efforts to examine the literature which is presented in Chapter 2, we clarified our intentions with regard to our practice and research concerning FOCUS with the scholarly constructs present in the literature. With regard to FOCUS practice, the program is best understood in terms of Boyle-Baise’s (2002) community building communitarian orientation. The program values the contributions of each stakeholder, emphasizes the importance of reflection for contributing to learning outcomes, and encourages students to work cooperatively with their partnering teacher. With regard to our research involving FOCUS, we were best guided by Butin’s (2003) cultural perspective. While at first glance our research question alluding to the relationship between service-learning and intellectual independence seems in line with his technical perspective, we believe that research orientation is too shallow to characterize the efforts represented within this document. At the outset of this study, we suspected that our students were internalizing learning behaviors they desired for the elementary students with whom they worked, and thus were making personal meaning of their lesson preparation and delivery. This type of internalization and meaning making is what characterizes Butin’s (2003) cultural perspective.

Thirdly, we set forth an argument in our literature review that suggested a possible relationship between service-learning participation and the development of habits consistent with intellectual independence. This potential for a relationship finds support in works by Dewey
(1900, 1902, & 1943) and we believe it is realized in studies of situational learning like those of Hung (1999) and Chin, et. al (2004). As evidence more explicitly implicating service-learning in the outcome intellectual independence, we referenced the works of Pate, Nichols, and Tippins (2001) and Steinke, Fitch, Johnson, and Waldstein (2002). Critical to the link between service-learning and intellectual independence is introspection on the part of the learner, specifically with regard to their own learning processes, both knowledge of cognition and regulation of cognition (Schraw, 1998). In our own experience with FOCUS, we have witnessed the central role which teaching plays with regard to this developing metacognitive awareness. Teaching within this program allows for our students to continually evaluate the status of their own ideas and question knowledge claims of others. Munby and Roberts (1998) argued that these were important characteristics of teaching for the accomplishment of intellectual independence. But beyond this, teaching within a real world setting where, for instance, the children quite often have been reared in a family setting quite different from one’s own experience, seems be related to the service learning experience fostering intellectual independence.

Based on our immersion in the literature regarding the guiding principles of service-learning and intellectual independence, we argued in Chapter 2 that service-learning research needs to focus on how service-learning programs can foster the development of intellectual independence in its participants. In science education, specifically, service-learning outcomes need to be examined from a K-16 standpoint and include teacher education experiences like those of Pate, Nichols and Tippins (2001) and Barton (2000).

Additionally, we put forth the argument that service-learning experiences with a significant teaching component merit special attention in the study of the relationship between service-learning and intellectual independence. Situations where service-learning participants
are teaching allow for shared power, questioning authority, and reevaluating their own knowledge as well as those of their students, as in reciprocal teaching (Munby & Roberts, 1998; Palincsar & Brown, 1984).

Chapter 3. A significant reason we felt the need to undertake this study rests with the diverging opinions among scholars about the worth of service-learning with regard to traditional academic achievement. In our practical experience, we have encountered many scholars who are skeptical about the potential of service-learning to meaningfully impact academic learning. Most often, these scholars represent fields of study within the natural sciences, rather than the fields within the humanities. In our 3rd chapter, we reported on a portion of our study specifically designed to inform scholars within the natural sciences about the potential influence of service-learning on students’ learning approaches. This chapter, which has been submitted for publication, reports the quantitative portion of our research regarding FOCUS participation and changes in learning styles. The purpose of the research reported here was to understand the effect of FOCUS on the learning regulation of the college science majors who participated in the program. Because of our interest in the phenomenon of learning regulation, we employed the Inventory of Learning Styles (ILS) created by Vermunt (1998). The ILS is a 100-item Likert scale instrument which asks students to provide self report responses regarding their approaches to learning across 4 domains of cognition. These domains include cognitive processing strategies, metacognitive regulation, learning orientations, and mental models of learning and are measured by scales and/or subscales within the ILS. For example, students’ metacognitive regulation is measured using 3 scales; Self-regulation, External Regulation, and Lack of Regulation. The Self Regulation scale is subdivided into two subscales, namely, self regulation learning processes-
results and self regulation learning content. Likewise, the External Regulation Scale is divided into two subscales termed external regulation processes and external regulation results.

In his research using the instrument, Vermunt (1998) consistently found four learning styles; undirected, reproduction-directed, meaning-directed, and application-directed style. Vermunt (1998) used four-factor principal component analysis to uncover the learning styles based on the four components we’ve just discussed. In other words, learning styles are characterized by certain patterns of responses along the fore mentioned scales. As an example, the undirected style had high loadings of lack of regulation, an ambivalent learning orientation, and cooperation and stimulating education models of learning. The reproduction style had high loadings for the ILS subscales labeled memorizing and rehearsing, analyzing, external regulation of learning processes, and learning results. Additionally, the style was characterized by an intake of knowledge model of learning and certificate and self-test-directed learning orientations. The application directed learning style has high loadings on concrete processing, use of knowledge as a mental model of learning, and vocational and certificate-directed learning orientations. Finally, the meaning-directed learning style is characterized by high loadings of relating and structuring, critical processing, self-regulation of learning processes and learning contents, a construction of knowledge learning model, and a personally interested learning orientation. Boyle et al. (2003) found that an analysis of students’ data from the ILS could predict academic performance as measured in a traditional sense (GPA). Specifically, Boyle et al. (2003) report that students who identify with Vermunt’s (1998) meaningful learning style, characterized by self regulation and constructivist views of learning, exhibit better academic outcomes than those who are externally regulated and have an intake view of learning.
In Chapter 3, the ILS was the primary means used to identify students’ approaches to learning. After participation in FOCUS college students report themselves as less externally regulated in their learning. The decrease in the mean value on the “results” subscale of the External Regulation scale indicates that FOCUS students are less dependent on their professor or their textbook for determining if they have reached mastery of material. For example, if a student makes a 100% on an exam, he/she doesn’t assume that the score equates to 100% mastery of the material. This is important, because research suggests that decreasing dependence on external regulators is a necessary step toward accepting responsibility for one’s own learning (Kuhn, 1999; Munby and Roberts, 1998). Further, accepting responsibility for one’s learning has been shown to predict gains in motivation and academic success (Findley and Cooper, 1983).

Our findings also indicated that after FOCUS, students are less likely to report using the “analyzing strategy” on the Stepwise Processing scale. We believe this is a positive outcome of participation in our program, because a decreased tendency to study items in a chapter or lecture detail-by-detail likely precedes a tendency to assimilate material more meaningfully and integrate it into a cognitive framework. Such integration requires metacognitive ability, in that a student must evaluate the status of their own ideas, the ideas they are encountering in their studies, and work to bring those sets of ideas into their own cognitive framework (Kuhn, 1999).

Additionally, students reported being more inclined to look for practical applications of material they encountered in their courses, after participation in FOCUS. This is another change which has been previously associated with increases in motivation and academic success (Findley and Cooper, 1983). We believe this may result from our students working in an elementary setting, where science is generally taught in a more concrete manner than it is in a college science course. For example, when our students teach a unit about electricity and
magnetism, they draw on daily experiences the elementary students will be familiar with, such as turning on a flashlight. In a lesson about plant parts, elementary students might see a salad made with roots, stems, and leaves. In this way, FOCUS participants are bringing their own science knowledge into concert with daily life to help make it meaningful for the elementary students with whom they work. It is not surprising that when our participants repeatedly turn abstract science concepts into concrete examples for their students, it leads participants to cultivate the habit of looking for such practical applications of material to further their own understanding.

Ultimately, Chapter 3 reported these important learning outcomes stemming from FOCUS, based on our findings using a reliable and valid quantitative instrument, the ILS (Boyle, Duffy, & Dunleavy, 2003). We believe that the use of quantitative methodology in this portion of our study enhances the likelihood that scholars from the natural sciences will read and understand the great potential service-learning experiences have in terms of impacting academic learning in a more traditional setting. The manuscript which is Chapter 3 is currently under review for publication in the North American Colleges and Teachers of Agriculture Journal, which has a readership consisting of practicing scientists with interest in college science teaching.

Chapter 4. In the fourth chapter, we reported on our qualitative study of learning outcomes stemming from participation in FOCUS. The purposes of the study presented there were to understand the university students’ learning outcomes resulting from participation in FOCUS and to determine which elements of the program structure were implicated in the development of these outcomes. Specifically, we sought to answer the following questions:

- What changes do FOCUS students experience with regard to their conceptions of learning, teaching, and schooling?
- Can these changes be related to aspects of the FOCUS program?
It is important to note here that we began this research with a strong focus on understanding learning outcomes that could be tied to academic achievement, and while we reported on those findings, we also reported other significant learning outcomes the students shared with us. Ultimately, we reported three significant findings. We found that students working with FOCUS learned science content as they prepared for and participated in teaching activities in their partner elementary classroom. This learning occurred for two reasons. First, the students encountered material they were unfamiliar with, and thus, had to study it in order to teach effectively. Second, the FOCUS students became aware of deficiencies in their content knowledge regarding topics they had previously thought they had mastered. This occurred as FOCUS students realized discrepancies between the learning outcomes they wished for the elementary students with whom they worked and their learning outcomes in their own university coursework. The modifications university students made in their own learning processes can best be understood in terms of the learning styles first outlined by Vermunt (1998). Specifically, FOCUS participants reported changing their learning behaviors such that they became consistent with a more meaning-directed learning style, which is correlated with high academic achievement (Boyle et al, 2003; Vermunt, 1998).

The second finding presented in Chapter 4 was that FOCUS students reported improving in their metacognitive awareness. Nearly all the FOCUS students reported coming to new understandings of learning processes and the highly personal nature of learning styles. Several were surprised to find that the elementary students for whom they prepared lessons did not process the material they presented as they predicted. This seems perhaps an insignificant learning outcome of the program. Yet, during interviews with extended participants, it became clear that this realization was an important first step
for some of the participants, in that this realization of the individual nature of learning styles led some to become introspective of their own approaches to learning. A few of the extended participants found that this introspection was accompanied by a shift in their own learning processes. The participants reported that they made the shift in order to implement the new view of learning they had acquired believing that it would be an aid to their learning in college course work. In terms of metacognition, this new awareness shows progress in two areas of metacognition described by Kuhn (1999). Specifically, students are engaging in meta-strategic metaknowing, because it involves being aware of and being able to use learning strategies, as well as meta knowing, which involves a student examining what he/she knows and how he/she knows it. Metacognitive ability has a strong correlation with academic achievement (Schraw, 1999; Everson & Tobias, 1998).

The third and final finding presented in Chapter 4 was that students participating in FOCUS came to new understandings regarding schooling and society. This manifested in two ways. First, students developed new understandings of the teaching profession. Specifically, they went from believing teaching was an “easy job” to the realization that teaching is an inherently difficult pursuit, and that the elements of public education such as testing, learning differences among students, and differing levels of parental involvement make it even harder. Second, students reported realizing their own life of privilege, and how the advantages they enjoyed during their upbringing positioned them to benefit from successes not possible for disadvantaged students.

The learning the FOCUS students experienced with regard to realizing their life of privilege can best be understood when viewed through a cognitive map offered by
Rockquemore and Shaffer (2000). They described a stage theory of engagement through
which students progressed as participants in service-learning activities. The first stage,
termed Shock, is the stage in which students began to understand the differences between
their sheltered perceptions of reality and the real or marginalized world (Rockquemore &
Shaffer, 2000). The second stage of engagement, which is important to the process of
learning through service-learning, Rockquemore and Shaffer (2000) termed
Normalization. Rockquemore and Shaffer (2000) offered a third and final stage within
their cognitive map, namely, Engagement. During this stage service-learning participants
began to ask the hard “how” and “why” questions about the inequities they have
witnessed in the community.

Each of the findings (science content, metacognitive awareness, schooling and society)
we presented in Chapter 4 was evident as a significant learning outcome stemming from the
FOCUS experience. Yet, we realized during our analysis that the magnitude of the learning was
very different for each student. We closed Chapter 4 with a discussion of our thinking regarding
this difference in magnitude. Specifically, we implicated the difference in the students’
perspective regarding the purposes of their participation. Students that approached the
experience intent on learning from it did in fact learn. Those who approached the experience
intent on “serving” also learned, but their learning was not as transformational. The findings
from our study are consistent with those of Sperling, Wang, Kelly, and Hritsuk (2003) who
found that participants’ individual characteristics and reasons for doing service learning were the
most significant mitigating factor with regard to learning outcomes. Specifically, the students
with the “charity” perspective, who approached the experience intent on serving, exhibited more
shallow learning outcomes than those who approached the service-learning activity intent on learning from it.

**Implications**

Taken together, our findings indicate that participation in FOCUS is associated with several positive outcomes. Students reported adopting approaches to learning consistent with a “meaning directed” learning style (Vermunt, 1998), gaining content knowledge, developing metacognitive awareness, and maturing in their views of social issues. These findings represent learning at 3 levels; namely, the discipline (science), the individual learner (metacognitive awareness), and the society (teaching as a profession and the learners’ life of privilege). In thinking about the classification of these results, we were struck by their similarity to the sources for objectives suggested by Tyler more than a half century ago. Tyler (1950) offered these three areas, the nature of the learner, the nature of the discipline (science) and the nature of the society in which schooling takes place, as the potential sources for developing learning objectives for students. Thus we feel that our experience with this service learning project fulfills long sought curricular goals. Beyond this, because of its structure, FOCUS encourages the accomplishment of objectives in all of these areas, and also allows for the concurrent accomplishment of them. Based on our study, we believe that FOCUS, and other service-learning programs with a significant teaching component, have a unique potential to foster learning across and between each of the curricular areas put forth by Tyler (1950).

However, while these types of learning are possible, the perspectives of the FOCUS participants are key in fostering their maximal development. As such, we believe further research is necessary to illuminate how instructors leading programs like FOCUS can foster students’ change in perspective to that of a learner, rather than a server. In the semester
following this research, we utilized two days of scheduled reflection time to explicitly discuss potential learning outcomes students might accomplish as a result of their participation. Indeed at the time of their entry to FOCUS, we found that the students were hard pressed to offer ideas beyond those of traditional service objectives (offer help, teach, etc). Yet, after we prompted them and discussed possible learning outcomes in the 3 domains reported in this document, we have seen evidence in their journals that they are focusing on learning from their participation, rather than just focusing on service for the sake of service. They often write about how the program is influencing their own studies, their views of society, and their content knowledge. Naturally, we have not collected data on this new strategy, and there is a possibility that the students are writing what they believe the instructors want to read, but we do believe this anecdotal evidence suggests that explicit discussion regarding learning outcomes is a potential practice which may improve the learning component of service-learning. We are currently initiating a study which will attempt to clarify the association between this explicit discussion and the development of a learner’s perspective as participants work in this service-learning program.
References


