A Case Study of Student Cognitive Responses to Learning with Computer-Assisted Modular Curriculum

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Abstract

Little is known about how students learn when using computer-assisted modular curriculum, if such curriculum truly promotes self-regulated learning, or if the cognitive principles of teaching and learning are integrated throughout the design of the modules. The purpose of this study was to investigate the phenomenon of student cognitive responses to learning with computer-assisted modular curriculum, based on the Phases and Subprocesses of Self-Regulation. This triangulation mixed methods case study connected qualitative and quantitative data derived from curriculum content analysis, student course evaluations, participant observations, and interviews. Thirty-six middle school students enrolled in an agricultural education course designed with computer-assisted modules served as the case study group. Data were transcribed, coded, and analyzed, leading to the emergence of six common themes. Overall, the design and content of the computer-assisted modules lack integral principles of teaching and learning. Participants prefer a mix of traditional and computer-assisted instruction because of the variety of instruction, opportunities for social learning, and the hands-on activities. When integrated properly, computer-assisted modules do not inhibit interactions among the teacher and the students. The activities associated with the modules do not encourage self-regulatory processes. However, self-regulation is innate and students engage in self-regulation at different levels during the learning experience. Despite intrinsic interest or value for a particular topic, participants felt it was always important to pay attention in school. Thus, when learning with computer-assisted

modules, students engage in social learning with their peers and desire hands-on learning experiences, with or without the modules.

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Chapter 1

Agricultural education programs fall under the umbrella of Career and Technical Education (CTE). CTE programs incorporate career and technical skills, benefiting students as these courses provide knowledge and experiences related to future career paths. The Florida Department of Education (Curriculum Framework Statutory Reference, n.d.) describes career and technical education as:

> Exploratory courses designed to give students initial exposure to a broad range of occupations to assist them in preparing their academic and occupational plans, and practical arts courses that provide generic skills that may apply to many occupations but are not designed to prepare students for entry into a specific occupation (n.p.).

Hughes and Barrick (1993) described the model for agricultural education programs as a form of individualized instruction including a range of activities for students of varying levels of ability and backgrounds. Agricultural education is designed to meet the needs of a broad, diverse spectrum of students.

Agricultural education programs follow a standards-based curriculum model incorporating three major parts: (a) classroom and laboratory instruction, (b) experiential learning through Supervised Agricultural Experience (SAE) programs, and (c) student leadership and personal development through the National FFA Organization (National Quality Program Standards for Secondary Agricultural Education, n.d.). To follow the three-part model, a wide range of agricultural education programs are implemented in middle and high schools. Traditional agricultural education programs typically consist of a land lab, often described in several different forms including outdoor livestock, horticultural facilities, an agricultural mechanics shop, or aquaculture facilities. Students who complete agricultural classes in the traditional setting are able to work hands-on with livestock animals, horticultural products, conduct scientific experiments, or utilize leadership skills. Students are able to apply the knowledge gained in the classroom to real-life situations in the learning by doing atmosphere. Traditional agricultural education programs offer a plethora of opportunities for students to reinforce what they are learning in the classroom through experiences and real-life connections. A study of laboratory experience in traditional agricultural education programs by Rothenberger and Stewart (1995) determined that students who participated in a greenhouse laboratory experience scored significantly higher on knowledge tests than students who were taught the same lessons without the greenhouse laboratory experience. Additional research conducted by Rossetti and McCaslin (2000) indicated that most state FFA executive secretaries believe students benefit from the hands-on experiences in agricultural education classrooms. This supports the argument that the hands-on component of traditional curriculum and instruction methods in agricultural education programs is beneficial for students as part of the learning process.

Student Cognitive Responses and Self-Regulation

Computer-assisted learning environments have led to a new agricultural education program design where modular curriculum is implemented. Computer-assisted modular curriculum is commonly integrated into middle school programs. Weymer (2002) stated that computer-assisted modular curriculum is developed by commercial vendors, designed for students to learn the various areas of a subject through interactive media presentations. In such learning environments, students are involved in a variety of learning activities by completing assignments in workbooks, writing responses in journals, or by conducting experiments. Moreover, computer-assisted learning environments strive to provide a student-centered, cooperative learning experience for students who are responsible for keeping track of their grades and in some cases, complete the module assignments with a partner. Computer-assisted modules are therefore, considered to be self-paced for the students (Reed, 2000). In order to complete assignments and monitor progress in a self-paced environment, students are expected to demonstrate self-regulatory processes where Schunk (2008) defined self-regulation as the cognitive behaviors students' exhibit to accomplish learning goals. These cognitive behaviors stem from a student's awareness of his or her abilities as a learner, as well as interest and motivation for learning (Zimmerman, 2002).

The Phases and Subprocesses of Self-Regulation model illustrated by Zimmerman and Campillo (2003) presented a theoretical framework for this case study. The phases (Figure 1) include the forethought phase, performance phase, and self-reflection phase, which correspond with the three steps in learning with computer-assisted modules. Within each phase are subprocesses in which learners engage during the learning process. As the framework for this case study, the forethought phase, which includes the subprocesses of task analysis and self-motivation beliefs, would take place for the learner at the start of the module. The self-regulatory skills learners may demonstrate during this phase are goal setting or planning an expected outcome, as well as strategic planning of methods that are "appropriate for the task and setting" (Zimmerman & Campillo, 2003, p.240.). The performance phase would occur for the learner during the module experience, and includes the subprocesses of self-control and self-observation. During this phase, the self-regulatory processes exhibited by the learner may include task strategies, self-instruction methods such as taking notes, asking questions, or summarizing key ideas, or attention focusing on the learning task at hand. Finally, self-reflection includes the subprocesses of self-judgment and self-reaction. This phase would occur at the end of the module and the self-regulatory skills expressed by the learner would include self-evaluation, self-satisfaction, or casual attribution. The Phases and Subprocesses of Self-Regulation guided the participant observations and interview protocol in order to answer the questions of how students engage in the classroom learning process using computer-assisted modular curriculum and how students use self-regulatory processes during educational experiences.

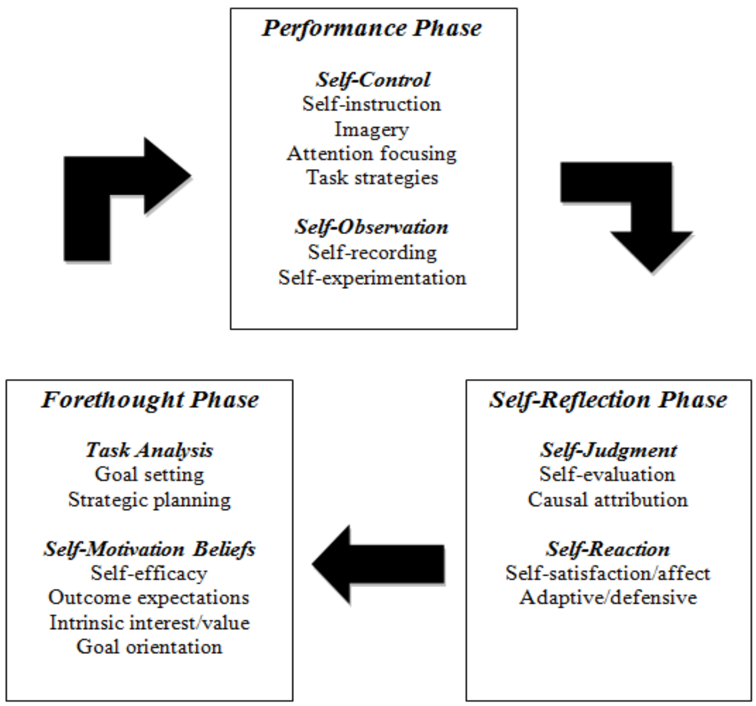

Figure 1. Phases and Subprocesses of Self-Regulation (Zimmerman & Campillo, 2003). Reprinted with the permission of Cambridge University Press (Appendix A).

Purpose and Research Questions

The purpose of this study was to investigate the phenomenon of student cognitive responses to learning with computer-assisted modular curriculum. This triangulation mixed methods case study connected quantitative data derived from curriculum content analysis and student course evaluations with qualitative data derived from participant observations, interviews, and additional document analysis. The reason for using both quantitative and qualitative data was to validate and confirm the qualitative findings with the quantitative findings, creating a stronger analysis of the data collected in the study. A middle school level agricultural education program designed with a computer-assisted learning environment served as the site. Middle school students enrolled in the course served as the participants. Three major questions guided the study:

1. How are the cognitive principles of teaching and learning implemented in the design of computer-assisted modular curriculum?
2. How do students engage in the classroom learning process using computer-assisted modules?
3. How are students using self-regulatory processes while learning with computer-assisted modules?

Importance of the Study

A study conducted by Johnson and Deeds (2002) investigated student achievement in learning utilizing computer-assisted modular curriculum in comparison to learning with traditional teacher-led instruction. The goal of the study was to determine student knowledge and comprehension based on assessment scores as a result of learning in with computer-assisted modules compared to the traditional model. The study did not explore teachers' attitudes towards or adoption of computer-assisted modular curriculum, and students' reactions to the modules were not examined.

Other studies in CTE areas including industrial arts and technology education explored computer-assisted modular curriculum based on the perspective of factors affecting student performance of 6th grade students. In one such study, Weymer (2002) discovered that cognitive style, verbal ability, prior knowledge, and motivation influence performance. Through his research, Weymer identified individual differences and instructional methods utilized in computer-assisted modular learning environments as areas lacking in research. Culbertson, Daugherty, & Merril (2004) explored the impact of computer-assisted modular curriculum on middle school students' achievement scores, and they determined that participation in a modular technology course does not increase students' achievement in other subject areas. The studies by Weymer (2002) and Culbertson et al. (2004) highlight what has been done to research computer-assisted modular curriculum, thus emphasizing the need for further research. Additional research is necessary to determine the value of transitioning from teacher-led instruction to computer-assisted modular curriculum.

Prensky (2008) argued that students today are growing up differently. For most learners, the availability of technology has created a new outlet for becoming connected to the world, especially through cellular phones, iPods, social networking, and instant information through the Internet. Prensky (2007) proposed that learners are eager to use technology in the classroom as part of learning because they have already mastered those skills, and because of the usefulness and importance of technology in society. Computer-assisted modular curriculum provides an opportunity for technology integration within agricultural education. However, there is little research to support the idea that agricultural education students truly prefer learning with computer-assisted modules.

Finally, Weymer (2002) identified computer-assisted modules as being self-regulatory in nature, where students are responsible for their own learning and progress, and the teacher becomes a facilitator or guide in the process. Self-regulation is a metacognitive process in which students monitor their learning progress, as well as set and accomplish learning goals, where self-regulation and motivation are closely related (Pintrich & De Groot, 1990). According to Donovan, Bransford, and Pellegrino (1999), students must be aware of their own abilities as learners if they are to demonstrate self-regulatory processes. To achieve learning goals, either through using self-regulation or metacognition, learners must find value in the information and have a desire to engage in the learning process. This study was critical in exploring how students learn with computer-assisted modular curriculum, specifically in how self-regulation is demonstrated by learners during such instruction.

As teachers enter programs in schools with computer-assisted modular curriculum, preparation and knowledge of teaching and learning with various curriculum materials is critical for their success. In addition, school districts contemplating the adoption of computer-assisted modular curriculum would benefit from a broad spectrum of data and literature, showcasing both the benefits and possible repercussions of computer-assisted modular curriculum. Little is known about student cognitive responses to learning with computer-assisted modular curriculum; therefore further research will provide insight into the potential of using this type of curriculum. As new agricultural education programs incorporating computer-assisted modular curriculum are developed, further research is necessary.

Personal Reflexivity

With a background as an agricultural educator, it was necessary for the researcher to examine her personal experiences and biases related to the phenomenon of teaching and learning with computer-assisted modules. Prior to entering graduate school, the researcher taught middle school agricultural education for three years. The program where she taught was designed with the traditional teacher-led learning environment. Approximately 250 students rotated through the program within a school year. The program consisted of a laboratory for conducting projects and experiments, a livestock barn facility, and two acres of land for horticultural use. The school was in an urban location where the majority of the students did not come from a traditional agricultural background. The researcher has a strong knowledge base and understanding of middle school agricultural education curriculum. She was able to develop her own curricula, lesson plans, and assessments based on state-wide frameworks. Her classroom did not have access to student computers, so technology integration was limited to overhead projectors and presentations by means of an LCD projector. If computers were necessary for a lesson, the researcher would send students to the media center to use the computers, or when possible, she would schedule a class period in the computer lab. While the researcher does not have the experience of teaching in a program with computer-assisted modules, she was familiar with the program design from visiting local programs that implemented the module design. As the researcher for this study, she brings a perspective of the benefits of traditional teacher led agricultural education programs.

The researcher's epistemology of learning is grounded in social constructivism. Individual learners have cognitive structures and processes that contribute to the construction of knowledge through information processing. At the same time, learning is heavily influenced by surroundings, social interactions, and experiences. Senses allow learners to capture environmental data based on sound, touch, taste, smell, and sight. Information is held in the sensory register as the form in which it was received, like sounds in the echoic memory or visual images in the iconic memory (Bransford, 1979; Schunk, 2008). When the sensory register receives the input from the senses, the information is held there very briefly allowing the learner to selectively attend to the data and consequently "move" that information to the short-term memory. This combination of social learning and information processing creates a complementary relationship among cognitive and social structures, thus contributing to the construction of new knowledge.

Definitions of Terms

This section includes definitions of commonly used terms used throughout this thesis. The definitions are provided from existing literature.

<u>Agriscience</u>, as stated by Johnson and Deeds (2002) refers to "the terminology 'agriscience and technology' describes the areas of agricultural education that integrates science-based instruction into the discipline. 'Agriscience' better reflects an emphasis on science in the curriculum" (p.102).

<u>Computer-assisted instruction</u> integrates computers as a teaching and learning tool. In this case, computer-based modules are the tool used to create a computer-assisted learning environment. Alessi and Trollip (2001) explain in computer-assisted instruction and interactive multimedia "screen design and presentation strategies increasingly reflected theories of attention and perception, and today designers are increasingly (though probably not sufficiently) incorporating motivation principles…modern interactive multimedia programs provide a better mixture of learner and program control" (p.31).

<u>Career pathways</u> are clusters of work-based courses designed for high schools to prepare students to transition into college or careers (Castellano, Stringfield, & Stone III, 2003). There are sixteen career clusters in which schools can offer, and Agriculture, Food, and Natural Resources (ANFR) is the career cluster for agricultural education.

<u>Digital immigrants</u> are individuals who did not grow up in the era of technology, Internet, or the "digital age" (Prensky, 2001).

The Fry Graph for readability is a popular tool used to determine the readability, or grade level score, at which a text is appropriate. Readability is determined based on a sample of 100 words, and the number of syllables and sentences within the sample text (DuBay, 2004).

According to the National Research Council (1996), inquiry-based learning "is central to science learning. When engaging in inquiry, students describe objects and events, ask questions, construct explanations, test those explanations against current scientific knowledge, and communicate their ideas to others" (p.2).

Intrinsic motivation is "engaging in a task for no obvious reward except for the activity of itself" (p.522). Students who are motivated to learn for reasons other than achieving high grades and find the course content interesting and significant, tend to be cognitively engaged in the learning process (Pintrich & De Groot ,1990). Students who are intrinsically motivated view the reward as the engagement or completion of a learning task.

The millennial generation is also known as Generation Y and was "born in the 1980's and 1990's" (Coley, 2009, p.24). This generation has also been referred to by Prensky (2001) as digital natives, who are native speakers of the digital language of computers, video games and the Internet (Prensky, 2001, p.1). Prensky (2001) explains that digital natives "have spent their entire lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age" (p.1).

Module is a term used to describe a classroom learning environment consisting of "eight or more modular work stations with a computerized management system," (Weymer, 2002, p.2). Each computer module comes complete with a student activity book and a hands-on learning component, where students are able to engage in learning activities that correspond with the content presented through the modules. Modules are typically developed by commercial companies which sell their products to school systems across the country.

No Child Left Behind (NCBL) Act of 2001 resulted in standards-based curriculum reform that aims to hold students accountable to higher standards, which are often measured by state mandated achievement tests (Ricketts, Dunan, & Peake, 2006).

Self-control refers to processes learners use to focus on a given task, such as self-instruction, imagery, attention focusing, and task strategies (Zimmerman & Campillo, 2003).

Schunk (2008) defines self-efficacy as "personal beliefs concerning one's capabilities to organize and implement actions necessary to learn or perform behaviors at designated levels" (p.525). Students who have high self-efficacy may be more confident in their abilities to accomplish learning goals, whereas students with low self-efficacy may doubt their abilities and lack the confidence to complete learning goals.

Self-judgment is part of self-reflection, where learners self-evaluate their performance and attribute "causal significance to the outcomes (Zimmerman & Campillo, 2003).

Self-motivation is comprised of multiple self-motivational beliefs, including self-efficacy, outcome expectations, intrinsic interest or value, and goal orientation (Zimmerman & Campillo, 2003), all of which are necessary to motivate learners.

Self-observation, according to Zimmerman and Paulsen (as cited by Zimmerman & Campillo, 2003) is the ability of learners in "tracking of specific aspects of his or her own performance, the conditions that surround it, and the effects that it produces.

Self-regulation in the context of this case study refers to the cognitive processes and behaviors exhibited by students while engaged in learning. Self-regulation is "the process whereby students personally activate and sustain behaviors, cognitions, and affects, which are systematically oriented toward the attainment of learning goals" (Schunk, 2008, p. 525). Zimmerman and Campillo (2003), explain that self-regulation also refers to "self-generated thoughts, feelings, and actions that are planned and cyclically adapted for the attainment of personal goals…"

STEM stands for Science, Technology, Engineering, and Mathematics and is a movement in curriculum and education (Bybee, 2007). The goal of STEM is to provide students with the opportunity to learn about science and technology by integrating STEM across the content areas.

Self-reaction occurs in two specific forms, self-satisfaction and adaptive inferences. Learners often monitor outcomes based on self-evaluation, where satisfaction or dissatisfaction is measured based on performance, and adaptive inferences help learners change, or adapt, in future situations to accomplish tasks or goals (Zimmerman & Campillo, 2003).

Task analysis, in this case, is a form of goal-setting which helps learners determine intended outcomes (Locke & Lantham as cited by Zimmerman & Campillo, 2003).

Summary

The purpose of this case study was to investigate the phenomenon of students' cognitive response to learning with computer-assisted modular curriculum. This section provided a description of the research problem, purpose and guiding research questions, the researcher's perspective as a former agricultural educator, a brief description of agricultural education program design, and the definitions important for this research. The following section will provide a review of the literature relevant to computer-assisted learning environments, curriculum reform, technology as a teaching and learning tool, and self-regulation and motivation theory.

Chapter 2

Review of Literature

The purpose of this triangulation mixed methods study was to explore the phenomenon of student cognitive responses while engaging in learning with computer-assisted modular curriculum. Middle school level students enrolled in an agricultural education program designed with a computer-assisted learning environment served as the audience for exploring this phenomenon. This chapter contains a review of the literature on computer-assisted learning environments and self-regulation. A significant study emerged from the literature by Johnson and Deeds (2002), comparing the knowledge and comprehension levels of high school students enrolled in a traditional learning environment with that of a computer-assisted learning environment in agricultural education. Aside from the work by Johnson and Deeds (2002), which was identified as the most recent study, research in agricultural education on computer-assisted learning environments using modular curriculum is limited. The predominant content area of research in computer-assisted modular curriculum was industrial arts. Therefore, the researcher examined research in computer-assisted instruction from disciplines outside of agricultural education, including professional journals in education, psychology, and technology.

Curriculum Reform

Career pathways, No Child Left Behind, and STEM. As part of the 10x15 initiative established to enhance agricultural education nationwide, career cluster content standards were recommended to serve as a guide for curriculum development for career pathways (National AFNR Career Cluster Content Standards, 2009). Career pathways are "intended to provide a rigorous, coherent program of study that includes high-level academics in addition to technology applications and work-based learning" (Castellano, Stringfield, & Stone III, 2003, p.256). In agricultural education, the career cluster is Agriculture, Food, and Natural Resources (AFNR). The specific career pathways within the AFNR cluster include Food Products and Processing, Animal Systems, Plant Systems, Agribusiness Systems, Biotechnology Systems, Environmental Service Systems, Natural Resource Systems, and Power, Structural and Technical Systems (National AFNR Career Cluster Content Standards, 2009). These pathways allow students to specialize in specific agricultural career areas based on personal preference. Career pathways begin with an introductory course for the field of agriculture and progress into specific advanced courses related to the pathway. Computer-assisted modular curriculum companies such as DEPCO promote modules that are developed to meet "the individual state's competency requirements" (About Us: Curriculum, 2009). DEPCO's modules are listed on the company's website under the specific career pathways and can be searched under the link for career clusters (Career Clusters, 2009). Thus, computer-assisted modular curriculum for middle school is typically designed to provide each module as an overview for the individual career pathways.

Career pathways and standards-based learning are the result of a piece of legislation called the No Child Left Behind Act of 2001 (NCLB). NCLB entered America's school system as part of an effort to provide all students with an education, while holding students accountable to the same academic standards (Martin, Fritzche, & Ball, 2006). As a result, student learning gains are measured based on achievement on standardized tests, while educators are evaluated based on their qualifications and the success of their students. Teachers are responsible for ensuring students are prepared for standardized tests by using curriculum frameworks that effectively integrate the benchmarks. As Ricketts, Duncan, and Peake (2006) have found, because NCLB has increased testing requirements, teachers often resort to teaching for student achievement on tests rather than teaching for understanding content and developing skills.

While the tests that correspond with NCLB are reflective of state standards of learning, there is a growing need for agricultural education courses to integrate science, mathematics, and other core standards into the curriculum. Martin et al. (2006) recommend that teachers in the secondary classroom and teacher preparation programs continue to emphasize the connection between agricultural education and core academics to reduce the threat that NCLB poses on career and technical education. NCLB is thought to threaten agricultural education simply because it is not a course recognized on the standardized tests. However, due to the nature of the course, the addition of science, mathematics, and language arts into agricultural education curriculum would reinforce the major concepts students are learning in their core classes. Martin et al. (2006) found that experts agree "there will be more application of core academics in the agricultural classroom to help fulfill the NCLB legislation's educational requirements" (p.107). The importance, rigor, and relevance of agricultural education courses would be enhanced, and to some, this would make agricultural education a valid course to continue offering in America's schools.

Curriculum integration of science in agriculture has increased at a rapid rate due to the biological revolution, which requires the agriculturist to understand more science (Wilson, Kirby, & Flowers, 2002). Connors and Elliot (1995) explained that "agriscience and natural resource (ANR) programs contain most of the same science objectives as other science courses…" (p.57). According to Bybee (2007), Science, Technology, Engineering, and Mathematics (STEM) is a significant area of reform which is rapidly evolving in secondary schools across the content areas. A major selling point for computer-assisted modular curriculum is that the modules are designed to incorporate STEM as well as the national content standards, making them more appealing to students and teachers. Synergistic modules, for example, are categorized on their company website by career clusters, career pathways, and by STEM content area (Curriculum: Pitsco Education, 2009), where each module is ranked according to the STEM components integrated into the module.

Furthermore, STEM education and science integration is important in agricultural education because of the shift to agriscience. Agriscience is a term that emphasizes the integration of science-based instruction into agricultural education (Johnson & Deeds, 2002). Both agriscience and STEM have presented new expectations and in some cases, requirements for agricultural educators. One example of science integration in agricultural education is a focus of a study by Balschweid (2002) conducted with high school students who were enrolled in a biology course designed in the context of animal agriculture. The study revealed that students enrolled in the course had positive attitudes towards agriculture and received high grades. As agricultural education curriculum incorporates aspects of the biological and physical sciences, courses can be offered for science credit in some states. Therefore, agricultural educators are often encouraged to earn a science endorsement or certification (Thompson & Balschweid, 1999). This is the case in Oregon, where approximately one fourth of agricultural educators reported having a science endorsement and 50% of their high school students receive science credit for agriculture courses (Thompson & Balschweid, 1999). Though computer-assisted modules are not as common in high school agricultural education programs, there is still a strong science influence in the middle school setting. Research is necessary to explore the extent at which scientific principles such as the scientific method are integrated within the modules, and if computer-assisted modules utilized in high school programs meet the requirements for science credits.

Finally, inquiry-based learning in science curriculum is a trend that involves critical thinking instruction, as students demonstrate higher order thinking skills by using analysis, synthesis, and reflection in the learning process (Gunn & Pomahac, 2008). Analysis and synthesis are also two of the higher levels of Bloom's taxonomy, which educators should aim for when planning educational experiences. Bloom's taxonomy is a set of "educational goals or outcomes" that help educators develop curriculum materials to encourage students to engage in "thinking, problem solving, or creating" or assess learning at varying levels of difficulty (Bloom, Engelhart, Furst, Hill, and Krathwohl, 1956, p.2). The levels of Bloom's taxonomy include knowledge, comprehension, application, analysis, synthesis, and evaluation. Inquiry-based learning provides students with opportunities for deeper learning, as the strategy of scaffolding allows students to build upon their prior knowledge through experiences in scientific research, while teachers provide guidance at critical points along the way (Nadelson, 2009). Due to the nature of computer-assisted learning environments, it is not clearly known if modular curriculum addresses inquiry-based teaching and learning needs, or the higher levels of Bloom's taxonomy. Consequently, there is little research to indicate the extent at which computer-assisted modular curriculum provides students with the opportunity for inquiry-based learning. An evaluation of the computer-assisted modules and their corresponding learning materials can provide insight into the module design based on teaching and learning principles and strategies, such as inquiry-based learning.

Computer-Assisted Instruction

Computer-assisted modular curriculum. Computer-assisted learning environments integrate technology into the learning process, where information is presented via videos, audio recordings, images, diagrams, and/or text resources (Winters, Greene, & Costich, 2008). The term “module”, as defined by Russell (cited by Reed, 2001) describes a specific type of computer-assisted instruction, wherein individualized learning packages are designed to enhance learning by making it possible for students to complete one instructional unit before moving on to the next, thus allowing learning to happen at an individualized pace. Pullias (1997) argues that computer-assisted modules are often designed to include “recipe-driven activities” that lack true learning experiences because of this “prescribed manner” in which the module rotations are designed (p.28). Aside from agricultural education programs, industrial arts, health, and business are a few of the Career and Technical Education (CTE) courses that have begun to implement computer-assisted modular curriculum (Curriculum: Pitsco Education, 2009). The description of the components of modules varies according to the subject area; however modules generally consist of a computer software-based curriculum component and a hands-on activity to reinforce the content. Modules are typically designed as work stations to provide a rotation-like system, where each student in the course has the opportunity to complete each module. Weymer (2002) reported that as of September 2001, 5,088 middle-level modular technology education labs were installed in schools across the country, confirming the transition in technology integration taking place in education.

Within the agricultural education literature, the study conducted by Johnson and Deeds (2002) showed that students enrolled in the high school Introduction to Agriscience course which incorporated traditional teaching methods including teacher-led instruction, had higher average test scores than the students enrolled in the Concepts of Agriscience computer-assisted module course. This casual-comparative study examined a sample of 152 high school students in ninth through twelfth grade using a 60-question achievement test designed by the researcher. Findings indicated that the percentage of questions answered correctly by the students enrolled in the traditional teaching method course was 8.83% higher than the students enrolled in the computer-assisted course (Johnson & Deeds, 2002). Students were tested in the areas of animal science, soil science, plant science, and mechanical technology on the corresponding unit exam within the course. The knowledge and comprehension of students enrolled in the traditional agricultural education program, in this case, was higher than that of the students enrolled in the computer-assisted agricultural education courses. A shortcoming for the field of agricultural education is that this study is only one of very few conducted on computer-assisted learning environments using modules. Hence, there is a need for further research in computer-assisted modular curriculum in agricultural education.

Among the companies distributing variations of computer-assisted modular curriculum across the country are Jaeger, Inc., DEPCO, LLC, Pitsco, Inc., and Applied Educational Systems, Inc. These products are typically distributed to the complete range of grade levels in secondary schools, from pre-kindergarten to high school and in all subject areas (Homepage: Pitsco Education, 2009). Specific products have even been designed for post-secondary education, as well as for uses in industry training (Products and Services: Jaeger, 2009). Within the divisions of grade level and subject area are multiple module packages that can be adopted in various educational settings. A few of the computer-assisted modular curriculum manufacturers that work to design curriculum to enhance the learning process and integrate technology into the classroom include AMATROL, TechCenter21, Lego Education, and Pitsco Education (Products and Services: Jaeger, 2009).

Synergistic Learning Systems offers computer-assisted module systems designed for 7^{th} through 9^{th} grade agricultural education programs. As indicated on the Pitsco, Inc. website, these computer-assisted modules are designed to align with STEM standards. The individual modules are rated by the company based on a STEM scale to indicate the content areas included in the module. The computer-assisted modules include subject areas such as animals, aquaculture, cell structure, soils, engines, genetics, and farm management, to name a few. Each module is accompanied by a set of learning objectives and a set of activities the students are expected to complete (Curriculum Results: Agriculture, Food, and Natural Resources, 2009). DEPCO, LLC computer-assisted modules mirror a similar design to that of Synergistic Learning Systems. DEPCO, LLC modules on the market target content areas including agricultural education, business, and health science. DEPCO, LLC modules are designed for up to twenty days of activities including pre-tests, post-tests, and daily response questions, along with five enrichment activities such as vocabulary review (Curriculum Specifications: DEPCO, LLC, 2009).

Modules are designed for cooperative learning, where students are encouraged to work with partners to complete the assignments that correspond with the modules. Students are able to keep track of their grades and progress during the course as part of the computer-assisted modules, making these programs self-regulatory. A shortcoming of the existing research is that evidence is limited in explaining the degree to which learning is truly cooperative in computer-assisted learning environments. The field of agricultural education would benefit from future studies in this area. Additionally, according to Jaeger, Inc., case studies were conducted to evaluate the effectiveness of the computer-assisted modular curriculum in the school systems. A particular study noted a middle school in Florida where the number of students with level III FCAT scores increased from 51% to 60% and scores in Reading increased from 27% to 34% (Jaeger, Inc.: Showcase, 2004). Though this data indicates a gain, there is no evidence of strategies that were implemented in using computer-assisted modules as a teaching and learning tool.

The American Association for the Advancement of Science (AAAS) has developed a federally funded middle school science textbook evaluation process called Project 2061 based on the National Science Education Standards. The goal of this project was to analyze how well curriculum and instructional materials in science education meet the learning needs and goals of students (AAAS Project 2061, 2002). A content analysis of computer-assisted modular curriculum for agricultural education is necessary, based on the AAAS standards for science education, to determine if the modules do in fact, promote student achievement and align with educational standards and basic principles of teaching and learning. Readability is a necessary component of the content analysis. As students engage in reading, they are expected to activate background knowledge, use various reading strategies, and monitor their comprehension, which are characteristics of self-regulatory skills (Park & Osborne, 2006). Readability is important to assess the difficulty and reading level of the content, as the content should be designed for students of various reading levels.

Technology as a Teaching and Learning Tool

The millennial generation. The millennial generation, or Generation Y, was "born in the 1980s and 1990s" (Coley, 2009, p.24). These students are generally fluent in technology and multitasking, and have strong values for personal relationships (Coley, 2009). Hart (2008) described specific characteristics of learners of the millennial generation, such as a value of social interactions, preference for team activities, ability to multi-task, and very independent while learning. Prensky (2001) calls this new generation of learners is "digital natives", as they have been surrounded by technology and computers since early childhood. In contrast, Prensky identifies individuals such as many of the current teachers who did not grow up in the era of technology, Internet, or the "digital age" as "digital immigrants". Digital immigrants tend to have difficulty relating to digital natives, and in education, this creates a technological knowledge-based gap between the teacher and the learner. Because the millennial generation is especially familiar with technology, Prensky (2001) believes that teachers working with digital natives must learn the "digital language" and integrate this technology into the classroom, thus bridging the gap and meeting learner needs.

The problem however, is that while some teachers embrace these changes and try to integrate technology into their curriculum, there are many other teachers who are hesitant because they are afraid of the shift in control in the learning environment or they are uncomfortable using technology (Prensky, 2007). Thus, as educational technology tools are developed, students are thought to want to use these tools for learning because they consider themselves to have mastered the skills, as they use technology daily and find technology to be useful. While there is good reason to believe that Presnky's work supports the need for technology in education, his opinion does not necessarily reflect the views of students who are learning with computer-assisted modular curriculum, specifically within agricultural education. Song and Keller (2001) have a different perspective, as they explain a potential problem associated with learner motivation in computer-assisted learning environments,

> Initially a new technology is appealing to many people because of its novelty and the variety of features that add interest. However, as computers are becoming more widely used for instructional delivery, the motivation that results from their novelty effects tends to disappear (Keller, 1997; Keller & Suzuki, 1988). With experience, students will no longer be as excited by these novel features, and it then will become more of a challenge to stimulate and sustain their motivation during computer-mediated instruction. (p. 5)

Research investigating computer-assisted modular curriculum is limited in evidence regarding students' reactions to the computer-assisted modular learning environment. A goal of this case study was to investigate how students respond to using computer-assisted modular technology as a tool for learning versus the use of technology for personal and social fulfillment.

Teachers and technology use. Background knowledge and comfort level with technology play an important role in the successful adoption and integration of technology in the classroom by educators. According to Ertmer (2005), teacher's pedagogical beliefs influence their technological practices, which relates to their personal learning styles as well as their comfort level with technology. There is support for this argument from Kotrlik, Redmann, and Douglas (2003), who investigated technology integration in secondary agricultural education programs. When teachers have anxiety towards using technology, they are less likely to adopt it as part of their curriculum. Kotrlik et al. (2003) indicate this issue is a barrier preventing teachers from integrating technology. As educators have specific preferences in their teaching methods, they may or may not think it is necessary to incorporate technology. Brusic and LaPorte (2000) described modular technology education curriculum as self-explanatory for teachers, where it can be used with little or no formal training. While this might suggest that this type of curriculum is easy to implement, it does not address the issue of individuals who are not necessarily comfortable working with technology. The literature shows that anxiety for teaching with technology is an issue among educators. Furthermore, research in other subject areas such as mathematics shows a positive outlook towards the use of computers and technology as a teaching tool. In exposing pre-service teachers to new technology and computer-assisted learning, this study showed that pre-service teachers who were exposed to online resources and computer integration into mathematics curriculum had positive attitudes towards adopting these strategies (Lin, 2008). There is little evidence indicating the level of training and preparation of agricultural educators in the implementation of technology or computer-assisted modular curriculum.

Teacher and learner interactions. Computer-assisted modular curriculum has the potential to impact the interactions between the teacher and the student, as students may spend the majority of their learning time using computers. Some teachers might be discouraged by the use of computers and technology as the main source of instructional information, since the setting would be quite different from that of traditional teacher led instruction. Specifically, Prensky (2007) states,

> The fact is that today's students know more – and will always know more – than their teachers about technology and how to manipulate it. This may be hard for many teachers to accept, because it means letting go of whatever control comes from being 'the only one in the room who knows' (p.42).

The scenario Prensky describes is simply one way the roles between the student and teacher differ when using computers as information sources. In some cases, students are able to help teachers with technological issues if they are more familiar and comfortable with technology. Prensky (2007) suggests that "teachers don't need to waste even a minute of their time learning to use and master any of the new technologies…because their students can do this - and they want to. What we should do is let them" (p.42). But aside from that, there is also the issue of the teacher as a facilitator of learning rather than the primary source of information. Thus, research is limited in the area of interactions between the teacher and their learners in computer-assisted learning environments using modular curriculum, and research in this area will be valuable.

Cognition and Strategies for Learning

Self-regulation and intrinsic motivation. Schunk (2008) defines self-regulation as, "the process whereby students personally activate and sustain behaviors, cognitions, and affects, which are systematically oriented toward the attainment of learning goals" (p. 525). In computer-assisted learning environments, self-regulation can be a metacognitive process used by learners to monitor their progress, set learning goals, and self-motivate during the learning experience. As teachers assume the role of facilitator, learners are expected to work independently or socially with a partner using the computer modules, with minimal guidance from the teacher. Zimmerman (2002) describes self-regulatory processes as they occur in three phases including the forethought phase, performance phase, and the self-reflection phase, as shown in Figure 1. Task analysis and self-motivation are the two major processes that occur as part of the forethought phase of self-regulation. Goal-setting and strategic planning during task analysis allows learners set goals and plan a strategy for accomplishing a learning task, leading to potentially higher academic achievement (Zimmerman, 2002). In the performance phase, self-control and self-observation are the processes that occur as part of self-regulation. The self-control process allows students to implement the plans they devised as part of the forethought phase, where imagery, self-instruction, and attention-focusing are among the strategies utilized to accomplish this task. Self-observation involves self-monitoring and self-recording of personal events during the learning process. Finally, self-reflection is the third phase, where self-judgment and self-reaction occur for the learner. In self-judgment, learners evaluate themselves based on their performance on an activity, or their beliefs about why their actions occurred. Self-reaction on the other hand, is specifically related to the learners' satisfaction about their performance on a learning activity. In some cases, learners have defensive reactions, which

Zimmerman (2002) states, “refer to efforts to protect one’s self-image by withdrawing or avoiding opportunities to learn and perform” (p.68). Hence, this three-phase process illustrates the self-regulatory processes learners may engage in while learning using computer-assisted modules, creating a need for further research in how the self-regulatory processes are reflected in student actions during learning experiences.

Self-regulation relates to self-efficacy, where self-efficacy is described as students’ beliefs about their capability to perform classroom tasks, and beliefs that the classroom tasks are interesting and worth learning (Pintrich & De Groot, 1990). In their study assessing self-regulation and motivation in classroom academic performance of 173 seventh-grade students enrolled in science and English, Pintrich and De Groot (1990) found that self-efficacy had a positive relationship to cognitive engagement and student performance. In other words, students who demonstrated high self-efficacy, where students believed they were capable of achieving success, were more likely to be self-regulating, use metacognitive strategies, and persevere through difficult or unexciting tasks. Data were collected using the Motivated Strategies for Learning Questionnaire (MSLQ), a 56 item instrument measured on a 7-point Likert scale (Pintrich & De Groot, 1990). Pintrich, Smith, Garcia, and McKeachie (1993) explain that the MSLQ is, “a self-report instrument designed to assess college students’ motivational orientations and their use of different learning strategies for a college course” (p.801). This instrument, however, can be adapted for use with students of various age groups because Pintrich and De Groot adapted and used instrument with seventh grade students (Pintrich & De Groot, 1990).

Computer-assisted learning environments are designed with a self-paced instructional approach, therefore requiring students to monitor themselves and be intrinsically motivated (Weymer, 2002). Schunk (2008) describes intrinsic motivation as a desire to engage in an activity for no apparent reward except task engagement itself. Pintrich and De Groot (1990) determined that when students are motivated to learn for reasons other than achieving high grades and find the course content interesting and significant, they tend to be cognitively engaged in the learning process. Zimmerman (2002) explains that students who are especially interested in a specific subject area, who take pleasure in mastering the skills relevant to that particular subject, are more motivated to learn "in a self-regulated fashion" (p.68). Intrinsic motivation often leads to learners seeking challenges, demonstrating skills, and pursuing their interests, as they are motivated by their internal desires and curiosities (Reeve & Jang, 2006). Rewards that result from goals accomplished by intrinsic motivation are often the direct involvement with the activity or achieving the specific goal, rather than items or rewards provided as a form of bribery to accomplish a task. According to Rezabek (1995), this type of student-driven reinforcement leads to personal growth for the learner. As students hold varying levels of intrinsic motivation, learning with computer-assisted modules could pose detrimental effects for students who do not have high levels of intrinsic motivation. While the review of the literature indicates that self-regulation and intrinsic motivation are important for student learning and success, there is insufficient evidence regarding self-regulation and intrinsic motivation of students learning with computer-assisted modular curriculum. Further research is necessary to evaluate student motivation and cognitive engagement strategies in learning with computer-assisted modules.

Student motivation, achievement, engagement, and overall success in school is a result of the relationship between the teacher and the student (Reeve & Jang, 2006). Reeve (2006) explains that "when teachers nurture students' inner motivational resources, they find ways to coordinate the instructional activities they offer with students' preferences, interests, sense of enjoyment, sense of challenge, competencies, and choice-making" (p.229). Modules with preexisting curriculum potentially limit the extent to which teachers have the freedom to design their own curriculum and instruction. An evaluation of the computer-assisted modular learning environments is needed to determine if teachers are integrating activities that are not implemented through the modules. Furthermore, research is needed to evaluate students' reactions to learning using computer-assisted modular curriculum. Students' reactions will help evaluate how students respond to what they are learning; particularly if they are motivated to learn using the computer-assisted modules, as well as the degree of his or her engagement in the activities. In addition, further research that explores the relationship and level of interaction between the teacher and their students in a course designed with computer-assisted modular curriculum will provide insight into the possibility of the affect of computers on this phenomenon. Table 1 illustrates the relationship between the Phases and Subprocesses of Self-Regulation model, the theoretical framework for this case study, and the research methods for this case study.

Computer-assisted instruction and learning styles. Research to evaluate the relationship between learning styles and student achievement in computer-assisted learning environments using modular curriculum will be beneficial to identify if the learning needs of students are being met. Culbertson, Daugherty, and Merril (2004) found that for students participating in a computer-assisted modular learning environment, a significant difference did not exist in achievement gain among reading, language arts, mathematics, science, and/or social studies compared to students learning in a traditional setting. In contrast, a study conducted by Lynch, Steen, Pritchard, Buzzell, and Pintauro (2008), showed that the use of computer technology for food science instruction is beneficial for student achievement and the enhancement of learning, if the technology being used is designed appropriately. Technology should be used with a purpose and it must be created for use in the classroom with student learning in mind. Research investigating technology use in middle school science classes conducted by Reid-Griffin and Carter (2008), determined that technology became the mediator of the learning process. Students were able to maximize their own learning, and they had higher opportunities for learning as the responsibility to learn was handed to the students, rather than directed by the teacher (Reid-Griffin & Carter, 2008). Thus, further research will contribute to the exploration of student achievement in computer-assisted modular learning environments.

Lynch et al. (2008) found that despite student learning styles, students were still able to learn using technological resources, specifically a web-based program. While this may be true in some cases, there are instances where learning does not take place successfully. The GEFT is an assessment used to analyze if learners prefer a field dependent or field independent cognitive style. Schunk (2008) describes field dependence-independence as the extent that one depends on or is distracted by the context or perceptual field in which a stimulus or event occurs. In other words, field dependent-independent learners do not differ in learning ability, yet they might experience different responses to learning environments and content (Schunk, 2008). Using the GEFT assessment as one of his tools, Weymer (2002) determined that when learning in an environment with computer-assisted modules, students with low verbal ability, lack of background knowledge, and a preference for field dependent style were at a disadvantage. Thus, the claims of computer-assisted modular curriculum meeting the needs of diverse learners are questionable. As students contribute varying abilities, skills, and knowledge to the learning process, additional research that investigates learning style preference and success with computer-assisted modular curriculum is compulsory.

Summary

Agricultural education has experienced a metamorphosis in the requirements and expectations placed upon learners. As a result, the development of career pathways and the establishment of the No Child Left Behind Act of 2001, the design of agricultural education programs, curriculum, and instruction methods have evolved. Though there is research explaining these developments, the field of agricultural education is limited in studies investigating the impacts of these developments on students. Consequently, computer-assisted learning environments are the latest trend in teaching and learning. Computer-assisted learning environments suggest that learners will experience independent, self-regulated learning through modular curriculum. Yet, this is an area still in need of research, as only one significant study has been identified in this area for agricultural education.

Research conducted by Johnson and Deeds (2002) provided evidence that traditional versus computer-assisted agricultural education programs have been evaluated based on student knowledge and achievement within each type of course design. However, their research did not examine students' reactions to learning in computer-assisted modular environments, specifically in regards to the cognitive responses of students while engaged in learning with the modules. Since the research conducted by Johnson and Deeds (2002) is limited and was one of few studies conducted in this area, further research is necessary to examine students' response to learning with computer-assisted modular curriculum, including how students engage in learning and the cognitive skills they use while engaged in the learning process.

It has been identified that agricultural education programs are not the only courses adopting this teaching and learning tool, as industrial arts programs, among others, are also utilizing computer-assisted learning environments (Reed, 2001). Moreover, as these CTE course areas are integrating computer-assisted modules predominantly in middle schools, there are also some high school programs using this teaching and learning tool. Johnson and Deeds (2002) focused on high school level courses as they investigated computer-assisted versus traditional agricultural education curriculum. Thus, research evaluating middle grade agricultural education programs implementing computer-assisted modular curriculum is essential. In addition, after evaluating the literature, it is apparent that while there is research supporting the use of technology as an instructional tool, there is also evidence supporting the need for hands-on experiential learning through traditional teacher led instructional methods.

Self-regulation, self-efficacy, and intrinsic motivation have been identified as areas in education and psychology research related to computer-assisted learning environments. There is sufficient evidence to support the idea that students who are engaged in independent computer-assisted learning environments must be self-regulated and demonstrate other cognitive skills to contribute to their success. These skills were identified as outlined as part of the Phases and Subprocesses of Self-Regulation (Zimmerman, 2002; Zimmerman & Campillo, 2003). Also an area of significant importance is research on technology integration in secondary schools. Prensky (2001) identified the current generation of learners as "digital natives", explaining that these students enjoy using technology for learning because they are so proficient with it in general. It has not been identified, however, if this theory is true for students learning with computer-assisted modular curriculum.

By exploring the phenomenon of student cognitive responses to learning with computer-assisted modular curriculum, new information identifying the cognitive skills used by students during the learning process could provide great contributions to the design and further development of computer-assisted modules. The intention of this case study was to determine the cognitive processes students demonstrate while engaged in learning, and how student are using those cognitive processes to enhance the learning experience. More specifically, a goal of this study was explore how students engage in self-regulatory processes while learning with computer-assisted modules.

Chapter 3

Research Design and Methodology

The purpose of this study was to investigate the phenomenon of students' cognitive response to learning with computer-assisted modular curriculum. This triangulation mixed methods study connected quantitative data derived from curriculum content analysis and student course evaluations with qualitative data derived from participant observations, interviews, and additional document analysis. The reason for using both quantitative and qualitative data was to validate and confirm the qualitative findings with the quantitative findings. A middle school level agricultural education program designed with a computer-assisted learning environment served as the site. Middle school students enrolled in the course served as the participants. Three major questions guided the study:

1. How are the cognitive principles of teaching and learning implemented in the design computer-assisted modular curriculum?
2. How do students engage in the classroom learning process using computer-assisted modules?
3. How are students using self-regulatory processes while learning with computer-assisted modules?

Rationale for qualitative case study design. This was a single case study of one middle school agricultural education program where students in four sections of an Agriscience Explorations course were engaged in a classroom learning environment using computer-assisted modular curriculum. Each student who consented to participate served as a unit of analysis. This case did not propose to represent the responses of all students enrolled in computer-assisted modular curriculum in various grade levels or other CTE courses. Rather, this case focused on a specific agricultural education program using a single type of modular curriculum, targeting middle school level students.

Yin (2003) explains that case studies are used to, “contribute to our knowledge of individual, group, organizational, social, political, and related phenomena” (p.1). An additional strength of case studies, when compared to other research methods, is that a variety of evidence is provided through an array of techniques, such as interviews, observations, or document analysis (Yin, 2003). To capture the “lived experience” (Corbin and Strauss, 2008) of participants and their reactions to learning with computer-assisted modular curriculum, the process of interviewing provided opportunities for both formal, structured interactions with the participants, as well as informal conversation (Rossman & Rallis, 2003). Interviews provided rich descriptions of the ways students engage in cognitive processes while learning with computer-assisted modular curriculum. Observations, as defined by Rossman and Rallis (2003), include “formal, structured noting of events, activities, and speech…and participant observation” (p.172). Participant observation is especially beneficial in, “studying processes, relationships among people and events, the organization of people and events, continuities over time, and patterns…” (Jorgensen, 1989, p.12). These methods allowed the researcher to observe the daily flow of the classroom learning environment, while observing the individual participants as they engaged in learning tasks. Content analysis of the student activity book, computer software applications, and assessments, provided a background and foundation for understanding the module design with relevance to teaching and learning, specifically in terms of cognitive processes and self-regulatory skills expected of the learner.

The Research Design

Yin (2003) describes several theories relevant to case studies, including individual theory, which focuses on "individual development, cognitive behavior…and individual perception" (p.31). Since the purpose of this case study was to investigate student cognitive responses to learning, the Phases and Subprocesses of Self-Regulation model served as the theoretical framework of this case study, as it focuses on individual theory. Four sections of the same course in seventh and eighth grade agricultural education currently using computer-assisted modular curriculum provided the setting to observe students as they engaged in the learning process with computer-assisted modules. Since the students were actively using the modules for learning, they were ideal participants as their experiences were current and descriptive. Case studies are designed for "direct observation of the events being studied and interviews of the persons involved in the events" (Yin, 2003, p.8). Accordingly, the researcher determined that triangulation mixed methods would be the ideal method for combining a variety of data for validation purposes (Creswell & Plano Clark, 2007).

Quantitative data were collected through a content analysis of the computer-assisted modular curriculum and end of course evaluations. Qualitative data were collected through participant observations of the classroom learning environment, detailed interviews with the students, and additional document analysis. The quantitative and qualitative data were collected separately and analyzed concurrently (Creswell & Plano Clark, 2007). The researcher was able to "take two data sets and explicitly bring them together" in the interpretation of the data (Creswell & Plano Clark, 2007, p.83). Each of these methods of data collection provided a variety of data sources for triangulation of the evidence (Rossman & Rallis, 2003; Yin, 2003).

The methods of data collection for the study were grounded in the Phases and Subprocesses of Self-Regulation model. The content analysis evaluation form was developed based on elements of the Phases and Subprocesses of Self-Regulation model (Zimmerman & Campillo, 2003), as well as elements of an existing middle school science textbook evaluation from the American Association for the Advancement of Science (AAAS Project 2061, 2002). Participant observations were guided by the Phases and Subprocesses of Self-Regulation model, where the researcher identified self-regulatory skills and behaviors based on the model. Furthermore, the interview protocol was designed based on questions adapted from the Motivation Strategies for Learning Questionnaire (Pintrich & De Groot, 1990), as well as elements of the Phases and Subprocesses of Self-Regulation model.

Contacting the case study group. Upon receipt of IRB approval, on December 2, 2009, initial contact was made with the principal of the school. The researcher provided the principal with a general overview of the case study and a draft of the observation and interview protocol and consent forms. Once approval was granted by the principal, the researcher met with the principal and agriculture teacher to discuss the purpose and overview of the case study. This discussion included grade levels of the participants, scheduling of the courses, the module rotation schedule for each course section, review of the consent forms, review the draft interview protocol, as well as the proposed interview schedule. Upon approval from the principal and the agriculture teacher, the researcher shared a presentation with each class about the purpose of the study, and discussed informed consent. Consent forms (Appendix B) and a letter from the researcher (Appendix C) detailing an overview of the case study were sent home with the students, to be shared with the parents of all students enrolled in each section of the course. Participation of the students was contingent upon their return of signed assent forms (Appendix

D). Informed consent was also requested of the teacher (Appendix E) as it was necessary to document the interactions of the teacher with the participants as they engaged in learning with the computer-assisted modules.

Sampling and participant selection. Participation in this case study was based on the use of computer-assisted modular curriculum as part of the agricultural education program design in middle school. Therefore, the researcher was purposeful in selecting a school that utilized computer-assisted modular curriculum in their agricultural education program. Students enrolled in the program at this school were purposefully selected as the sample for this case study, as their experiences were relevant to the research questions (Schwandt, 2001).

Preliminary work. The *a priori* propositions proposed in Table 1 assisted the researcher in the planning and development of the interview guide and observation protocol. Yin (2003) explains that propositions can "reflect an important theoretical issue" or provide guidance in "where to look for relevant evidence" (p. 22). Thus, "each proposition directs attention to something that should be examined within the scope of the study" (Yin, 2003, p.22). Table 1 explains how the propositions are correlated with the participant interview guides and classroom observation protocol, as well as the supporting literature.

Table 1

a Priori Propositions

Proposition	Supporting Literature	Research Question	Interview Questions	Observation Guide
Computer-assisted modules integrate technology into the classroom as teaching and learning tool, creating a more social learning environment.	Over the past several years, Prensky (2001) points to the advancements of technology and the new generation of learners called "digital natives". Digital natives have grown up surrounded by technology in the digital age, thus they have preferences for learning with technology. Students use technology for socializing, finding information, or networking, by using computers, cell phones, iPods, and other mobile/handheld devices. Therefore, Prensky's literature explores the idea of students wanting to learn with technology because they are familiar with it and don't have the same attention span for traditional teaching methods.	1. How are the cognitive principles of teaching and learning implemented in the design of computer-assisted modular curriculum? 2. How do students engage in the classroom learning process using computer-assisted modules?	Describe what you thought about using the computer modules. -How do you feel about using these computers for learning? Is this your first time using computer modules? Describe a typical day using the computer modules in agriculture class. - How is your English or science class different from agriculture class? -How do the computer modules keep your attention? Describe the steps you take in order to complete a computer module. -What is the first thing you do when you start the computer module? -How difficult is the computer part of the module? -How long does it take for you to complete the computer part of the module? Why? -What do you do when you come across something you don't understand? How did you use the computers to help with your projects? What makes you want to complete the computer modules? What does the teacher do while you are working on the modules?	d. Are there behavior or classroom management issues that arise while students are using the modules? e. How are students completing the computer module? f. How are students interacting with the computers? Are there issues with the technology? g. What is the nature of the learning environment? c. When students talk to each other, are they talking about the class assignments or socializing about irrelevant topics? h. How are students motivated to complete the assignments with the computer module?

Table 1

a Priori Propositions Continued

Proposition	Supporting Literature	Research Question	Interview Questions	Observation Guide
Students must be intrinsically motivated and have high self-efficacy to accomplish learning tasks with computer-assisted modules successfully.	Self-regulation relates to self-efficacy, where self-efficacy is described as students' beliefs about their capability to perform classroom tasks, and beliefs that the classroom tasks are interesting and worth learning (Pintrich & De Groot, 1990). Computer-assisted learning environments are designed with a self-paced instructional approach, requiring students to monitor themselves and be intrinsically motivated (Weymer, 2002). Pintrich and De Groot (1990) determined that when students are motivated to learn for reasons other than achieving high grades and find the course content interesting and significant, they tend to be cognitively engaged in the learning process.	2. How do students engage in the classroom learning process using computer-assisted modules? 3. How are students using self-regulatory skills while learning with computer-assisted modules?	Is agriculture an easy or hard subject for you? Why? What grade do you expect to get at the end of this course? What topics in agriculture have you learned about so far? -How important are those topics to you? Describe what you thought about using the computer modules. -How do you feel about using computers in class? Did you work with a partner? If yes: -How many partners? -Have you helped each other with quizzes or other assignments? -How do you feel about taking the tests when your partner can see it? -When you were working with your partner, did you ever feel excluded or did it distract you? Did you get to pick your team? -How did you pick your team? -How did you keep your team on task? -How did you determine your role on the team? What do you do when you come across something you don't understand? What is the best part about learning with computer modules? What is the worst part about learning with computer modules? What motivates you?	a. Are students asking the teacher questions about the computer module assignments? b. Are students asking each other questions about the computer module assignments? h. How are students motivated to complete the assignments with the computer module?

Table 1

a Priori Propositions Continued

Proposition	Supporting Literature	Research Question	Interview Questions	Observation Guide
Students exhibit self-regulatory skills when learning with computer-assisted modules, such as self-questioning, note taking, goal setting, self-evaluation, attention focusing, task value, etc.	Schunk (2008) defines self-regulation as, "the process whereby students personally activate and sustain behaviors, cognitions, and affects, which are systematically oriented toward the attainment of learning goals" (p. 525).	3. How are students using self-regulatory skills while learning with computer-assisted modules?	How much time outside of class do you spend on agriculture class? What kinds of activities are you doing to study or complete assignments? -How do you study for quizzes or tests? -How do you go about completing homework assignments? -Which habits or skills work best to help you learn the material? How often do you receive feedback on assignments you have completed in this class? -Describe how the teacher provides feedback for class? -What kind of feedback is provided by the computer module? How do you feel when you complete assignments or projects? How do you know when you did well on a project?	a. What are students doing as they start the module and engage in learning? b. How. Long does it take before they begin the assigned activity? d. How are students setting learning goals? e. What are the expectations for completing assignments with computer modules? f. When do students take notes on the information they are learning from the computer modules? g. How are students receiving feedback during class?

Table 1

a Priori Propositions Continued

Proposition	Supporting Literature	Research Question	Interview Questions	Observation Guide
When students value what they are learning, they are more engaged in learning tasks.	Zimmerman (2002) explains that students who are especially interested in a specific subject area, who take pleasure in mastering the skills relevant to that particular subject, are more motivated to learn "in a self-regulated fashion" (p.68).	1. How are the cognitive principles of teaching and learning implemented in the design of computer-assisted modular curriculum? 2. How do students engage in the classroom learning process using computer-assisted modules? 3. How are students using self-regulatory skills while learning with computer-assisted modules?	How do you feel about what you are learning in this class? Why? How do you react when you are learning about topics you are not interested? How do you react when you are learning about topics you really like? What is the best part about learning with computer modules? What is the worst part about learning with computer modules? When you are interested, do you put forth more effort than when you are not interested? How do you apply the information you learn with the modules to everyday life?	c. Is student attention kept on the module throughout or are students distracted? a. Are students asking the teachers questions about the computer module assignments? b. Are students asking each other questions about the computer module assignments?

Pilot testing. The interview guide was pilot tested with two students who have experienced learning with computer-assisted modular curriculum, yet were not enrolled in the course in which this case study took place. The pilot test for the initial interview protocol took place one week prior to the first scheduled interview. As a result of the pilot test, the researcher was able to make modifications to the interview protocol based on feedback from the interviewees. Modifications included the addition of questions regarding (1) the number of modules completed in the course, (2) experiences in working with a partner, (3) feedback provided by the teacher, and (4) how course information is applied to everyday life. The curriculum content analysis evaluation form was also pilot tested by the researcher, who completed the initial content analysis. By completing the content analysis of the computer-assisted modules prior to the four agricultural education professionals, the researcher was able to assess the wording and accuracy of the questions when used to evaluate the modules.

Data Collection

Quantitative content analysis. The content analysis of computer-assisted modular curriculum was the preliminary step in data collection. Prior to engaging in classroom observations and interviews, the content analysis was developed to address the question of how the module design integrates teaching and learning principles based on the cognitive process of self-regulation, as well as to determine the content readability. Since reading was a key component of the computer-assisted modular curriculum, it was important to determine readability as student cognitive responses could be impacted by difficulties with reading or if the reading level was too easy. For this reason, readability was assessed using the Fry Graph, Flesch Reading Ease, and Flesch-Kincaid Grade Level formulas to determine the grade level difficulty and reading ease at which the content in the computer-assisted software applications and corresponding materials were designed.

The Fry Graph assesses readability based on semantics, which is the difficulty of the words based on word length, and syntax, which is the average number of words in a sentence (Fry, 1996). The Fry Graph was designed to assess readability of content from elementary school level up to college, making this assessment appropriate for middle school level content. In addition, the Fry Graph was created in and has been widely used since the 1960s as a readability assessment (DuBay, 2004). The Flesch Reading Ease is a measure determined by calculating a mathematic formula based on a 100-word segment of text, where the level of difficulty is based on results that fall on a scale of 0 to 100, zero being the most difficult and 100 being the easiest (DuBay, 2004). Derived from the Flesch Reading Ease is the Flesch-Kincaid grade level formula, which measures the grade level of a particular text based on a scale of 0 to 20. Both the Flesh Reading Ease and Flesch-Kincaid have been researched, utilized, and modified by the United States Navy (DuBay, 2004). Readability assessments are considered to have "a good level of objectivity" because "two different people or computers using the same formula will get the same score for the same book" (Fry, 2002, p.287). Moreover, this assessment "was validated with comprehension scores of primary and secondary school materials and by correlations with other formulas" (DuBay, 2004, p.45).

The content analysis instrument (Appendix F) was modified by the researcher based on the Phases and Subprocesses of Self-Regulation model and the American Association for the Advancement of Science (AAAS) Project 2061 middle grade science textbook evaluation. The AAAS Project 2061 evaluation was selected over other instruments because it was a benchmark-based tool developed specifically for middle school textbooks, designed from the National Research Council's National Science Education Standards. The instrument was utilized by a team of trained reviewers on a variety of science textbooks, which enhanced the reliability of the instrument (AAAS Project 2061, 2002). The researcher modified the existing AAAS Project 2061 evaluation to incorporate aspects of computer-assisted modular curriculum, technology, and self-regulation. Permission to use the AAAS Project 2061 evaluation materials can be found in Appendix G. The researcher requested that the modules to be evaluated were randomly identified by the module company to prevent researcher bias. The researcher requested and secured written permission from the company prior to the study (Appendix H). The instrument was first utilized by the researcher for the evaluation of the contents of the student activity book, the computer software applications, and assessments that correspond with each of the selected modules. Learning objectives, lesson summaries, computer module content, and questions throughout the student activity book and computer applications were among the content selected for evaluation. Four agricultural education professionals signed consent forms (Appendix I) and completed the content analysis for interrater reliability of the researcher's initial evaluation results. This process occurred at the same time observations began at the case study site.

Document analysis. The first group of students who completed the agriscience course were given course evaluations to describe their experiences within the class and with learning using computer-assisted modules. These evaluations were distributed in two formats, one that was a part of the module workbook to evaluate the specific module completed by participants, and a second that was a stand-alone hand-out rating the entire course. Since the documents were anonymous and did not identify students, the researcher was able to complete the document analysis using all evaluations from the first semester of students. The documents were reproduced into a Word document, and it was determined that quantitative style questions with yes-no or Likert scale responses would be analyzed using SPSS statistical software, and open-ended questions would be analyzed qualitatively using Atlas ti© coding software.

Participant observations. Observations of the classroom computer-assisted learning environment took place over the course of five weeks. This time period allowed the researcher to follow two groups of participants as they engaged in learning with computer-assisted modules. The first group of participant observations took place with two sections of seventh and eighth grade students for two weeks, as students completed their final round of learning with the computer-assisted modules for the semester. The second group of participant observations took place, also with two sections of seventh and eighth grade students, for three weeks. During the three-week period, the researcher observed the classroom learning environment for one week, during which time students were not engaged in learning with computer-assisted modules. This time period allowed the researcher to observe traditional instructional methods in this specific classroom without computer-assisted modules. The last two weeks of observations began as students engaged in learning with the computer-assisted modules for the first time in the course. From the researcher's experience of the first round of module observations and the traditional instruction observations, she was better informed as she engaged in the final set of observations with computer-assisted modules. Jorgensen (1989) states that, "participant observers generally keep a diary or log of activities in the field, unique experiences, and other matters of possible interest" (p.22). Thus, the researcher kept a daily journal of field notes based on the classroom observations. Only those students who returned consent forms were documented in the observations.

The researcher developed an observation guide based on the Phases and Subprocesses of Self-Regulation model. Observations were informed by the curriculum content analysis, which guided the researcher in specific behaviors to look for based the design of the modular curriculum. The observation guide can be found in Appendix J, and Table 1 illustrates the relationship between the literature and observation points of interest. The researcher paid special attention to: (1) students who raised their hands to ask questions and the types of questions they asked, (2) conversations between the teacher with students as well as between students, (3) disruptive behaviors and the rate at which they occurred, (4) the length of time students spent on their activities and how quickly they finished their assignments, (5) if students took notes or engaged in other self-regulatory processes during the computer-assisted piece of the module, and (6) other points of interest as they emerged through observations. The researcher was able to observe the group dynamic in the computer-assisted learning environment as a whole by sitting and observing from stationary points around the room. Additional observations were made while the researcher circulated the room as students began their assignments on the modules. This provided the researcher with the opportunity to hear the specific conversations among students and have a closer look at the behaviors of the students as they engaged in learning. As observations took place, the researcher noted specific behaviors, events, and situations relevant to the phenomenon, and created memos which were later used as a reference for further investigation in the case study.

Participant interviews. Yin (2003) explains that interviews are, "one of the most important sources of case study information" (p.89). Interviews were conducted with 36 participants. Some participants requested to conduct their interviews in pairs or groups of three, resulting in a total of 31 interviews. In working with middle school aged students, it was important for the researcher to establish rapport early on with the participants so they would feel comfortable sharing their experiences during interviews. Therefore, the researcher spent one week prior to the start of each round of interviews and observations engaging with the participants during normal classroom activity. The interview protocol was developed based on the Phases and Subprocesses of Self-Regulation model, as well as the Motivation Strategies for Learning Questionnaire (MSLQ). The interview guide can be found in Appendix K. The interview questions were designed with an "open-ended nature" (Yin, 2003, p.90), wherein participants were able to respond to the questions by explaining their opinions, perceptions, and experiences of events as they related to the phenomenon. The researcher developed interview questions based on the Phases and Subprocesses of Self-Regulation model in order to investigate the question of how students use self-regulatory skills in the learning process with computer-assisted modules. Zimmerman and Campillo (2003) explain that "self-regulation models seek to explain students' proactive efforts to acquire knowledge…" (p.238). Thus, this model was selected as the three phases connect with the phases of learning with computer-assisted modules: (1) the start of the module and preparing to learn, represented by characteristics of the forethought phase, (2) the process of learning during the module, represented by the characteristics of the performance phase, (3) and the end of the module when the activities are completed, represented by the self-reflection phase.

The MSLQ was originally developed as "a self-report instrument designed to assess college students' motivational orientations and their use of different learning strategies for a college course" (Pintrich, Smith, Garcia, and McKeachie, 1993, p.801). The MSLQ consists of questions focused on motivational beliefs such as self-efficacy, intrinsic value, as well as self-regulated learning strategies and test anxiety, which is why this instrument was selected as a model over other instruments (Pintrich and De Groot, 1990). Pintrich and DeGroot (1990) utilized the MSLQ in a study assessing self-regulation and motivation in classroom academic performance of seventh-grade students, thus it was determined that the MSLQ would be an appropriate framework for interview questions to be adapted and used with middle school students in this case study. Questions from the MSLQ were identified as they related to the cognitive responses of learners including self-regulatory processes, their values for learning and content of the lessons, motivation, as well as how they view themselves as learners. The researcher adapted the relevant questions to fit the purpose of this case study as it relates to the phenomenon of student cognitive responses to learning with computer-assisted modular curriculum. Questions regarding the computer-assisted learning environment were developed by the researcher and incorporated into the interview protocol.

The first round of interviews was conducted with the first group of participants upon completion of their final module rotation, enabling participants to explain their experiences based on a complete course experience using at least two computer-assisted modules. Additionally, students gained the experience of multiple content areas within the subject of agriculture, in addition to a variety of learning activities, thus limiting bias and providing students with a rich experience. The second group of participant interviews was conducted upon completion of their first module experience within the course, where participants were able to describe their experiences using the modules for the first time in the course based on one module rotation. Participant interviews at the beginning and end of the module experience allowed the researcher to explore perspectives of learners at different points of the course and curriculum. The interview protocol was designed for a fifteen-minute timeframe. Upon completion of the interviews, the researcher provided the participants with the themes as they arose during preliminary analysis, thus providing the researcher with participant feedback. As previously referenced, the pilot test allowed the researcher to make necessary changes to the initial interview protocol based on feedback from the interviewees. Classroom observations and the difference in the content of the modules from the first two course sections to the second two course sections, informed the researcher's decision to add and remove relevant questions from the interview guide. This second round of modifications added questions relevant to (1) the difference in the design of the modules and activities, (2) motivation to complete assignments, and (3) self-reflection on the completion of projects. Questions regarding assessments were not as relevant for the second round of interviews due to the difference in module content.

Data Analysis

The purpose of this study was to investigate the learning behavior responses, including self-regulatory processes, which students demonstrated as they engaged in learning with computer-assisted modules based on the Phases and Subprocesses of Self-Regulation model. The process of data analysis began as data were collected and followed the constant comparative method, wherein the process involved "joint coding and analysis" (Glaser and Strauss, 1967, p.102). By using this method, the researcher was able to "differentiate one category/theme from another and to identify properties and dimensions specific to that category/theme" (Corbin and Strauss, 2008, p.73). The researcher kept a research journal during her five weeks in the field to record classroom observations and her perceptions of the phenomenon, which helped develop a path for data analysis. The journal was valuable in providing the researcher with guiding notes throughout data analysis. Furthermore, the classroom observations recorded in the journal provided a guide in developing categories. As transcription of the observations and interviews took place, the researcher created memos based on her reactions and interpretations of the data.

Express Scribe© transcription software was used during the transcription of 31 interviews resulting in 99 pages of interview transcripts. Observations from the researchers' journal of field notes were also typed and stored for further analysis, resulting in 62 pages of observation data. Memos were created throughout the transcription process to make note of themes, categories, and reactions as they emerged. Atlas ti© software was then used to store, code, and categorize the observations, transcripts, and qualitative document analysis data. The researcher analyzed the field notes and observations, transcripts, and course evaluations for themes as they emerged from the data. Data were analyzed using several tools for qualitative inquiry, including the use of questioning, meanings of a word, and the emotions that are expressed (Corbin and Strauss, 2008). Themes were derived from the coded and categorized data, which were used to guide further analysis.

Trustworthiness, Reliability, and Validity

The triangulation mixed methods design of this case study ensured the "criterion for validity has been met" by using at least three methods of data collection (Schwandt, 2001, p. 257). Participants in four sections of the same course in the same grade level were observed and interviewed, allowing the researcher to delve deep into the phenomenon with two groups. Furthermore, the use of four methods for data collection was incorporated into this case study to enhance the reliability of the research findings and address the issue of construct validity.

Content analysis. Four professionals volunteered to assist the researcher in completing the content analysis procedure to determine interrater reliability. The researcher conducted the initial content analysis and over the course of two weeks, the volunteers completed the same content analysis evaluation. Interrater reliability, also referred to as intercoder reliability, is a method used to determine if the "independent coders evaluate a characteristic of a message or artifact and reach the same conclusion" (Lombard, Snyder-Dutch, & Camapanella Bracken, 2004, p. 2). The goal of interrater reliability was to determine the level of agreement among participants for each item of the content analysis evaluation forms in measuring computer-assisted modular curriculum. Interrater reliability of the content analysis was based on Cohen's Kappa, which identifies three assumptions for the coefficient agreement among items. The assumptions include (1) independent units, (2) categories measured on nominal scales that are mutually exclusive, and (3) judges functioning independently (Cohen, 1960). In this case, the content analysis evaluation form had independent sections and items, where the categories could be measured on a nominal scale. Each item and section is mutually exclusive of one another, and during the content analysis, participants evaluated the modules independently. Thus, Cohen's Kappa was an ideal measure of interrater reliability for this particular case. Cohen's Kappa, however, has a limitation of measuring reliability among two raters. Since the analysis included five raters, intraclass correlation (ICC), a form of Cohen's Kappa, was selected to measure reliability.

Interclass correlation measures the differences among raters (Howell, 2007). The raters in this case are considered fixed, because they were not randomly selected and were "the only judges of interest" (Shrout & Fleiss, 1979, p. 421). Since the raters are fixed, the two-way mixed model was the appropriate measure of analysis. By interpreting the average measure of reliability, intraclass correlations for the average mean of the raters can be determined (Shrout & Fleiss, 1979), and this was accomplished using SPSS statistical software. Landis and Koch (1977) identified a range for the strength of agreement of Cohen's Kappa, where "0.41 to 0.60 is moderate, 0.61 to 0.80 is substantial, and 0.81 to 1.00 is almost perfect" (p. 165). The correlations for both modules A and B had ICC average measures of 0.56 and 0.61, respectively. The raters were in agreement with interclass correlations ranging from 0.33 to 0.96.

Researcher Bias and Limitations

Insider/outsider considerations. The researcher holds both the insider and outsider stance. As an insider, the researcher was a former agricultural teacher and had an understanding of how agricultural education programs operate including strong knowledge of the course content and curriculum. However, the researcher's teaching experience came from a traditional agricultural education program that did not have computer-assisted modules. Therefore, as an outsider, the researcher was able to enter the computer-assisted learning environment and "overview a scene, noting major and distinctive features, relationships, patterns, and events"

(Jorgensen, 1989, p.56) as they emerged through participant observations. A journal was utilized by the researcher during her time in the field to record her reactions to the computer-assisted learning environment. The journal helped the researcher create an awareness of possible biases towards the phenomenon, which was useful during data analysis.

Limitations. This was a case study of middle school level students in a computer-assisted learning environment using modules from a particular company. Thus, this study has several limitations. Since middle school students were on an elective wheel rotation where they have more than one elective course in a school year, some participants already experienced learning with computer-assisted modules in other courses prior to the case study setting. This is a limitation to the study because those participants may have had preconceived opinions of computer-assisted modular curriculum from their other elective courses coming into the agriculture program, which could influence their responses during the interviews. Furthermore, the agricultural education program was designed with computer-assisted modular curriculum from a particular company. Therefore, a limitation exists in that the findings of this study do not apply to agricultural education computer-assisted modular curriculum products from other companies.

Summary

This chapter described the rationale for qualitative case study design and methodology for investigating student cognitive responses to learning with computer-assisted modular curriculum. Three methods for data collection were selected to address each question, including curriculum content and document analysis, participant observations, and participant interviews, and a description of the methods for each was explained in this chapter. Finally, this chapter explained the rational for sampling, the process for data analysis, reliability of the findings, and researcher bias and limitations of the study.

Chapter 4

Findings: Quantitative Content and Document Analysis

The purpose of this study was to investigate the phenomenon of student cognitive responses to learning with computer-assisted modular curriculum. This triangulation mixed methods study connected quantitative data derived from curriculum content analysis and student course evaluations with qualitative data derived from participant observations, interviews, and additional document analysis. The reason for using both quantitative and qualitative data was to validate and confirm the qualitative findings with the quantitative findings. A middle school level agricultural education program designed with a computer-assisted learning environment served as the case study site. Middle school students enrolled in the course served as the participants. The qualitative findings will be further discussed in Chapter 5. Three major questions guided the case study:

1. How are the cognitive principles of teaching and learning implemented in the design computer-assisted modular curriculum?
2. How do students engage in the classroom learning process using computer-assisted modules?
3. How are students using self-regulatory processes while learning with computer-assisted modules?

Data for this case study were collected through a content analysis of the computer-assisted modular curriculum, participant observations, participant interviews, as well as a document analysis of end of course evaluations. Data for the content analysis were collected using an adapted version of the AAAS Project 2061 middle grades science textbook evaluation form (AAAS Project 2061, 2002). Participant observations were noted in a field journal, and interviews were digitally recorded. The data were then transcribed and coded for further analysis.

Content Analysis

A content analysis of two computer-assisted modules, Module A and Module B, was conducted to determine how the cognitive principles of teaching and learning were implemented in the design of computer-assisted modular curriculum. Four agricultural education professionals participated in the content analysis, in addition to the evaluation completed by the researcher. The categories and criteria presented within the content analysis evaluation are ranked on a scale of poor (0, 0.5, 1), fair (1.5), satisfactory (2), very good (2.5) and excellent (3). The results of the content analysis were compiled and a means analysis was conducted to determine interrater reliability, where the average rating for each item among raters was measured. Findings are described in Table 2 based on the instructional categories as listed on the content analysis evaluation form.

Table 2

Mean Scores for Modules A and B

	Module A			Module B		
Instructional Categories	*M*	*SD*	95% CI	*M*	*SD*	95% CI
Providing a sense of purpose						
Conveying unit purpose	1.20	0.57	[0.49, 1.91]	1.30	0.27	[0.96, 1.64]
Conveying lesson purpose	1.40	0.55	[0.72, 2.08]	1.50	0.35	[1.06, 1.94]
Justifying activity sequence	1.90	0.55	[1.22, 2.58]	1.70	0.67	[0.87, 2.53]
Encouraging students to set learning goals	1.00	0.61	[0.24, 1.76]	1.30	0.67	[0.47, 2.13]
Attending to intrinsic value and interest	2.10	0.55	[1.42, 2.78]	2.30	0.67	[1.47, 3.13]
Taking account of student ideas						
Attending to prerequisite knowledge and skills	1.10	0.65	[0.29, 1.91]	1.00	0.61	[0.24, 1.76]
Addressing commonly held ideas	0.60	0.82	[-0.42, 1.62]	0.80	0.57	[0.09, 1.50]
Encouraging use of task strategies	1.60	0.55	[0.92, 2.28]	1.90	1.19	[0.42, 3.38]
Engaging students with relevant Phenomena						
Providing a variety of phenomena	1.10	1.34	[-0.57, 2.77]	1.70	0.97	[0.49, 2.91]
Providing vivid experiences	1.00	1.04	[0.01, 2.59]	1.90	0.22	[1.62, 2.18]
Captures attention	1.00	1.10	[0.34, 3.06]	2.00	0.50	[1.38, 2.62]
Providing audio and visual multimedia	2.00	0.35	[1.56, 2.44]	2.00	1.06	[0.68, 3.32]
Developing and using scientific ideas						
Introducing terms meaningfully	1.60	0.82	[0.58, 2.62]	1.60	0.82	[0.58, 2.62]
Representing ideas effectively	1.70	0.91	[0.57, 2.83]	2.10	0.42	[1.58, 2.62]
Demonstrating use of knowledge	1.60	0.82	[0.58, 2.62]	1.40	0.96	[0.21, 2.59]
Providing practice	1.70	0.91	[0.57, 2.83]	1.50	0.61	[0.74, 2.26]

Table 2

Mean Scores for Modules A and B Continued

	Module A			Module B		
Instructional Categories	*M*	*SD*	95% CI	*M*	*SD*	95% CI
Promoting student thinking about phenomena, experiences, and knowledge						
Encouraging students to explain their ideas	0.80	0.91	[-0.33, 1.93]	0.80	0.91	[-0.33, 1.93]
Guiding student interpretation and reasoning	1.20	0.67	[0.37, 2.03]	1.30	0.76	[0.36, 2.24]
Encouraging students to think about what they've learned	0.50	0.50	[-0.12, 1.12]	0.80	0.76	[-0.14, 1.74]
Encouraging self-evaluation of knowledge and comprehension	1.40	0.42	[0.88, 1.92]	1.60	0.65	[0.79, 2.41]
Assessing progress						
Aligning assessment to goals	1.50	0.94	[0.34, 2.66]	2.00	0.50	[1.38, 2.62]
Testing for understanding	0.80	0.76	[-0.14, 1.74]	1.30	0.57	[0.59, 2.01]
Tracking of time on task	0.80	0.91	[-0.33, 1.93]	0.60	0.82	[-0.42, 1.62]
Summary of content and learning objectives	1.00	0.61	[0.24, 1.76]	1.30	0.91	[0.17, 2.43]
Providing feedback throughout	0.40	0.65	[-0.41, 1.21]	0.60	0.65	[-0.21, 1.41]
Opportunities to pause, skip ahead, or refer to a previous screen	1.10	1.08	[-0.25, 2.45]	0.80	0.76	[-0.14, 1.74]

Note. M = mean; SD = standard deviation; CI = confidence interval. Items on the content analysis evaluation for are evaluated on a scale of 0 to 3, where 0 = poor; 0.5 = poor; 1 = poor; 1.5 = fair; 2 = satisfactory; 2.5 = very good; 3 = excellent.

Providing a sense of purpose. The purpose of this section was to determine if the module curricula clearly identified a purpose, and if the purpose was meaningful to learners. The sequence of lessons and activities were also critical to this category. Each module presented a unit introduction, purpose, lesson objectives, and key terms for each lesson within the module. Based on the evaluation criteria, a sense of purpose is created when the information creates motivation for learning, indicates a need for learning, and ties all of the information together, and according to the raters, these qualities were lacking from the modules (M = 1.20 for Module A and M = 1.30 for Module B). Key terms were always available to learners as the glossary button provided easy access throughout the modules. Each daily lesson ended with a conclusion, which consisted of a restatement of the learning objectives from the lesson. However, upon completion of each module, there was no summary or review as the modules simply ended with the last day of activities for the last lesson. One participant identified this as an issue during her interview, which is further described in Chapter 5.

Module A (M = 1.90) was clearer in the sequence of lessons and activities compared to Module B (M = 1.70). Module B contained a great deal of information without clear transitions between the content. One daily lesson in particular switched between three topics without any transitions or reviews. While the topics related to the same content area, there was no clear relationship or rational for discussing them together within that lesson. In terms of self-regulation through student learning goals, interest, and intrinsic value, opportunities for students to set their own learning goals were not available. This was the lowest ranked category for Module A (M = 1.00). Though lesson objectives were clearly stated at the start of each lesson, the modules did not include an opportunity for students to determine personal learning outcomes. The student workbook activities did include a goal-setting activity as part of one of the lessons, yet goal-setting in this case, was related to lifelong goals corresponding with the content for the lesson, and not goals for the specific outcomes of the learning experience.

Taking account of student ideas. The instructional categories emphasized in this section focused on the preexisting knowledge that students bring to a learning experience. Specifically, this area examined how the modules address the ideas learners have towards the subject matter and how those ideas shape the learning process. The content analysis evaluation indicated three criteria for this category, including attending to prerequisite knowledge and skills, addressing commonly held ideas, and encouraging the use of task strategies. The modules did not attempt to access the background knowledge of learners through any means other than the brief introduction at the start of the module. There was no indication of any necessary prerequisite knowledge requirements for learners to complete the assignments. The modules presented important information related to relevant agricultural issues, but there was no explicit connection between the content in the module and the ideas students may hold towards those issues. Modules A and B had the lowest means of 0.60 and 0.80, respectively, in the category for addressing commonly held ideas.

Additionally, the self-regulatory skill of task strategy use was not sufficiently addressed through the modules ($M = 1.60$ for Module A and $M = 1.90$ for Module B). Due to the technological design of the module software, it was challenging to engage in task strategies such as taking notes or reviewing content. The modules paused after each video and screen presentation; however learners were unable to pause while the presentation is occurring. In some cases, information would flash on the screen and then disappear. Rather than staying on the screen for the learner to refer to throughout that particular screenshot, it disappeared after it was discussed, making it difficult for the learner to take notes or mentally rehearse the information. Finally, the modules did not incorporate activities throughout, as only a small portion of the modules were interactive, interactive meaning students could click on links to see or hear information, not interactive in completing assignments or entering information. Examples and demonstrations for activities were presented in the module videos; however the activities themselves were strictly hands-on, not included in the computer component, and/or completed through the student workbooks. Thus, the computer portion of the module provided few opportunities for practice of the skills or knowledge application.

Engaging students with relevant phenomena. The purpose of this section was to evaluate "whether the curriculum material relates important scientific ideas to a range of relevant phenomena and provides either firsthand experiences with the phenomena or a vicarious sense of phenomena that are not presented firsthand" (AAAS Project 2061, 2002). Thus, Module B was rated the highest in providing a variety of phenomena with a mean of 1.70, and 1.90 for providing vivid experiences. The modules provided vivid experiences as the laboratory activities that correspond with the modules, for the most part, provided a variety of learning experiences to support the content presented in the module. The examples, images, and activities supported the key ideas and were directly related to the topics. However, despite the integration of these features, the computer portion of the modules was weak in capturing attention, as Module A had a mean of 1.00 and Module B with 0.50. The images appeared to be out of date, and did not appropriately represent the content in some areas.

Overall, both Modules A and B had a mean of 2.00 for providing audio and visual multimedia. While the modules did present learners with a variety of images, audio, videos and multimedia features, there were still areas of weakness. The information as it was presented in the computer portion of the modules did not appear to be efficiently designed for a variety of learners. For example, the modules contained very little reading material. The only text content provided in the modules was in the form of bullets, definitions, and short summaries of the narrated information. The majority of information was presented as audio recordings supported by images and videos. Thus, the audio information did not align with the visual information, as the audio information often went into greater detail than the text information as it appeared on the screen. In assessing the student workbook materials, reading was also limited to assignments including lab exercises and worksheets. Between the two modules, computer software and student workbooks, true reading assignments were not included. Therefore, students who enjoy reading, or who learn best when the text is visually available to follow along with audio, may become disengaged or at a disadvantage if they do not have access to such tools. Participants described their perceptions of these issues, which are further described in Chapter 5.

Developing and using scientific ideas. The instructional categories in this section focused on determining how the curriculum materials present information in a way that the key ideas are useful, applicable, and easily accessible for future learning experiences. The modules were rated fair in introducing terms meaningfully (M = 1.60 for Modules A and B). Key terms were clearly introduced at the start of each lesson, and then referenced throughout the lesson where applicable, though they were not presented in a way that created a need for learning the information. In terms of representing ideas effectively, Module A (M = 1.70) included a particular lesson that presented the information, but did not include a corresponding activity to reinforce the content. The corresponding activity was to finish incomplete assignments from previous lessons. Thus, this particular lesson did not provide learners with the opportunity to apply or practice the new knowledge. Aside from this issue, in the demonstration of the use of knowledge, Module A(M = 1.60) was rated fair due to the step-by-step demonstrations of the accompanying activities, as well as a variety of activities for learners to apply new knowledge, though there is room for improvement in this area since Module B was rated poor (M = 1.40). In providing practice, the modules were rated fair (M = 1.70 for Module A and M = 1.50 for Module B). The computer component did not incorporate any opportunities for practice, thus the majority of practice was integrated through the hands-on components.

Promoting students' thinking about phenomena, experiences, and knowledge. The purpose of this section was to evaluate how the modules provide learners with experiences necessary for conceptual change, such as time, guidance, and opportunities for "making sense of the experiences and ideas" (AAAS Project 2061, 2002). This section specifically evaluated how the curriculum materials encouraged learners to express, think about, and reshape their ideas (AAAS Project 2061, 2002). Both modules were rated poor (M = 0.80 for Modules A and B) in encouraging students to explain their ideas. The computer component did not relate to the learners or encourage the expression of the learners' ideas, nor did they encourage students to represent their ideas in their own way. The corresponding activities were extremely guided with little room for learners to personalize the activities. The modules appeared to present information using direct instructional methods versus a learner-centered approach. In learner-centered environments "learners construct their own meanings, beginning with the beliefs, understandings, and cultural practices they bring to the classroom" (Donovan, Bransford, & Pellegrino, 1999, p.136). Thus, the modules were not learner-centered in the sense that students were rarely able to express themselves or explore their own ideas. Even so, the modules could be interpreted as learner-centered as they were designed for completion of activities with minimal guidance from the instructor, in a social learning environment.

In guiding student interpretation and reasoning, the modules were rated poor with the mean for Module A being 1.20 and Module B as 1.30. The tasks were specific and generally relevant to the content, however, there appeared to be a disconnect between prior knowledge and the new information. The content in the modules was not scaffolded in that the lessons and activities did not build upon each other. Each lesson had a specific activity, making the tasks separate. Some participants found this to be helpful in reducing cognitive load, as described in

Chapter 5. The modules, unfortunately, did not encourage students to think about what they had learned, especially for the computer component. The information was presented quickly and did not incorporate time for reflection, thus Module A has a mean of 0.50 and Module B has a mean of 0.80, a rating of poor for encouraging thinking. As the information was rushed and quickly moved to the activity, there was little time for learners to process the information presented by the computers. The student workbook offered journal writing as a supplementary activity where learners could write about what they had learned in a particular lesson. However, this activity was optional at the discretion of the teacher. Finally, the modules included pretests and posttests, as well as daily response assessments to allow learners to self-evaluate their knowledge and comprehension. However, the modules lacked other methods of evaluation throughout the computer component, such as questions or activities to encourage students to assess their learning throughout the module experience.

Assessing progress. This section was designed to evaluate if the curriculum materials included a variety of assessments that align with the key ideas as they are presented, and Module B (M = 2.00) received a satisfactory rating for this category. Each module included a pretest, posttest, daily quiz, as well as the activities within the student workbook. The pretests and posttest questions reappeared throughout the daily quiz assessments. This meant the students saw the questions the first time when they took the pretest, throughout the daily assessments, and then a third time on the posttests. All questions were multiple choice, with the exception of a written response question with each daily assessment. Aside from these methods, the modules did not integrate questions to check for understanding or other assessment methods through the multimedia application. In addition, exclusive from the hands-on components, opportunities for learners to express their own ideas and demonstrate true problem solving and critical thinking while using the computer component were limited. This issue is critical because the repetition of assessment questions promotes the memorization of test questions rather than deep learning for understanding or conceptual change. In this case, the hands-on activities would serve as a more beneficial assessment tool when compared to the pretests and posttests.

The modules did not track time on task (M = 0.80 for Module A and M = 0.60 for Module B) while learners were working with the computer component. There was a clock that appeared on the screen when students began the hands-on activities; however there was no explanation behind the purpose of the clock screen. It was simply a clock and did not include a timer for tracking time on task. The learner could simply click on next once the clock appeared to end the module. Furthermore, since the modules lacked sufficient reviews or summaries (M = 1.00 for Module A and M = 1.30 for Module B) at the end of each lesson, students were not provided with the opportunity to thoroughly assess what had been learned during the lesson. Feedback received the lowest rating with Module A having a mean of 0.40 and Module B with a mean of 0.60. Since the modules did not integrate learning activities, feedback was missing from the computer component altogether, thus the modules were rated poor in providing feedback.

Module A (M = 1.10) and Module B (M = 0.80) received poor ratings for multimedia design based on the ease of navigation and inability to skip ahead, pause, or refer back to a previous section. If the learner wanted to refer back to a previous section, the back button allowed this action. However, to move ahead to the previous screen where the learner left off, the next button does not allow for skipping. The learner must watch each screen again until he or she reaches the point in which they left off. There was no button for pausing during the presentation, though each screen pauses when the audio/visual component is complete. Therefore, it is the responsibility of the learner to press the next button to continue. The benefit is that the learner can take notes or ask questions during that pause. A disadvantage, however, is that there is no pause during the presentation and to review the information, the learner would have to watch the entire presentation multiple times.

While each screen in each lesson within the module was equipped with a next and back button, only certain sections within each lesson allow the learner to skip ahead before the presentation for the screen has been completed. For instance, one of the screens that offered the next option was an explanation of a particular concept including images and visual representations, and by selecting next, the learner was able to move on without completely watching or listening to the information. Unfortunately, this issue creates a gap among learners. Those who decide to move on miss important information gained by those who decide to complete the screen. Some screens that may be equally or less important do not allow the next feature before all information for the screen has been presented and there was no clear rationale for this feature.

Readability

Readability was measured using three instruments, including the Fry Graph, Flesch-Kincaid, and Flesch Reading Ease. The text identified within Modules A and B was not intended to be read for comprehension or literacy. Rather, the text was presented to be informative, in the form of bullets, outlines, or short paragraphs. A narrated voice explained the content for the particular screen by reciting most of the text as shown on the screen, but also adding information to thoroughly explain the information. The content on the screen did not always completely match the audio information. Therefore, in order to calculate the readability of the modules, it was necessary to sample text from a variety of corresponding screens and lessons within a module to determine the average readability for the entire module. According to the Fry Graph, Module A rated 10th grade level and Module B rated 11th grade level. Using the Flesch-Kincaid formula, Module A rated 8th grade level and Module B rated 10th grade level. By using the Flesch Reading Ease formula, Module A rated 58.73, which is a reading ease of fairly difficult, and Module B rated 49.80, a reading ease of difficult. These results indicated that the computer modules as a whole, on average, have readability scores above the intended grade level of seventh or eighth grade.

Document Analysis

The quantitative data from the document analysis consisted of two questions on the course evaluation. The course evaluation was developed by the teacher and completed by students upon completion of each module and at the end of the course. The questions analyzed in Table 3 asked participants which modules they completed, what they liked most and least about each module, and the rating of each module on a Likert scale of 1 to 5 (1 = Strongly Disliked, 2 = Disliked, 3 = OK, 4 = Liked, 5 = Strongly Liked). To account for missing values, where participants partially answered the questions by leaving off a rating response, the researcher assigned 6 to missing values labeled n/a (6 = n/a). SPSS statistical software was used to analyze the data using frequency analysis for each individual module.

Table 3

Attitudes towards the Modules Used by Students during Agriscience Class

Attitudes Towards Modules				
Module	Rating	Frequency	Percent	Valid Percent
Animal Science	Strongly Disliked	1	3.4	3.4
	Disliked	2	6.9	6.9
	OK	4	13.8	13.8
	Liked	10	34.5	34.5
	Strongly Liked	8	27.6	27.6
	n/a	4	13.8	13.8
	Total (N)	29	100.0	100.0
Plant Science	Strongly Disliked	1	3.6	3.6
	OK	6	21.4	21.4
	Liked	12	42.9	42.9
	Strongly Liked	7	25.0	25.0
	n/a	2	7.1	7.1
	Total (N)	28	100.0	100.0
Aquaculture	Strongly Dislike	3	11.5	11.5
	Dislike	3	11.5	11.5
	OK	5	19.2	19.2
	Like	7	26.9	26.9
	Strongly Like	5	19.2	19.2
	n/a	3	11.5	11.5
	Total (N)	26	100.0	100.0

Table 3

Attitudes towards the Modules Used by Students during Agriscience Class Continued

Attitudes Towards Modules				
Module	Rating	Frequency	Percent	Valid Percent
Soil Science	Strongly Disliked	1	3.6	3.6
	Disliked	1	3.6	3.6
	OK	2	7.1	7.1
	Liked	15	53.6	53.6
	Strongly Liked	6	21.4	21.4
	n/a	3	10.7	10.7
	Total (N)	28	100.0	100.0
Food Science	Strongly Disliked	2	6.9	6.9
	Disliked	2	6.9	6.9
	OK	4	13.8	13.8
	Liked	9	31.0	31.0
	Strongly Liked	7	24.1	24.1
	n/a	5	17.2	17.2
	Total (N)	29	100.0	100.0

Animal science. Twenty-nine students turned in course evaluations for the animal science module. Of the 29 students, 3.4% strongly disliked the module. Students who strongly disliked this particular module did not specifically indicate what they disliked about it. However, of the 6.9% of students who indicated that they disliked the module, they specifically disliked the aspects of the work and expressed a lack of teamwork when completing activities with a partner. The module was rated OK by 13.8% of students, as they enjoyed the hands-on activity of making butter, but disliked the assessments and various aspects of the work. Most students liked the module (34.5%) and especially enjoyed the hands-on activities. Students (26.6%) strongly liked the animal science module, as they agreed that the module was fun and enjoyed the hands-on activities. For this module, 13.8% of students did not indicate a rating.

Plant science. Twenty-eight students submitted course evaluations for the plant science module. In the area of strongly disliked, 3.6% of students selected this rating but did not specifically indicate the aspects of the module disliked the most. There was no indication of students who disliked this module. The module was rated OK by 21.4% of students, who expressed that they preferred the hands-on activities such as making popcorn, but did not particularly enjoy watching the videos and some of the associated work. The majority of students (42.9%) who engaged in learning with the plant science module liked the module experience. Students who liked this module enjoyed the experiments and hands-on activities, such as growing plants. Twenty-five percent of students strongly liked the plant science module because they felt it was fun, preferred the experiments, and enjoyed eating popcorn. A total of 7.1% of students did not indicate a rating for this module.

Aquaculture. Twenty-six students completed course evaluations for the aquaculture module. Of the twenty-six students, 11.5% strongly disliked this module because of the content and associated experiments, such as examining microscope slides. Similarly, 11.5% of students disliked the aquaculture module, mostly because of the tests and amount of work. The module was rated OK by 19.2% of students, as they liked the experiments and ability to work with a partner, but disliked some of the work. Of the students who completed this module, 26.9% liked their experience, as they liked the experiments involving fish. Students who strongly liked the module (19.2%) also liked working with fish and preferred the experiments. A total of 11.5% of students did not indicate a rating for this module.

Soil science. Twenty-eight students completed course evaluations based on their experiences learning with the soil science module. Of the twenty-eight students, 3.6% strongly disliked this module, mostly because of the tests. Of the 3.6% of students who disliked this module, they disliked the experience because of the lack of teamwork faced with the partner. The soil science module was rated OK by 7.1% of students. Some students felt that this module lacked difficulty and expressed that as something they liked, but also felt the module was rushed and explained they disliked the lack of time. Other students who thought this module was OK enjoyed the edible activities but did not enjoy watching the videos. Students (53.6%) liked the soil science module more than any other module. Students unanimously enjoyed making and eating pudding from the soil profile activity. There were 21.4% of students who strongly liked the soil science module. Students strongly liked this module because of the abundance of hands-on activities and experiments. A total of 10.7% of students did not indicate a rating for this module.

Food science. Twenty-nine students completed course evaluations based on their experiences learning with the food science module. A total of 6.9% of students strongly disliked their experience with this module, though they did not indicate what was specifically disliked about this experience. Also, 6.9% of students disliked the food science module, because it was difficult to understand, and because of the activity involving bacteria. The module was rated OK by 13.8% of the students, who liked food science because of the experiments involving edible food products, but were not fond of the module due to some of the assignments. Thirty-one percent of students liked the food science module because of the cooking and food. Students

(24.1%) also strongly liked this module because of the cooking and experiments. A total of 17.2 students did not indicate a rating for this module.

Total rating frequency. Table 4 describes the overall frequency of ratings for the entire group of 140 students who submitted course evaluations. Eight students strongly disliked the modules, eight students disliked the modules, and 21 students were indifferent and rated the modules OK. Fifty-three students liked the modules and 33 students strongly liked the modules. Seventeen students did not identify a rating for the modules they used during the course.

Table 4

Frequency of Ratings of the Combined Module Evaluations

Combined Rating Frequency			
Rating	Frequency	Percent	Valid Percent
Strongly Disliked	8	5.7	5.7
Disliked	8	5.7	5.7
OK	21	15.0	15.0
Liked	53	37.9	37.9
Strongly Liked	33	23.6	23.6
n/a	17	12.1	12.1
Total	140	100.0	100.0

Students generally agreed that the hands-on activities and experiments are the reasons that modules are fun, and that they enjoy learning with modules. The majority of students (37.9%) who completed the course liked the modules.

Summary

This chapter described the findings from the quantitative data collected as part of this triangulation mixed methods case study. The data collection methods included a content analysis of two computer-assisted modules, readability scores for the selected modules, and a document analysis of course evaluations. The purpose of these methods was to determine how the cognitive principles of teaching and learning are implemented in the design of computer-assisted modular curriculum. These data will be further referenced in Chapter 5 to validate and confirm the qualitative findings from the interviews, observations, and qualitative document analysis.

The researcher determined that the current design of the modules included in this content analysis does not sufficiently integrate the cognitive principles of teaching and learning. The mean rating of the researcher and the four agricultural education professionals have resulted in overall ratings of poor for Module A and Module B, as they each have individualized strengths and weaknesses. Generally, the modules (1) thoroughly integrate multimedia features such as audio and visual effects, (2) include step-by-step instructions for completing the corresponding activities, (3) and provide vivid experiences by integrating a variety of hands-on activities. On the other hand, (1) the lessons within modules lack flow and do not build upon one another, (2) navigation of the modules can be difficult and lacks the option to pause, (3) modules lack feedback and sufficient application of content, and (4) the modules are weak in encouraging problem-solving and engaging students. Through examining the module content for the readability analysis, it was determined that the module content was in fact designed for disseminating information rather than reading for comprehension and literacy. Therefore, the readability scores represent grade level and ease averages for each individual module as a whole.

Module A and Module B rated a minimum of 8^{th} grade and maximum of 11^{th} grade level. Reading ease scores also indicated that both Modules A and B are difficult, to a degree.

The quantitative document analysis provided insight into students' perceptions of the computer modules to which they were assigned over the course of a semester being enrolled in agriscience. Overall, students like the computer-assisted modules because they did in fact provide a variety of learning experiences, which was supported by the findings of the curriculum content analysis. In fact, the soil science module had the highest percentage of students who liked a particular module, and this was due to the abundance of experiments and hands-on learning opportunities.

Chapter 5

Findings: Qualitative interviews, observations, and document analysis

The purpose of this study was to investigate the phenomenon of student cognitive responses to learning with computer-assisted modular curriculum. This triangulation mixed methods study connected quantitative data derived from curriculum content analysis and student course evaluations with qualitative data derived from participant observations, interviews, and additional document analysis. The reason for using both quantitative and qualitative data was to validate and confirm the qualitative findings with the quantitative findings. A middle school level agricultural education program designed with a computer-assisted learning environment served as the site for the study. Middle school students enrolled in the course served as the participants. Three major questions guided the case study:

1. How are the cognitive principles of teaching and learning implemented in the design computer-assisted modular curriculum?
2. How do students engage in the classroom learning process using computer-assisted modules?
3. How are students using self-regulatory skills while learning with computer-assisted modules?

Through a thematic analysis of the data, the following themes emerged and organize this chapter:

1. The content and design of the components of the computer-assisted modular curriculum create challenges for learners and lack integral principles of teaching and learning.
2. Based on their preferences for learning, students favor a mix of traditional instruction and instruction with computer-assisted modules because of the choices and variety of activities and instruction methods.

3. As students engage in learning with computer-assisted modules, they prefer to learn socially and value interactions with their peers.
4. The social nature of the classroom learning environment allows students to be independent while still interacting and learning with the teacher.
5. Self-regulation is innate and is not necessarily encouraged by the software or activities associated with computer-assisted modules.
6. Despite the level of intrinsic interest or value for a particular topic, students believe it is important to pay attention when engaging in learning experiences in school.

Context of the Middle School and Agriscience Program

The middle school was located in a semi-rural, yet suburban neighborhood. The school facility was new, having been recently built several years ago. Based on the geographic location of the school and the population of the surrounding community, the school population of students and teachers lacked diversity. The school culture created a sense of community among each grade level, as each grade was designated as a team. Each team had a name and a designated wing of the school in which their classes were held. The lunch room was not a room at all; it was actually an open space in the center of the school building with circular tables where students could socialize during lunch. The agriscience classroom shared a wing of the school with physical education and the gymnasium, and neighbored the technology education lab. The agriscience and technology education instructors shared a shop facility equipped with woodworking machinery. The agriscience classroom also included a shop-like workspace with an aquaculture tank, a variety of small animals, and a back door leading to a greenhouse. The agriscience classroom was warm and welcoming with inspirational posters and splashes of color lining the walls and cabinets. There were snowflakes hanging from the ceiling in the winter and butterflies in the spring. The classroom was lively with plants and animals around the room, including mice, fish, hermit crabs, rabbits, and guinea pigs. The daily agenda was always posted on the board at the front of the room.

With the new school facility, along came new forms of technology. Technology was abundant and easily accessible in the school. The classroom was equipped with ten student desktop computers plus one for the teacher, a high volume printer, a Smart Board, and television with DVD player. Additional technological tools such as clickers were also available for teachers to use through the media center. Among the ten student computers, there were two computers designated per module, meaning two computers were assigned as the food science module, two assigned as the animal science module, and so on. So each pair of computers assigned to a module was then considered a module station. Each module station was designed with two chairs per computer, for a total of two computers and four chairs at each module station, so two students shared one computer and four students could work at the station at a time. The computer stations lined the perimeter of the room, five on each side of the classroom. In the center of the classroom were tables with chairs, a refreshing difference from the traditional desk with chair attached, as commonly seen throughout schools. The tables were arranged as five groups, where two tables were put together to allow four students to sit within each group. Approximately twenty students were enrolled in each section of the course.

Participants included 24 female students and 12 male students. Some classes consisted of more male students than female, and vice versa. However, the course sections observed in this case study were female dominated or included an even mix of males and females. Participants also included learners with special needs, such as lower level reading abilities or a hearing impairment, model students who took school very seriously, and students with behavioral issues who were less interested in school. When comparing the 36 participants to the overall population of students within the agricultural education program, and even the school, this mix of students was a reflection of the spectrum of learners that make up the student body at the case study site.

The courses within the agriscience program were intermixed by grade level. Therefore, seventh and eighth grade students may be enrolled in the same course at the same time. As typical middle school students, who ranged in ages 11 to 14, the seventh grade students did not always socially interact with the eighth grade students, and their interactions were often limited to course activities and module assignments. In a sense, students segregated themselves according to their grade level. The team concept created a close community among members within the grade level, but that sense of community did not necessarily expand across students of different grade levels. The students enrolled in the classes were of varying educational levels and needs, ranging from students with Individualized Education Programs (IEP's) to a student with a hearing impairment and sign language interpreter.

The classroom environment was very social in nature. Because students were able to work with partners when using computer-assisted modules, they had opportunities to interact with partners during learning activities. In some cases, students had the freedom to select partners and work with friends, creating opportunities for personal socialization or what appeared to be a more comfortable work environment. In other instances, students were assigned partners, and this often led to either new friendships or difficult working environments among students who either did not initially know each other or did not work well together. The teacher, "Ms. Martin", encouraged conversation among students during learning activities, especially when the class was engaged in working on hands-on projects, taking difficult assessments, or when questions about the learning activities arose. Students shared equal responsibility with the teacher, as the class officers were responsible for things like dismissing class, taking attendance, leading class clean-up after projects, or making sure students logged-off of the modules.

Implementation and design of the modules. The original design of this agriscience program did not include computer-assisted modules. In fact, Ms. Martin's initial reaction to integrating modules was negative because of the limited knowledge she had of computer-assisted modules. Before deciding to adopt computer-assisted modules, the principal encouraged Ms. Martin to spend some time visiting other agriscience programs around the area to see how they worked, how they could be implemented, and to explore the different module products that are available. Through this experience, her perspective of computer-assisted modules changed, and she agreed that the adoption of modules into the program would benefit students. In anticipation of the arrival of the computer-assisted modules, Ms. Martin attended a formal training regarding module implementation.

The methods of facilitation and utilization of the computer-assisted modules by Ms. Martin and students in this agriscience program are unique only to this program and is very different from the intended use suggested by the module company. First, students rotated on and off of the modules throughout the course, so the classes experience an even mix of both traditional and modular instruction, including six weeks in the woodshop. This is different from the suggested facilitation of students rotating from module to module until all of the modules have been completed. Agriscience Explorations, the course offered to 7^{th} and 8^{th} grade students in Ms. Martin's agriscience program, began with a few weeks of introductory agriscience content through traditional instructional methods. This was followed by the FFA module where students spent about ten days learning about the National FFA Organization on the computers. It is important to note that many of the modules in this program were designed for five days of instruction. However, due to unpredictable daily classroom events and the amount of time it sometimes took for students to complete the module assignments Ms. Martin allowed a ten-day period for completion. Through her experience teaching with the computer-assisted modules, Ms. Martin felt that five days was often too rushed for students to complete the modules. The extra few days created a window for students to spend time making up module activities if they were absent or simply needed more time. Following the FFA module, students spent six weeks in the shop creating a woodworking project. Upon completion of the woodworking project, students spent the remainder of the course rotating on approximately two modules, which could be any of the following: animal science, plant science, aquaculture, food science, or soil science.

Addition of content and activities. Ms. Martin spent a great deal of time reviewing each module, determining the strengths and weaknesses, and then modifying the activities and integrating supplemental activities she called "extra credit." The activities were intended to be completed once students finished the original module activities and were graded as extra credit. The activities were also intended to be extra activities if the students finish their assignments early. So, Ms. Martin took the original module workbook and created an adapted packet with additional activities and experiments. For each module, this adapted packet included a module check list outlining the daily activities, where students were able to check off their activities as they were completed. The adapted packet also included a grade sheet that listed each activity and the total points each activity was worth. Within each module packet, Ms. Martin also added relevant Virginia agriculture facts as it related to the particular topic. For the aquaculture module, for example, Ms. Martin added a fact sheet about commercial fishing in Virginia. Additionally, an original activity for this module asked students to view microscope slides. Ms.

Martin added the exercise of drawing and labeling the microscope slides. She followed this same process for each of the five modules to modify and enhance the student workbooks by adding hands-on activities, assignments providing opportunities for deeper learning, and facts to help students learn about Virginia's agriculture industry. In explaining this modification process to the researcher, Ms. Martin explained that as each school year came to a close, she assessed the learning that occurred in her classroom to determine how to modify and improve the module workbooks for the next school year, making the process of modification and improvement on-going.

Theme: The content and design of the components of the computer-assisted modular curriculum create challenges for learners and lack integral principles of teaching and learning.

The computer-assisted modules contained a unit of instruction for the National FFA Organization, plant science, animal science, food science, soil science, and aquaculture. Each of the modules had a unique way of disseminating the content through a wide range of activities. The computer software component is one component to the modules that is essentially divided into videos that teach content, pretests and posttests to assess learning, and other activities such as games or the use of the Internet. With each class, Ms. Martin described potential technological issues that could arise as a result of learning with computers, in an effort to forewarn students about proper computer use and create awareness of issues as they might arise.

Minor technological issues were observed, such as equipment or sound not working properly, error messages, or students having to restart the modules because they would freeze. "Sally" said that sometimes it was difficult to learn with the modules because "it would glitch and then you would miss some words in the videos and then the computer would freeze." The most significant technology issue that was observed was the discovery that a piece of software was not installed to the computers when an update of the computers took place in the fall. The media plus software was a tutorial for students to learn how to navigate the modules, since this software was absent from the modules, Ms. Martin created a lesson to walk students through an initial experience navigating through the module software.

The first step students usually had to take in order to begin using the computer piece of the module was log-on by entering their name and password, which helps organize students' assessments and told Ms. Martin who is logged-on to what computer. The computer piece of the module had a bar at the top left of the screen that students could click on and it had a menu. If they clicked on any one of the links, it would take them back to where they left off on the previous day. While the modules appeared to be user-friendly, there were still participants who were not satisfied with specific navigational features of the modules, such as the inability to skip ahead. In an interview with "Henry" and "Bridget", they described their feelings about the module navigation:

> Henry: No, I just don't like it. You gotta listen to it [the video] and you can't move on. Cause I can read quicker than it can talk, and you can't move on till it's done.
>
> Bridget: I know, it's like 'come on…'

The inability to skip ahead was also noted as a problem with the design and navigation of the module software through the content analysis. Furthermore, due to the module software and equipment set-up, for each station, there is only one set of equipment per team, and the same students were observed sitting in the same seats each day. This meant that unless teammates made a conscious effort to switch seats and allow their partners to have control of the mouse and keyboard; the same students were in control of the computer each day.

Once participants were able to log-on to their modules, they were observed completing videos prior to engaging in other module-related activities. Some participants expressed a preference for the videos because when learning they would “rather watch it than do work on it.” Participants also described how the videos were helpful as an easy way to catch up on missed assignments. But the majority of participants found fault with many aspects of the videos, specifically the audio features and the assessments. “Brad”, a hearing impaired learner, explained that even though he liked the videos, he felt that the videos were sometimes difficult to understand and would have “liked to have closed caption on it, but they don’t have that.” Some participants felt that, not only were the videos difficult to understand because of the voices of the narrators, it was difficult for students to relate to the videos as well. “Jenny” shared her feelings about this particular issue when she said, “when you watch the video you can’t really understand the guy that’s talking, it can be really hard to know the answers to the quizzes.” When asked what it was specifically about the voice that was difficult to understand, Jenny said, “Like, he is an old person, no offense. And like, the voice is really scratchy, and that can be a little difficult.” While watching the module videos, “Tracy” was observed saying “mine sounds like an alien.” “Emily” explained that she felt like “the videos were talking to a five-year-old”, and “Cindy” described the videos as “really dry…they were really boring.” According to the end of course evaluations, many students expressed a dislike for the modules in reference to the videos because they felt the videos were “boring.”

Another challenge presented from the videos was the fast pace of the modules, specifically with the videos. As identified through the content analysis, the computer-assisted modules generally lack a pause feature during the videos. Many students found the pace of the modules to be too fast, and expressed a frustration with the lack of ability to pause. A conversation was observed among “Britney”, “Yvonne”, and Tracy, students working on the FFA module at a station:

Britney: “Can we pause?”

Yvonne: “It goes too fast.”

Tracy: “I know, it goes super fast.”

Brad also expressed frustration with the inability to pause, as he was observed tapping his mouse against the table and said to Ms. Martin, “It won’t pause.” So, Ms. Martin helped Brad and he a watched the video a second time to capture the information. The pace of the modules and lack of a pause feature also made participants feel pressured to pay extra attention to the videos in order capture important information, as “Rachel” said, “when we watched the videos and stuff we had to pay attention because they couldn’t pause or anything….”

Because assessments followed each module video, participants found it challenging to watch the videos, complete the workbook activities, and successfully take the assessments due to the pace of the modules, as “Jackie” explained:

> when we were going through the videos, it would go like really, really fast, and then you would have to go and take the test and I wouldn’t remember anything. And, when we had to do the fish dissecting thing that was hard because it went through how to like, do it, but I didn’t get it.

In addition, participants found it difficult to successfully complete assessments without thorough reviews of the content. “Jill” described her frustration with this issue:

> Um, they gave us this note sheet and we just kinda wrote in what we wanted to. But at the end we had a test and like, it wasn’t really too hard, but like, it was simple because they put everything on there and the stuff on the beginning was like, the week before and we

didn't go over it again. We just went straight through it and there wasn't really a review or anything so it was kinda hard on that…

When asked what Jill would like to add to her interview, she specifically said, "I wish that on the modules, they had a review day instead of just a test every day." As identified through the curriculum content analysis, it was documented that the computer piece of the modules does in fact lack frequent and/or thorough content reviews. Britney described her personal challenges with asking and answering questions during the videos:

Britney: If you have a question about something, it doesn't really get answered, you know? So…

Researcher: So how do you handle that, when you have a question, what do you do?

Britney: If I have a question, usually if I don't have to answer it on like a worksheet, I just kinda ignore it, you know. I don't ask anyone.

Researcher: Is that different from what you do in your other classes?

Britney: Yea, cause we've got the teacher there teaching the lesson or whatever, and it's just easier to ask.

Aside from the videos, participants described other module activities that involved the use of computers, including assessments, games such as SimFarm which simulates the responsibilities of owning a farm, or using the Internet to complete workbook activities. Of all the activities using computers, participants disliked the assessment component the most because of the level of difficulty and frequency of assessments. When asked what the worst part of the module was, "Madison" specifically described her experiences with the assessments:

Um, probably the tests [were the worst part of the modules] because they were a little hard, and then sometimes I would forget [to take the daily tests] and then I'd have to take like three or four. But um, they're really hard to get good grades on cause it had it [the test questions] in like different words from the video on the actual test, but other than that it was pretty good.

Because pretests and posttests accompanied each day of instruction with the modules, participants developed strong negative emotions towards the assessment component. When asked her perception of the worst part of learning with modules, Emily said, "The tests. I hate tests, especially when you have it every day and it's almost like you expect it. So yeah, 'test today, woo'." On the end of course evaluations, many students responded that they "do not like the module tests" because they were so difficult and frequent.

The next module component was the student workbook. The majority of students described the workbook activities as the worst part of learning with the modules, which corresponded with their feelings about the assessments. As participants engaged in watching the videos on the computer, they concurrently completed the workbook activities. Yvonne described the process she engaged in to complete workbook activities, "um, bits of it [the modules] are difficult, but sometimes the worksheets afterwards are difficult because you have to backtrack on the modules and watch it over again and try to get the right answer." "CJ" also described challenges with completing his workbook assignments:

Researcher: How difficult would you say was the computer part of the module?

CJ: It was a little hard but not that hard. It just took time to figure it all out.

Researcher: Figure what out?

CJ: Like there would be some questions that it'd ask and we'd have to go back and re-do it [the video] to see what it said cause we were going too fast…

Thus, many participants disliked the process of completing workbook assignments. "Kevin" explained that "taking notes off the module and having to do worksheets" was the worst part of the modules. Many participants described the workbook activity as "paperwork." "Bertha" described the modules as being "kinda boring", and when asked why, she said, "it's just a lot of work, paperwork and stuff like that. I mean there's some fun activities, but usually it's just like, writing down stuff and all that." Madison also said that the modules had "a lot of paperwork." On the end of course evaluations, some students expressed that the activity they disliked the most was "paperwork, boring."

The third component of the modules, the hands-on activities, was favored most by participants. The hands-on activities are what students looked forward to the most when learning with modules, as Yvonne described her affection for hands-on learning:

> Um, my Ag class is definitely more hands-on than every other class I've been in, other than Work and Family cause I had modules [in that class] too. But the core classes that I take upstairs…are just kinda like, sit there, listen, do a worksheet. And Ag is like, go to a module, do a couple activities, build a picnic table, I like it a lot.

On the end of course evaluations, students described their favorite instructional methods as "projects because it was hands-on and you actually got to experience some of the things." Jackie was observed talking to her friends after making a leather bracelet at the animal science module, when she said "that's the only part of the module that I like, when we're not on the computer." Kevin also described his feelings towards hands-on learning, "[the best part of learning with modules] definitely the activities and the projects that go with it. I like hands-on stuff." Additionally, hands-on activities comprised many of the topics that participants identified on the end of course evaluations as what they learned from the modules, such as how to grow corn plants, how to make dried fruit, or how to test water. Thus, participants expressed preferences for learning with a mix of traditional and modular instruction because of the variety of activities associated with each method.

Theme: Based on their preferences for learning, students favor a mix of traditional instruction and instruction with computer-assisted modules because of the choices and variety of activities and instruction methods.

Despite the challenges presented by the design and content of the computer-assisted modules, participants generally favored agriscience class over core subject area courses or other electives. The majority of participants expressed a positive attitude towards agriscience class when they described it as being "fun" and explained on the end of course evaluations that they "wouldn't change anything" about the course. Rachel expressed her excitement towards agriscience class when she said, "I can't wait to get to this class during the day and I just have fun and I do my hardest on everything…this class is one of the funnest classes."

The fact that agriscience class integrated the use of computer-assisted modules did not impact participant's attitudes towards the course, as participants generally did not perceive there to be a significant difference between agriscience with modules, and other classes without modules:

> Researcher: How was your agriscience class using the modules different from your other classes?
>
> Jill: Um, not too bad, not that much difference because there's still like…somebody is teaching whether it be a computer or a teacher, it's still like teaching. So it's really not that big of a difference. Just that you have a test at the end of every day.

Even with the use of computers for learning, Britney agreed that while she did not use computers much in her other classes, “the teacher teaches the lesson instead of listening to it [on the computer]…so [agriscience] it’s not much different.” Tracy had a similar response when she said, “computers are kinda just, like a teacher, just computerized.” “Faith” portrayed her other classes as “not as loud” as agriscience class, and described agriscience class as easy, fun, and “not that much different” from her other classes. When asked how her other classes were different from agriscience class, “Elaine” responded:

> They’re boring [laughs]. Well, they’re kinda, I guess they’re boring, but you don’t really have a lot of social time, and you don’t really learn as much because you’re like sitting there and it’s the same every day. The teacher is the only person teaching you and sometimes it’s fun to have someone else kinda teaching you.

For some participants, however, a common difference between agriscience class and other classes was the amount or type of work assigned. Kevin felt like his other classes were different from agriscience because “in classes where we don’t use modules, it’s more like a sit down and listen thing, more than it is a hands-on type of thing...”, and some participants agreed with this because they felt that in the other classes, as CJ explained, “we usually just sit and do work.”

So, as participants completed their first and second module rotations during the course, they explored their impressions of learning with modules. Though they generally had positive attitudes towards agriscience class, they felt mixed reactions to their first experiences using computer-assisted modules. Jenny described her first ever experience using computer-assisted modules and her first impression was a feeling of uncertainty, “I thought it was going to be kinda hard but kinda easy, so I wasn’t sure what to think. And then I got to it and I’m like ‘oh my gosh, this is so easy’….” Bridget was initially excited to learn with modules and thought “Sweet, this is kinda fun…and then a week later [she thought] 'ugh, do I gotta do this again? It's boring.'" Madison was also a first time user of computer-assisted modules, and she was especially interested in the choices and variety of activities associated with the modules:

> I thought it was pretty cool, but uh, we all weren't doing one thing at a time. That's what all our classes are. Like core classes, we all do the same thing all day. But in, but here and my new 5th period…we use modules. And it's pretty cool because we don't all do the same thing; we get to see what everybody else is doing as to what you are doing.

She later added:

> I liked it because you…you have more variety, or like, on the computer you have more stuff you can do instead of just the book telling you what to do. You have, kind of, choices…

From a different perspective, first time module user, "Kris", said that he initially perceived learning with modules to be easy "because you're on the computer." But for learners like Yvonne, who had prior experiences learning with modules, she sees the modular learning experience in a different light:

> Well um, I had them in the work and family class upstairs, which is like home ec. kind of, and I, I didn't like them at first because I didn't like the idea of not really having a really interactive teacher, and um, but then we got into them and I liked the fact that there was hands-on things other than just the computer, read and answer questions. So now, I enjoy them because I understand the full concept of it.

Thus, participants identified the specific activity of learning with computers as a difference between agriscience class and other classes.

Through talking with participants during interviews and based on their end of course evaluations, participants revealed strong preferences for a mix of traditional and computer-assisted modular instruction. In particular, participants felt as if constant traditional instruction methods became boring, as did learning with computer-assisted modules on a daily basis, and that "it's not fun doing the same thing every day." So, they preferred a variety of instructional methods because in core subject area classes, as well as some other elective courses, they generally engaged in traditional teaching and learning methods. One student wrote on their end of course evaluation that they preferred "a mixture of both because the traditional teaching is what I'm used to but modules are more fun." Another student wrote that the mix of traditional and modular instruction was their preference because "they don't get as boring as fast."

Additionally, a mix of traditional and computer-assisted instruction was preferred by participants because of the opportunity to use computers. Participants felt that having access to computers while they were learning allowed them to find information when they wanted it, either because they were curious or to help with assignments, as CJ explained, "on some assignments, if we're allowed to use computers, I can research everything I need and then write it down so I can use it." Kris described learning with computers as "normal", and Nicole said that learning with computers is a "privilege" because not all schools have access to computers they way she does at her school. But for students like Cindy, using computers for learning was not ideal, as she stated, "I like being on the computer, but I don't like it for educational purposes. Like, unless if it's Google, well things that I wanna look up instead of 'who died in this year' or whatever…." While other participants, like "Ashley", found it challenging to use computer-assisted modules because of her lack of access and knowledge of technology:

> It's okay [learning with modules]. But using computers is not really my thing. I don't really use computers much, I don't have one at home. So when I'm here, it's just kind of like I don't know what to do, I'm just not used to it.

Yet, on the end of course evaluations, students indicated that using computers was a preferred way to learn because it's fun and is what they are accustomed to using in the classroom.

Participants expressed an even mix of preferences for traditional over computer-assisted instruction, and vice versa. Participants who preferred computer-assisted modules over traditional instruction explained that modules are more fun than traditional instruction, more hands-on, and to some students, computer-assisted modules made learning easier. Participants described computer-assisted modules as easier because of the way the module content was designed to present one particular topic with a corresponding activity per day. "Ricky" said he preferred computer-assisted modules over traditional instruction was because, "you learn one thing every day…and it's not like a teacher where it tries teaching you five things in 45-mintues. It teaches you one set of things in 45-minutes." During an interview with Faith, she shared similar feelings about learning with computer-assisted modules:

> Faith: I think they're pretty fun because it's easier to learn how to do certain things cause you only learn one thing a day and then you have an activity to go along with it, so…
>
> Researcher: Ok, so how does that help you?
>
> Faith: It kinda keeps you on one thing, like if I'm learning one thing, if I'm trying to learn like different things each day, it kinda helps me to focus on that certain thing, but if I'm learning a lot in one day, I can't really understand what's going on. It's like, easier.

On the other hand, through the end of course evaluations, there was one student who specifically preferred traditional instruction over computer-assisted modules because they "get enough of computers in keyboarding class", and others who expressed that the modules are "boring." Britney described her preference for traditional instruction over computer-assisted modules:

> I am one that likes to have a teacher, like, it's impossible to have them one on one, but I like to be able to ask questions and to have them teaching the lesson. Um, so the computers aren't really my thing, the modules, but I mean, they're fine.

Tracy described similar feelings when she said that she likes "when the teacher does the class instead of computers, cause I think that I learn more and learn it better than I would on the computer…I like the teacher better when she's teaching the class."

Regardless of their preferences, participants generally found some value in learning with computer-assisted modules. Emily described her feelings about this:

> I mean, I might not like the modules that much, but they should have them. I mean, it's fun to be let on the computer once a day without having some teacher stand over you. And it's okay for being like, you can't go to this place or this place [websites], but it's fun. I like it.

Jill even felt like she "learned a lot more than I guess I would have, quicker than I would have just with taking notes…" even though she was not fond of the assessment component.

Participant's learning style preferences ultimately shaped their desire for specific instructional methods and influenced their attitudes towards traditional and computer-assisted modular curriculum. Participants were obviously aware of their learning style preferences and articulated how they learn best. Participants identified the strategies and instructional methods that help them to be successful in school, such as audio, visual, or hands-on learning. Jill said, "I really liked the experiments or hands-on things, I think I learn better that way." Jason felt like the best part of learning with modules was “watching and listening to it.” Henry preferred to learn by reading and seeing the information versus hearing it because:

> I think I would rather read, like, I mean you read on a computer, but I would rather get it out of a book rather than the computer. I don’t know why, I just, I don’t really like listening to somebody talk cause I can’t get it better. Just reading out of a book, it helps me.

“Jose”, a visual learner who said he likes “seeing a visual object”, appreciated the fact that the computer-assisted modules provided pictures to correspond with the content. “Jeff” especially enjoyed the videos because he perceived himself to be “someone who needs to watch something to understand it.” Particularly on the end of course evaluations, students described how they like to learn “working with my hands and be actively working,” or through engaging in hands-on activities.

Ultimately, participants still perceived learning with computer-assisted modules, in most cases, to be easy. Brian said that learning with computer-assisted modules is “not very hard because all you do is sit there and listen, watch.” “Shea” also felt like it was easy because of the thorough instructions and the modules “explained things really well.” Britney perceived learning with modules to be easy because “it’s not really something you have to really think about.” Generally, what made learning with modules fun was the hands-on activities and food that was often associated with the projects. On the end of course evaluations, participants often said that “making food was fun,” “we got to do activities every day and we ate,” and they “enjoyed the modules the best…we got food.” When describing things participants enjoyed about learning with modules, they often used the words “hands-on” or “fun.”

What made learning with computer-assisted modules difficult for participants was the specific activities that came along with it, such as the tests, questions, or workbook. "Nikki" pointed out that the questions are hard "and then you gotta go on the computer and try to figure it out." In fact, what most students disliked most about learning with computer-assisted modules was working with the modules that lacked hands-on activities, or modules that seemed to have more work than others. On the end of course evaluations, students described their thoughts when they wrote that they did not enjoy the aquaculture module "because of all the work" and that they disliked a particular module because "we didn't do a lot of projects." The FFA module in particular was one that lacked abundant hands-on activities because the "hands-on" activity was the team campaign project. Many participants did not perceive the team campaign to be a hands-on activity and identified this module as being the most difficult. Rachel felt like the FFA module was "really hard" because "just trying to find some of the stuff, like the dates and stuff for some of the papers we had to do" was challenging. On the end of course evaluations, one student said they disliked the FFA module because "I didn't really understand," while another said "we didn't do any hands-on stuff." Overall, on the end of course evaluation when asked if students would make any changes to the course, students often said they would change the modules, add hands-on activities and more food, less tests, but many said they would not change a thing.

Theme: As students engage in learning with computer-assisted modules, they prefer to learn socially and value interactions with their peers.

The nature of learning with computer-assisted modules allowed students to engage in social experiences with partners and classmates. Participants truly valued social learning and desired opportunities to work with their peers, as Jose said, "um, you just get to have more freedom and you get to be with the friends that you like, instead of being forced to sit with somebody you don't know." When asked her opinion of the best part of learning with modules, Yvonne expressed similar feelings:

> The fact that you can be more independent without the teacher. You can ask, that's great, but you need to learn how to learn without having the teacher by your side all the time, and you know, like that cause that's the way high school's gonna be. Teachers aren't your best friend and college too.

Students were observed completing experiments with partners from other module stations, helping each other determine how to proceed with their activities or find information, and engaging in discussions about the activities. Students viewed their peers as a resource during the learning experience, especially because when they had questions, participants typically asked their partners before they asked Ms. Martin. Jose said that he preferred to ask his partner for help before asking Ms. Martin because "he might have the answer and I wouldn't want to bug the teacher about it." Ashley preferred to ask her partner questions first, because:

> Usually I'll always go to a classmate first to ask questions cause I'm always embarrassed to ask the teacher, but if they don't know either, then I'm usually confident that I have to go ask the teacher or I'm never going to find out the answer.

On the end of course evaluations, students emphasized their desire for social learning when they wrote "it's fun to interact with new people" and small group learning "allows a bigger spectrum of ideas." Other students wrote that they preferred social learning because "it is easier for me to learn with a group" or because "if I don't understand something the other person might." During her interview, Jill agreed that when learning with computer-assisted modules, “you have a partner and if you don’t get something, you can ask hem and see if they get it.” Britney said that social learning was the best part of learning with modules:

> I guess learning what we have to learn in this class and then being able to like, socialize…with the person, with your partner, and learning at the same time as them, cause then you’re able to talk while you’re learning, I guess, so that’s pretty nice.

Ashley also described her appreciation of the social learning that resulted from learning with computer-assisted modules, “…you can work with someone new, you don’t always have to have the same people to work with, but is that you can make new friends and learn more about each other as you go along.”

While the majority of module partners are assigned arrangements, there were a few instances where participants could select their partners. Students typically selected individuals to work with based on their existing relationships, or in some cases, work ethic. Jose said that he “picked one of my good friends in the class” as a partner, and Yvonne did the same as she responded, “by friends that I hang out with outside of class” when asked how she selects partners. “Nicole” also opted to work with a friend when she said, “I usually pick my friends, and not usually the person who’s the absolute best at it, I just pick the person who I’m definitely comfortable [working] with, so it makes it a lot easier to do my work.” Kevin was purposeful in selecting a partner that he knew he would get along with, “well, the person that I joined up with I’d known for a little while and we got to know each other in previous grades, so it was easier for us to get along and respect each other.” Nikki was one of the few participants who said she selected partners based on work ethic and whether or not they would get along during the learning experience, “I chose a partner that I knew that we could work well, it was easier for me that we both knew stuff.” Peer relationships played a major role in the social learning and selection of partners that took place as students engaged with the computer-assisted modules. Most participants said that they worked well with their partners, rarely felt excluded or distracted by their partners, and overall had a positive experience with their partners.

Students were observed engaging in team learning by choice, as two teams of students from the same module would naturally gravitate into a working team of four to complete experiments. Many participants explained that they shared equal responsibilities among their teammates when completing assignments, as Kevin explained:

> Well we kinda both just agreed to work on an equal level. So, like one person wouldn't have more control over the other person, so that way if someone messed up, then the other person could remind them of something without being misjudged or something like that.

For other teams, sharing responsibility was implied, as Yvonne said, "we didn't really even talk about it, we just kind of knew that we…were just gonna work together and we weren't gonna split any work up, we were just gonna work together." Particularly during the FFA team campaign activity, participants were observed dividing assignments, like with Tracy's team, where she worked on the campaign poster, Britney wrote the campaign summary, and Yvonne wrote the speech. There were several teams that operated in a similar manner. When asked how her experience with teamwork, Faith said:

> Well I wanted to be class president…when we got in our groups I was like 'can I run for class president' and everybody was like, 'ok' and then we kinda had a little argument about who secretary was and then we just kinda figure that out . It was pretty simple.
>
> Researcher: Do you think your team worked well together?
>
> Faith; We had our off's and on's but yeah we did.

Adding to the social nature of learning with computer-assisted modules was the fact that students were not afraid to ask questions. There were many resources available for asking questions, including Ms. Martin, the researcher, and other classmates. Students were observed asking questions among different teams. For example, when Jill and Lori were working on the pH test for the soil types, and Jill walked over to the other soil group to ask if they needed water first or the soil first to do the experiment. When students specifically needed help from Ms. Martin, "Brian" described the process for asking questions, "there's a little light, and it turns the light on so if you leave it on or if it doesn't work then you can just raise your hand and she comes over and helps you." But when students couldn't get Ms. Martin's attention immediately, they turned to the researcher to ask for help, like one instance when Tracy asked the researcher if silverware contains animal by-products. Students would ask questions about how to find information or answers to specific questions in the workbook, such as Brad asking Ms. Martin, "where can we find the first national president [for FFA]?" Elaine asked for clarification on her team campaign project when she asked Ms. Martin, "What's a campaign statement?" Despite the fact that the daily assignments were posted on the board throughout the class period, or the fact that the modules usually told students where they left off on assignments and what to do next by showing demonstrations, participants were observed asking many questions about how to proceed with activities.

As with any team situation, there were instances where partners experienced conflict or a lack of team participation. Several observations were made of participants who had partners that did not engage in activities with their teams. Henry experienced this particular situation and was observed watching the teacher confront his partner about helping with the experiments. Henry responded to the teacher by saying, "She doesn't help, she doesn't help with anything ever."

Cindy was observed ignoring her partner when she chose to work with a friend from the module team nearby. Cindy would lean in closely to her friend, showing her back to her partner, making it difficult for the partner to engage as part of the team. Shea described her frustration with her partner and lack of teamwork, "my first partner didn't do anything. She was out of it the whole time, so she didn't do anything at all." Yet, even though students had partners and were encouraged to engage in conversations, participants were also observed working independently, not usually by choice. When module partners were absent, there would be times that participants had to complete experiments alone. There were other times when module teams were observed completing assignments at different rates, so for instance, Bertha was finishing her workbook activity while her partner was finished with that and had already started the experiment.

Another challenge of social learning with the computer-assisted modules is the lack of privacy for participants when taking the assessments and issues with cheating. Because of the frequent assessments at the end of each module lesson, students were seated next to each other while they were taking turns with the assessment. An incident between Jill and her partner "Lori" was observed when Jill went to Ms. Martin to tell her that Lori had seen her test answers and copied. The problem was that Jill took the assessment first, with Lori sitting there watching, so Lori was able to see all the correct answers for the questions that Jill had gotten wrong. Therefore, when Lori took the test second, she knew the correct answers. Ricky also described a similar scenario:

> I would make them [the partner] go first…so that way I would know what questions they got wrong and I wouldn't put that answer. So that way I would get at least a 75%, I would have 75% of the choices to choose from if I would eliminate that one question.

When asked if Ricky considered that cheating, he replied, “uh, I don’t know. Maybe, maybe not. I don’t know.” There were, of course, many students who did not feel that cheating was appropriate, as Jackie said, “they [the partner] understood that my grade is my grade and their grade is their grade. And cheating is bad, so don’t do it.” But in addition to cheating, some participants were simply uncomfortable knowing their partners could see their tests and grades. Jenny was very uncomfortable, “I was scared that I was going to get a low grade, which I did. And I was afraid of what my partner would think or say, and I was like, really nervous about it.” “Bobia” felt that it was “embarrassing if you got a low grade on a test” and the partner could see her grades at the end of the assessment. “Bob” also felt embarrassed by this because “I didn’t know the answers and I kind of guessed and he’s like ‘you’re wrong, you’re wrong’, so it was a little embarrassing.”

Theme: The social nature of the classroom learning environment allows students to be independent while still interacting and learning with the teacher.

Each class period began with teacher-led instructional time, where Ms. Martin gave instructions, explained the daily agenda, and engaged students in an occasional whole-group activity prior to module time. Activities such as short videos, reviews, assessments, or PowerPoint presentations occurred during this time. Ms. Martin integrated a variety of technology into her curriculum in addition to the computer-assisted modules, such as clickers (to be used for quizzes or reviews) and the Smart Board (for interactive activities). On the end of course evaluations, many students indicated that they enjoyed learning with the Smart Board because “you get to touch it” and “everyone is involved.” In terms of the clickers, Ms. Martin asked the class how many students preferred to take quizzes using the clickers, and the majority of students raised their hands in agreement. So, Ms. Martin used clickers for the FFA end of unit quiz, where students were assigned a numbered clicker that they would use to answer timed questions. Ms. Martin gave students the option to take their quiz on paper if they were uncomfortable using the clickers. This instructional time at the start of class usually lasted anywhere from three to fifteen minutes, depending on the activities that took place, allowing approximately thirty minutes for students to complete their assignments and clean-up before the class change.

On a typical day, most students were present and there would be one or two who were absent. Being absent while learning with computer-assisted modules created challenges for participants. Bobia explained that after being absent, “it’s hard to catch up…like if you are on an experiment.” Shea agreed and said that “when you are doing the experiments you partner had to explain it to you.” Ashley was one student who was observed as absent quite frequently, so to catch up to her partner she had to find an empty module station and watch the videos and complete the workbook assignments that she missed. Aside from absences, the typical instances of participants experiencing time out of class were observed, such as going to the restroom, being called up to the main office, or leaving class for other reasons like being checked out of school.

A typical daily agenda when learning with computer-assisted modules consisted of completing the computer component of the module, completing the corresponding workbook activity, followed by the experiment or team activity. If students completed their daily activities before the end of the class period, they were allowed to finish incomplete assignments from prior lessons or complete the extra credit assignments. Once students were allowed to move to their modules, they were generally observed following directions and starting their assignments immediately. However, there were several instances where students were observed not following directions. Ms. Martin specifically told students at certain modules that in order to proceed with their experiment, they had to wait for her to get information for the next step. There were several instances where students went ahead and started the experiments without waiting for Ms. Martin. On occasion, it was observed that students did not always turn in their module packets at the end of class as they were instructed. In one class period, Ms. Martin said there were twelve out of seventeen packets turned in. There were also instances where students like "Fred", tried to change their seating arrangements in order partner up with friends, so instead of there being two students per module, they would move seats and have three or four students per module. Aside from these issues, the classes were typically very responsible in following directions as they engaged in their learning activities.

The tone of the classroom learning environment changed frequently during a given class period. As students were engaged in watching the videos and completing their workbook assignments, the classes were very quiet and students were mostly in their seats. But as students completed those assignments, the tone began to change and the class became more talkative and students were moving around the room. Faith described this as one of the reasons why she likes agriscience class, "I like it because…it's not too loud and it's not too quiet or anything, so it's pretty fun." When asked how long it took to complete the module assignments, Jill said it would take approximately "thirty minutes, depending on what the module has in it for that day" to complete the daily activities. "Like, if there's an experiment it could take longer, but if it's just a movie and a worksheet then it doesn't take that long," Jill added. Rachel said that from her experience in learning with computer-assisted modules, "we usually got it done before class was over and everything, so we could work on anything else that we had from the past couple of days." As students were observed from the time they started the modules to the time they finished the computer part of the modules, they typically had anywhere from ten to twenty minutes left of class. So depending on the students and how long it took them to complete their workbook activities, and the module they were working with, the computer part of the module took approximately ten to twenty minutes to complete, sometimes longer. So there would be days where students would finish the computer part of the module, but not have enough time to start the experiments, so the experiments would carry over to the next class period. So, it often took students longer to complete the modules than suggested by the company.

During the time that students were working with the modules, Ms. Martin made herself available to answer questions, check progress, and learn with the students. Ms. Martin would say things like, "how are you guys doing on the timeline" or "good job on your test scores." Ms. Martin was frequently observed walking around the room, going from station to station asking the students how they were doing or if they had any questions and providing feedback. The only feedback provided by the computer-assisted modules was in the form of scores on the assessments, so participants appreciated receiving feedback from Ms. Martin or they would seek feedback from each other. CJ said, "it [feedback] helps me see what you messed up on or what you can improve on." Jenny also said that when Ms. Martin told her she was doing well, it "I would be happy." Madison described a time when she received positive feedback from Ms. Martin:

> Yeah, if we were doing the experiment with the fish, changing the water temperature, she said we were doing good because we were actually, we paid attention during the video and we were following what the book said, not just going and doing whatever.

Ms. Martin explained that on the days when students are working with the modules, according to her pedometer, she walked several more miles in a school day then she did when students were not using modules. Ms. Martin also explained another challenge with working with computer-assisted modules. Aside from the FFA module, students were not working on the same module at the same time. Ms. Martin said that is design made it difficult to make a general announcement to the class about a question they might have, because it would not apply to everyone. Participants were observed experiencing a slight frustration when, on occasion, they would experience a long wait time for Ms. Martin to answer their questions or make her way around the room. The challenge was that many students had questions at the same time, so it would take Ms. Martin a while to make her way around the room. Students were often observed making comments to each other or to the researcher about the amount of time they had to wait to get an answer for their questions. During this wait time, however, participants were observed experiencing some downtime, where they were not working, but simply sitting and waiting for Ms. Martin. But aside from answering questions, Ms. Martin was observed as being fully engaged in the learning process with the students. In fact, Ms. Martin specifically added stopping points into the modules where after students reached a certain point they had to talk with her before moving on, so that they could discuss the lesson content one on one.

When asked what the teacher does while participants were working with the modules, the majority responded that Ms. Martin "helps us." Nicole said:

> She [Ms. Martin] goes around the room to each person and makes sure you're doing the right thing, makes sure you're doing okay, and for me, I don't really ask a lot of questions, except when it's something you really can't find on the computer. And she really helps a lot.

Cindy and Lori said that when they are working on the computer-assisted modules, Ms. Martin "helps us…we are always asking questions." Yvonne also said that "She [Ms. Martin] goes around and answers questions if you have any, and if you don't she just makes sure that you're ok and that you fully understand everything and know what to do."

In one particular class, Brad required special accommodations because of his hearing impairment, and Ms. Martin was very involved in helping him even though he had a sign language interpreter with him daily. It was often challenging for Brad to engage in learning with computer-assisted modules. If he watched the videos with his microphone laying inside the headphones, then his interpreter was not able to hear the audio to sign for him. But if he watched the videos with audio aloud instead of using headphones, he was able to have the interpreter help, but still had difficulties because of the pace of the modules. Plus, if he was looking at the interpreter, then there would be times where he would miss information on the screens. Brad was observed on several occasions not watching his interpreter sign for him, either during the modules or when Ms. Martin was speaking to the whole class, so the interpreter would wave at him to get his attention. Despite these challenges, Brad worked with a partner who would often help him when Ms. Martin or the interpreter was not necessarily available.

As students began to complete their daily activities, there typically was not much time left at the end of class. Approximately three minutes were built into each class period to allow students time to clean-up and log off of the computers to prepare the module stations for the next class. Ms. Martin offered students the opportunity to come visit with her during their study period to complete unfinished assignments, if necessary. When describing her experiences with finishing assignments, Lori said:

> Like the movies and everything, you could get the worksheet done. But some activities, like that leather keychain, you didn't, like, I didn't want to be rushed with wood burners because once it's on there, it's on there, and I didn't want it to look ugly. So, I wanted to

> take my time, but after you finish you have to be doing worksheets…but we came during advisory and did it…

Participants who managed to complete their assignments before class ended often experienced some downtime. When asked what she does when she finished her assignments, Emily said, “most of the time, either we help people that aren’t finished or we sit and talk, but we don’t like, get all crazy and stuff.”

Theme: Self-regulation is innate and is not necessarily encouraged by the software or activities associated with computer-assisted modules.

As students began their daily assignments with the computer-assisted modules, they engaged in task analysis to determine exactly how to proceed. Nikki said that when she arrived in class and prepared to begin her assignments, the first thing she did was “grab my book and just, like whatever part I’m on, then that’s where I’ll go on the computer and just try to finish that.” Participants were observed discussing their daily assignments with their partners to determine what they had to do to complete specific tasks. As participants engaged in learning with the computer-assisted modules, they also engaged in task analysis to assess progress. When working on the team campaign project associated with the FFA module, Kevin was observed looking at a rubric and telling his team what they had completed and what they still had left to finish. The same was true with Faith, as she also utilized the rubric to keep her team on task and analyze how to proceed for the class period. Yvonne was observed telling her team, “we’ve done everything up there except the speech” as she read the daily agenda to determine what her team had left to complete. But, on a more personal level, when Nicole was asked how she knows when she did well on a project, she responded, “if it says I should put ten of those pictures on a poster, like we did the collages of the by-products, I'm pretty sure I got a good grade because it was on the paper."

Participants were also observed as they engaged in self-recording, where they kept track of the amount of time they dedicated to the completion of specific tasks. When she was trying to learn new information in class or study, Nicole usually has "a certain time limit on my hands for that." As a team, Britney and Yvonne were very focused on keeping track of their time for tasks. On one occasion, as they engaged in learning with their computer activity, Yvonne said, "we have eight minutes left," to Britney, and from then on they focused on the task to finish before the end of the class period. Yvonne was observed on a separate occasion saying, "we're not gonna have time to finish all that" as she looked at the clock, read the agenda, and spoke with Britney about what they had to complete for the day. There was another instance where Britney said to Yvonne, "oh my gosh, it's 11:16 a.m." as she looked up from their workbook assignment and they realized how much time was left to complete the assignment before the class change.

Since the assessments associated with the computer-assisted modules occurred daily, participants did not have an opportunity to take their packets home to truly engage in studying. Even on the days when there were assessments given that were not associated with the modules, participants explained they still did not study the same way they would for other classes, such as math or science. So, when asked about the strategies she used to learn new information in class, Nicole said that when she had to study, she liked to work with a friend:

> I usually study with a friend. If we don't get that done, then that's a problem. Studying alone is kinda hard. I usually rewrite the answers on a piece of paper and try to memorize them and like say them over and over again just to get them in my head.

Emily felt like watching the videos and completing the worksheets in class was a form of studying, as she said, "well, we study by watching the videos…when we do the little worksheets, I guess that could be considered taking notes because we are writing it down and it's better in your brain." But more specifically, Emily explained that she uses specific task strategies when using computer-assisted modules because "sometimes you can take it [the information] a different way than it's supposed to be," so, she prefers to "re-read it or re-watch it." Re-reading information and re-watching videos were the most common task strategies that participants identified to help with learning or studying.

Kevin described the task strategies he used to work through content he did not necessarily understand:

> Usually you just go back and try to re-read it, see if it can come through my head, and if not, I would just go back to the vocabulary page and look at the definition of it and if that's not there, then usually I go back to where the word is and look at a sentence around it and see if I can figure out what it means.

Rachel added that she "re-checked" her answers on the worksheets to make sure they were correct before turning in assignments. Britney was observed saying to Yvonne, "can we go back and find the definitions," while they watched the videos. In many instances, when learning with computer-assisted modules, participants were observed re-watching videos, in some cases, three or four times in order to find the answers they needed to complete the workbook activities.

Participants revealed that when they had a strong intrinsic interest or value for what they were learning, they were more likely to put forth effort; participants stayed focused, motivated, and engaged in task strategies. Many participants said that they would "participate" and wanted to "do the work" when they liked the topics. When asked how she responds to learning about something she is interested in, Jackie explained:

> I get really excited, and like usually I learn more than I thought it was gonna be, and end up being like 'Oh this was fun, but not what I expected'. But if it is what I expected, I'm just like 'Oh yay, this was fun, I wanna do it again' because it's just, it like catches my interest and I like it.

Jill said that when she liked what she was learning, "I kinda get it quicker, like understand the subject better." "Chloe" said, "I wanna do it if I'm interested in it. Like, I wanna work on it and stuff." Jenny described a specific experience she had with the aquaculture module:

> When I really like it, like with aquaculture, I was like, really excited about it because I like all animals and stuff, so that was perfect for me. And then, I was like, kinda jumping inside. And then with the food, I was like 'okay'…

Many participants expressed a specific interest in topics like animal science because of career goals, such as a veterinarian or marine biologist. Elaine said that the topics she learned about were "really important" because "I wanna be a marine biologist or veterinarian when I grow up…so it's one of my favorite classes." Jill shared similar feelings when she explained why the content she was learning in agriscience class was important to her, "I really liked it because I want to be a vet when I grow up, so I kinda wanted to get some introduction in animals and stuff, so yeah." To determine if he even thinks a topic is interesting, Kevin said that he would "kinda tune in to see if there is anything interesting, and if not, I just kinda soak it in, but it's easier for me to understand the next go around." If Kevin decided he was interested, then he would be "a little more interactive with the subject and it's easier for me to learn because it's more fun." On the end of course evaluations, students described why they liked specific topics or activities within the course. One student wrote that they valued the experience with the floral project because "I like plants," and another student wrote, "woodworking because I thought it was cool to learn that stuff."

On the other hand, participants described their feelings of learning information in which they were less interested and lacked value. Emily explained how she often responded when she is not interested in a lesson:

> Emily: It just seems boring and you do different stuff just to get your mind off of it.
>
> Researcher: So what do you do when you're bored?
>
> Emily: Doodle, and just you know, talk.

Yvonne described her thoughts and behaviors in response to learning about a topic in which she lacked interest:

> When I'm not interested in it I just kinda sit there, and sometimes I zone out because I just, I'm thinking to myself 'this is stupid, da, da, da, I don't want to learn it' and I don't like, even react to the teacher, don't look at her or anything. That's what I think most students do when they're not interested.

Ricky said that he does not "really show any interest" and does not "really try" when he lacks interest for a particular topic. When Jose lacks interest in a topic, he explained, "you get really bored and you don't feel like listening to it anymore, you just want to do something fun that you like." Participants described the difficulties associated with learning about content they could not relate to or did not value. When asked how Britney applied the information she learned in agriscience to her everyday life, she said, "Um, I don't guess I do really. I mean, honestly, the only thing I remember doing so far is the FFA thing and I'm not in FFA." When asked how or if he applied the information he learned in agriscience to his everyday life, Brian responded, "no, not really." On the end of course evaluations, students listed the modules and activities they thought were exceptionally "boring" because they either were not interested or felt the modules did not include enough activities.

Despite the occasional lack of interest for certain topics, the majority of participants explained that as students in school, doing the work was a requirement, so whether they liked it or not, they chose to "go with the flow" and complete the learning tasks. The only difference, in some cases, was the amount of effort that participants put into those tasks. Sally believed in this philosophy as she said that she chooses to "go along with it" because "it's learning and it's a part of school." Jackie admitted that while she might initially dislike a topic, she prefers to give it a chance and then make a decision:

> When I do something I'm not interested in, I kinda just like, ignore it at first and then just go with it. But then, when I learn more about it, I usually get more into it because, at first when I got aquaculture, I was like 'oh, this is gonna be horrible. I'm not gonna like it.' And then when I got into it and we started doing things and I liked it, I was like 'well I wanna do this again sometime'…

During an interview with Henry and Bridget, they explained their work ethic:

> Henry: I figure it doesn't really matter if you don't like it, you gotta do it. I mean, it's just, you're just gonna have to deal with it.
>
> Researcher: So you just kinda push through and get it done cause you have to?
>
> Henry: Yeah. I just wanna go ahead and get done.
>
> Bridget: If you're gonna get it done, get it done right. But even if it does kill you, you have to do it for a day or two. Get it done right.

Researcher: So you put in the same amount of effort in work that you really don't enjoy as work that you do enjoy?

Bridget: Yeah.

Henry added, "I'd say I put a little bit more [effort] into stuff I don't like because the stuff that I do like, I do it more, so I'm kinda used to it, so I don't have to put as much effort into it." Jose said that he can gauge his level of effort, especially when he is interested in the topic, because "I'm actually having fun doing it, I want to get it done, so I do it faster and more accurate."

For the majority of participants, motivation to put forth effort during learning with computer-assisted modules was directly connected with the drive to achieve "good grades" in agriscience class and in school. When asked about their outcome expectations for the course, participants often said they expected to receive a passing grade, such as an A or a B. Jill said that she thought she would receive an A for the course because, "I had fun and I just really worked hard at it because I wanted to get an A on it." Lori stated that her motivation to complete the computer-assisted modules was based on, "[the fear of] getting a bad grade." Plus, when asked about the specific motivation as a student and completing assignments with computer-assisted modules, many participants specifically said they were motivated by grades, usually to either "be a good student" or "get into a good college." "Jason" explained the reason behind his motivation as a student, "I want to get a good job and get into a good college, so I need to get straight A's." Tracy felt like she needed to get good grades because of the expectations associated with leaving middle school:

Researcher: So, as a student in general, what motivates you?

Tracy: Just kinda getting good grades, and like, we're going to high school next year, so try to do our best, and um, college.

Britney shared similar feelings:

> Well, I want to, I wanna be successful I guess. I wanna be able to go to college, and I think that it's important to try to keep your grades up and do well so when you get to high school, you still have, like you still want to do well, and then you get to college and you still want to do well. So, I just figure, grades are pretty important to me, you know?

But aside from grades, Faith and Jose described additional outcome expectations, such as "free time at the end [of class]" to play with the class animals. Though, for some participants, like Henry, they were unable to pinpoint specific motivation for completing assignments, as he said, "I don't really have a motivation, I just do it."

Self-efficacy was also a factor in participant's perceptions of agriscience class, learning with computer-assisted modules, and how they characterized themselves as learners. Lori and Jill were observed saying, "We're bad at this whole soil test thing," as they engaged in an experiment following a module video. Prior to her first experience in the agricultural mechanics shop, Britney was observed saying, "Which one is the band saw? I'm scared; I don't want to do this." Ricky described a time when he was learning about cattle breeds, and said that the assignment was difficult for him because he is "just not good with remembering stuff." Jenny explained the challenge of sharing a computer monitor with her partner, because in trying to complete activities, she described herself as "a slow reader" and said, "my partner would be a faster reader than me, and I'm a really slow reader." Ashley, who expressed her discomfort with using computers, explained that even though her partner would help her use the computer-assisted modules, it was still a difficult experience, "I would say it's hard for me, but as far as like the questions and logging on to all these websites, it's just confusing. I'm just not used to computers." Emily shared similar feelings about how learning with computer-assisted modules was "not my thing," and how she felt she was not necessarily "good at it":

Researcher: What grade did you expect to get at the end of this term in your agriscience class?

Emily: Um, a C. I don't know what I got, but I think I got a C cause I'm not like, good at it, but I'm not horrible.

Researcher: Why do you think you're not good at it?

Emily: I guess I don't have the attention span for this class.

Researcher: Why, what is it about it that doesn't keep your attention?

Emily: I don't know, it's just all the tests and the videos…It's not my thing.

Even so, prior knowledge or experience of either the course itself or the content within the course seemed to increase participant's self-efficacy. Lori felt like agriscience was an easy course because she "took it last year, so basically knew everything." But more specifically, Faith said that learning with computer-assisted modules was "not really difficult" for her because "since I've already used them, it was pretty easy for me. I didn't really have to learn much from it other than what we had to click on and stuff like that." In addition to prior knowledge, participants described how feedback can enhance self-efficacy, as Madison said that feedback was helpful to her because it, "kinda boosts your self-esteem up."

While participants were engaged in learning, they were observed self-reacting to their performance. As Jose answered a question and saw the correct answer, he shouted, "Yes, I got it right!" CJ was timid, put his head down, and laughed as he watched himself on video as part of the team campaign project. When Brian completed an assessment on the animal science module, he was observed saying, "I failed it on purpose." Chloe said, "I feel really confident about it, if

I'm like 'I know I got this', I know I did good." Elaine also said that she felt confident turning in assignments when she knew she performed well. Britney explained that she could tell when she performed well on an assignment because:

> I guess you kinda get like, a sense of accomplishment…with cutting the wood, I was kind of nervous, so after I finished it was like, 'okay, I can do it, it's not that bad'. I mean, you feel accomplished after you do something."

Jose said that, "when I actually understand the questions they are asking," he knows he did well. Faith described how she measures her learning based on her performance:

> If we were taking a quiz or something and I'd get like high grade or something then I'd know that I was actually learning something and just listening, or if I was working on the computers and I could fill in the worksheets faster of if I just knew what I had to do, then I would know I was making progress.

Ashley tuned into her thoughts and opinions to determine if she was satisfied with her performance on a project:

> I base it on doing my best, like how am I feeling, and what my personal opinion was about it. I mean, if I know that I didn't know what to do and I know I didn't really care about the subject we were working on, then I know I did not give it my best. But I mean, if it's something that I'm interested in and I know I want to get it done, I feel pretty confident that I did well on it and I really liked it.

Theme: Despite the level of intrinsic interest or value for a particular topic, students believe it is important to pay attention when engaging in learning experiences in school.

Attention focusing was a significant self-regulatory process described by participants and observed by the researcher. Participants immediately went to the modules after instructional time, put on the headphones, and got started with the daily activities. Participants demonstrated what appeared to be attention focusing behaviors, such as working quietly, intently watching the videos, watching the videos while wearing both headphones, asking each other questions specifically about the videos and assignments, or discussing the activities without side conversations. Rachel described her attitude and behavior when keeping her team on task and focused:

> Well, we just liked to get stuff done fast so we could do the other stuff afterwards, but we did it, like we made sure we had the right answers and we, but we made sure we got it done and didn't talk about anything so we could get it done.

While some participants found the computer-assisted modules to be interesting and successful in capturing attention, others found it difficult to stay focused. Modules kept Jose's attention because he would "rather look at a computer screen than look at a white board" because he felt that he was "easily distracted" when looking at a white board. Britney felt differently when asked if the modules kept her attention, she explained that the videos did not peak her interest:

> Researcher: So, did the modules keep your attention?
>
> Britney: Um, enough to get the worksheet done. I mean, I don't know… not really. It's just kind of like, the person talking is extremely boring, and usually what they're talking about isn't too exciting either, so, no it doesn't really. So, I just wanna get the worksheet done so I pick out what I need to hear, honestly. [laughs]

For Brian, it was the monotony of using computer-assisted modules that decreased his attention. When asked if the modules kept his attention, Brian simply said, "not really" because "after doing it like every day, yeah [it gets boring]." When asked his opinion of how the modules keep his attention, Jason said that they do keep his attention because, "if you put on headphones then you sorta are zoned out to everything except for the computer." Sally agreed with this, as during her interview, she said that, "the headphones are on your ears so it brings just the sound in, it doesn't go out." But on the other hand, some participants chose to watch the videos on the modules by wearing only one headphone up against one ear, or by not wearing headphones at all and listening to the audio aloud. Observations of this were made on several occasions with many participants, like when Madison was observed wearing her headphones on one ear, and holding the other onto her ear as she worked.

Even so, participants explained the importance of attention focusing because no matter how they felt about the learning experience, participants felt strongly about the need to "pay attention" when engaged in a learning experience. For Jenny, paying attention makes learning with computer-assisted modules easier, "um, the modules, they're like really easy, and um, you like gotta pay attention to what she's saying and it will be like a lot better and easy." Yvonne described how her behavior changed when she was paying attention when she said, "um, I'm really interested in it. I pay attention, and I don't chatter with my friends or anything like that, and I just sit there and try to take it in and ask a lot of questions about it cause I want to know a lot about it." Ricky said that when he is learning new information, he would try not to "goof off and pay attention." But for Ashley, attention focusing was about the mental effort in having a clear, focused mind:

> I'm kind of a laid back person. I don't really have strategies [to help with learning]. I just try to get my mind off things, just clear my mind and just breathe and read my questions and try to pay attention.

Jackie said that she would pay attention "no matter what" because even when "there are points when you're just like 'blah'…I still pay attention and do the work."

Even though participants put great effort into staying focused, it was not uncommon for some students to demonstrate a lack of attention as they engaged in learning with the computer-assisted modules. Participants were observed on different occasions engaging in off-topic conversations, throwing things like paper, engaging in horseplay, or walking around the room. Participants also demonstrated body language to possibly indicate a lack of attention, such as nail-biting, slouching, head down, making noise by tapping on desks, or doodling. On one particular day, Ricky and Brian were observed watching the videos. In the process, Ricky hit Brian. Then Brian took off his headphones and was groaning. Ricky was laughing and Brian was telling people that Ricky hit him hard. Then he put his headphones back on and they continued the video. During that time, Ricky and Brian missed the information playing on the videos.

During an interview with Cindy and Lori, they explained their feelings and behaviors when it became difficult to stay focused on learning:

> Researcher: So when you are learning about something you are just not interested in, as a student, how do you respond?
>
> Lori: Don't listen.
>
> Cindy: It's hard to remember because you don't learn it in the first place because you don't listen. [Lori says "don't listen" at the same time as Cindy and they laugh]
>
> Researcher: So you kinda tune it out?
>
> Cindy: Yeah.
>
> Lori: Go to sleep.
>
> Researcher: Go to sleep, what else?
>
> Cindy: I just think about other stuff.
>
> Researcher: Your mind wanders?

Cindy: Yeah, and then when we get the worksheet sometimes I get kinda confused.

Lori: That's why you have somebody to copy off of.

Sally admitted that she expected to receive a lower grade in the class, like a "C or B", because "I work hard but then sometimes I goof around cause I'm that kind of person." Sally was observed on many occasions, almost daily, walking around the room or simply out of her seat, talking with friends at other module stations, or disengaged as her partner led the activities. Emily lost interest after "the third day" working with the food science module because "there was no more hands-on stuff, so it just got boring."

A major cause for the lack of attention was related to the social nature of the learning environment. Several participants were paired to work with their friends, while others were simply distracted by what their friends were doing across the room. Social distractions were a significant cause of participants demonstrating a lack of attention during learning with computer-assisted modules. Sally had mixed feelings about whether or not the computer-assisted modules kept her attention, as she said, "yes and no because my friends are in there, and sometimes they distract me." Shea also explained how she was distracted by her classmates, "Sometimes Jake and [his partner] would be goofing off, which made class fun, but you didn't get as much work done because you were laughing at them." Jill stated that, in working with her partner, "there were some parts where I felt kinda distracted where I just wanted to talk, but that was, we kinda just finished and then started talking, so it wasn't too bad."

On one particular occasion, Fred spent the entire time allotted for module time socializing with his partner:

> The class was dismissed to modules at 11:53 a.m. When he got to his station, Fred was just playing around in his chair. "What are you looking at," he said to a classmate. Then

> he asked to go to the restroom and was back in class by 11:59 a.m. Fred and his partner began talking and continued a conversation for several minutes, while wearing the headphones around their necks. It was obvious the videos were not playing because they were on the home screen of the module, which listed the daily lessons. They opened day 4 instead of day 5, but were still talking and had not started working yet, and it was 12:03p.m. It's been 10 minutes and Fred and his partner were simply socializing. The partner kept looking around the room. Their module packet is due on Friday. They also have a test Friday. They don't seem too concerned, since they aren't working, and it was 12:11p.m. By 12:16p.m., there was one minute left until clean-up and Fred spent the entire class period socializing.

On a different occasion, Tracy was observed going to Ms. Martin's desk to ask her a question. On her way back to her module, she stopped at Rachel's module to chat with a friend. Tracy was talking about softball on Friday, and Ashley looked up from her work to see what was going on.

Summary

This chapter provided the findings that resulted from the qualitative analysis of classroom observations, participant interviews, document analysis of the end of course evaluations, with some reference to the findings of the quantitative analysis of the curriculum content analysis discussed in Chapter 4. Six themes emerged from the data, which addressed each of the research questions that guided the study. For the first research question, "How are the cognitive principles of teaching and learning implemented in the design computer-assisted modular curriculum?" participants agreed with the results of the curriculum content analysis. Participants identified problems with the software such as the pace of the modules, lack of ease of navigation, and inability to pause, causing videos to be perceived as "hard." Participants also expressed their inability to relate to the content and narrators, making the videos “boring.” When participants described their attitudes towards learning with computer-assisted modules, many agreed that a mix of traditional instruction and computer-assisted modules was the best method for instruction because participants can still learn from the teacher, and experience time learning using computers, preventing either method from becoming “boring.” They also favored the hands-on activities over any other component of the modules. In response to the second research question, “How do students engage in the classroom learning process using computer-assisted modules?” it was made very clear by participants that the classroom environment is social in nature, which is their preferred way to learn because they value learning in social groups, and turn to their partners for help before considering asking Ms. Martin. Participants also agreed that even though learning with modules reflects “trust” from Ms. Martin and a sense of independence during learning, they still have the desire to interact with her as they engaged in learning. Research question three was, “How are students using self-regulatory skills while learning with computer-assisted modules?” Participants engaged in self-regulatory processes because they naturally had the abilities, and not because it was encouraged by the computer-assisted modules. Participants agreed that the greatest motivating factor in school is grades and achieving success in order to go to college some day. They also agreed that attention was the most significant influence in the learning process. Because of the social nature of the classroom learning environment with computer-assisted modules, participants felt that they were easily distracted by their peers. Yet, despite their distractions or inabilities to focus, participants felt it was very important as students to always “pay attention.”

Chapter 6

Conclusions, Discussion, Recommendations, and Summary

The purpose of this triangulation mixed methods case study was to investigate the phenomenon of student cognitive responses to learning with computer-assisted modular curriculum. Middle school students enrolled in an agricultural education program designed with computer-assisted modules served as the case study group. Over the course of the case study, participants engaged in using all of the content area modules available within the course, and completed one or more rounds of modules. While some participants had prior experience in learning with computer-assisted modules in other courses, for many, agriscience class provided the first encounter with learning environment centered on computer-assisted modules.

Triangulation mixed methods connected quantitative data derived from curriculum content analysis and student course evaluations with qualitative data derived from participant observations, interviews, and additional document analysis. The reason for using both quantitative and qualitative data was to validate and confirm the qualitative findings with the quantitative findings. Three research questions guided the case study:

1. How are the cognitive principles of teaching and learning implemented in the design computer-assisted modular curriculum?
2. How do students engage in classroom learning using computer-assisted modules?
3. How are students using self-regulatory processes while learning with computer-assisted modules?

Through a thematic analysis of the data, the following themes emerged. The themes provide an understanding of how computer-assisted modules are designed, and how students engage in learning in an environment with computer-assisted modules:

1. The content and design of the components of the computer-assisted modular curriculum create challenges for learners and lack integral principles of teaching and learning.
2. Based on their preferences for learning, students favor a mix of traditional instruction and instruction with computer-assisted modules because of the choices and variety of activities and instruction methods.
3. As students engage in learning with computer-assisted modules, they prefer to learn socially and value interactions with their peers.
4. The social nature of the classroom learning environment allows students to be independent while still interacting and learning with the teacher.
5. Self-regulation is innate and is not necessarily encouraged by the software or activities associated with computer-assisted modules.
6. Despite the level of intrinsic interest or value for a particular topic, students believe it is important to pay attention when engaging in learning experiences in school.

While the data were collected separately and analyzed concurrently, the quantitative data informed and supported the qualitative data, and vice versa. The quantitative and qualitative data sets were merged through the interpretation of the findings. The following sections of this chapter holistically present the conclusions, discussion of the findings of the study, and suggest recommendations for future practice and research.

Conclusions and Discussion

Through the analysis of the data, it became clear that the computer-assisted modules evaluated and utilized by students in this case study lack important principles of teaching and learning. Participants expressed perceptions and feelings towards the module content and design that supported the findings of the curriculum content analysis, observations, and document analysis. In a piece by Pullias (1997) critiquing computer-assisted modules, he described the opportunities provided through modular instruction as “lower-level” and “recipe-driven activities” that do not provide learners with opportunities to “use creative problem-solving skills, or to demonstrate a true understanding of the various concepts being addressed” (p. 2). Hart (2002) explained that learners of the millennial generation prefer to “draw their own conclusions” as they engage in learning experiences (p.5). The analysis of the data revealed supporting evidence for such claims. Participants often said that in order to be successful in agriscience class, all one had to do was listen, follow the directions, and turn in assignments. Even though the modules integrated a variety of activities and features to appeal to a variety of learners (i.e. audio, visual, multimedia software, hands-on activities, student workbook), according to the curriculum content analysis, the modules were rated poor due to the lack of opportunities for learners to engage in critical thinking or problem-solving within those activities. The direct instructional design of the modules identified through the content analysis, could prevent learners from being able to apply personal ideas to the learning activities.

Furthermore, the lower-level nature of computer-assisted modules is supported by participant’s perceptions of the modules being “easy.” The workbook activities, described by participants as “paperwork,” were said to require finding answers and filling in blanks. The workbook could be considered lower-level because the questions on the worksheets are typically fill in the blank, identification-type questions where learners report facts, instead of higher-level questions requiring open-ended responses. The same is true for the assessments, which are also lower-level in nature, as they are comprised of multiple choice type questions designed for learners to recognize information presented within the module videos. Thus, such questioning and assessment techniques prevent learners from being able to apply and express their own ideas during the activities.

Additionally, Pullias (1997) explained how computer-assisted modules present activities that are independent of each other, which can prohibit connections forming among the content across modules. The findings of the curriculum content analysis support this claim, as there was a lack of scaffolding among content and individual modules. While it is possible that the lack of scaffolding could make it difficult for learners to make connections between what they are learning at each module station and to everyday life, some participants found this design to be beneficial from a different perspective. Two participants explained that the simple design of the modules in presenting one topic with one specific activity each day is helpful in reducing cognitive load. Since one idea is presented at a time, rather than multiple topics being presented in a given lesson, it was easier for some learners to understand new information because of this design. So for some learners, the current design of the computer-assisted modules is beneficial in the teaching and learning process because of the way in which the content is divided and presented.

The curriculum content analysis, interviews with participants, and observations of the learning environment revealed that module navigation (i.e. pause, skip ahead, rewind) and the pace of the modules, especially in the design of the videos, were identified as software design flaws. The lack of a pause feature for the majority of the screens created challenges for students, especially those with learning differences. Many participants explained how they felt rushed by the pace of the modules, and that they often had to "backtrack" to complete assignments because of the lack of a pause feature. It was also necessary to re-watch segments of the videos to find the answers for the workbook activities. Participants defined backtracking as watching entire videos or segments of videos at least more than once. While the task of watching a video more than once could be considered a task strategy for the sake of completing a given assignment, according to Zimmerman (2002), this behavior is not a true demonstration of the correct use of task strategies. An example of at true task strategy would be grouping similar words by association to learn new meanings (Zimmerman, 2002). So, even though participants were watching videos multiple times, in this case, their motivation was to complete an assignment or fill in the blanks on the worksheets, not necessarily because the strategy of repetition would enhance learning. In addition, the navigational defect of the inability to skip throughout the module made the process of backtracking difficult for participants. Even though participants were able to use the menu to navigate throughout daily lessons within the module unit, it was not as easy to navigate through a given daily video. In many cases, participants explained or were observed watching the entire video to find the desired information, creating frustration and challenges during the learning process, and also taking time away from the hands-on activities that followed.

The lack of sufficient content reviews was a significant design flaw identified through the curriculum content analysis and participant interviews. Jill specifically expressed her frustrations with the fact that the videos ended with assessments and thorough reviews were not included. Because participants are expected to successfully complete a post-test following each daily module lesson, a lack of review can make the assessments difficult for some learners, especially for those who complete the assessments on different days from which they initially watched the videos. The act of reviewing content is a self-regulatory process (i.e. studying or reviewing content for a test), and if participants do not have access to a quality review through the module, then it would be solely up to the learner to take the initiative to study or review on his or her own. Learners who are limited in this ability may be at a disadvantage if reviews are not sufficiently included within the video portion of the computer-assisted modules. Furthermore, because the assessments are incorporated into the videos, it becomes difficult for many participants, as they felt the pace of the modules made it difficult to capture the information they needed to listen for in order to pass the assessments. This issue reaffirms the need for thorough content reviews within the module videos.

Participant's attitudes towards the modules were influenced by the module content, hands-on activities, and other work associated with the modules. The analysis of the interviews, observations, and end of course evaluations revealed that, while reactions to learning with computer-assisted modules were mixed, most participants had positive attitudes towards the experience. Participants mostly had positive first impressions from learning with the modules because initially, the experience was a change from the traditional methods experienced in other courses. Thus, the mixed responses of participant's attitudes and perceptions are related specifically to their learning style preferences, as well as whether or not participants found the modules to be easy or difficult. Participants who identified themselves as visual learners preferred the modules because of the video demonstrations of the activities to follow. Participants who identified themselves as hands-on learners looked forward to completing the computer portion of the modules in order to engage in the experiments. Yet, a consensus was not met among students as to their perceptions of learning with computer-assisted modules. There was a divide among participants who enjoyed learning with computer-assisted modules and those who preferred traditional instruction. Generally, learning with computer-assisted modules proved to be a personal preference and this varied from learner to learner based on learning style preferences, opinions of traditional instruction, and the positive or negative experiences learners had with their partners or in using the modules. Furthermore, based on Table 4 referenced in Chapter 4, which described the ratings participants gave to the particular modules in which they were assigned, most participants said they liked the particular modules. However, the reasons they liked the modules was because of the activities that came along with modules (i.e. hands-on activities or food), not necessarily for the concept of learning with a computer-assisted module. Therefore, even though participants liked the modules they were assigned to, in most cases, this was not synonymous with the idea that learning with computer-assisted modules was the preferred method of instruction.

Of the components associated with the computer-assisted modules, participants favored the hands-on activities. Hart (2008) described millennial learners as being experiential learners who prefer to interact with the content instead of being told about the content. As discussed in Chapter 4, participants often rated the modules they liked the most based on the activities that were associated with the particular modules, like the Soils module where eating pudding was one of the activities. The hands-on activities that participants described as the best part of the modules are truly no different from hands-on activities integrated within an agriscience class designed without computer-assisted modules. In a class without computer-assisted modules, students may still engage in soil testing, cleaning animal cages, making food items such as dehydrated fruit, or many of the other module-related experiments. Therefore, participants simply enjoy the opportunity to be engaged in hands-on activities, meaning the modules appeal to learners because of the hands-on activities, not because of the module package (including the workbook and/or videos). This is supported by the interview, observation, and end of course evaluation data, where participants expressed mostly negative attitudes towards the workbook activities, assessments, and video components of the modules, essentially everything except the hands-on activities. This is also supported by the fact that, on the end of course evaluations and through the interviews, participants expressed negative attitudes to modules that they perceived to lack hands-on activities, such as the FFA module. The application activity for the FFA module was the team campaign project, and participants did not perceive this activity to be hands-on.

The participants in this case study demonstrated behaviors and expressed opinions that were clear descriptors of the millennial generation. Hart (2002) described the millennial generation as "self-reliant and very social" where "friends are very important to them, and they have a large network. They like to multitask and are always onto the next thing" (p. 2). These characteristics were clearly identified through observations, interviews, and the end of course evaluations. Participants explained their preferences for social learning, as they described how they value interactions with their peers. Because computer-assisted modules are completed while students are in pairs, they are allowed to work with partners, which made learning "fun" and "easier". Participants relied on their partners to answer questions and complete activities. However, in learning socially, participants would rather select their partners or work with friends over working with a classmate in which they did not already have an established relationship. This is especially supported by the fact that many participants admitted they select their partners based on who they are friends with both in and outside of class. Participants were often observed gravitating into teams of four during module activities, which supports the idea that millennial learners desire social learning. The need for multitasking and variety of learning is also supported by the data. Participants often said they enjoyed the modules because of the variety of activities, and the fact that everyone in the class was engaged in something different. Participants were excited to see what their peers were working on at other module stations.

Thus, the learning environment created by computer-assisted modules is favored by millennial learners because of the social nature created by the course design.

Hart (2008) explained how there is a “spectrum of digital literacy” (p.4) among the different generations across time. But, within the millennial generation, comprised mostly of “digital natives” as described by Prensky (2001), there is a spectrum of digital literacy within its own generation. Among the participants were several students who either did not own a computer at home, were uncomfortable using technology, or who did not engage in online social networking, such as Facebook. Thus, despite the generalizations made about individuals born within the millennial generation, there are still learners who could be considered digital natives, but are truly digital immigrants because of their lack of technological access, or personal choices not to engage in excessive technology use. There are others, however, who feel that using computers in school is “normal” because they are so used to using technology on a daily basis. Some participants also felt that they are more trusted by the teacher when they are allowed to use computers during learning, and that the modules allow participants to lean independently. As Hart (2008) described the millennial generation as being independent during learning, this supports those findings, since participants specifically acknowledged that they appreciated the independence created by the learning environment with computer-assisted modules.

As referenced in Chapter 2, as students gain experiences learning with computers, the excitement eventually fades and it becomes difficult to maintain the motivation to learn during computerized instruction (Keller, 1997; Keller & Suzuki, 1988). This concept holds true for participants who engaged in learning with computer-assisted modules. While some participants found the experience to be overall exciting when compared to other classes that did not use computer-assisted modules, many participants explained how simply learning with modules became “boring”. Some participants were enrolled in two elective courses at the same time and were using modules in both courses. Thus, participants prefer a mix of traditional instruction and computer-assisted modules, because using modules every day causes learners to lose interest. Interestingly, many participants said that they do not have the opportunity to use computers quite as often in other classes. From that perspective, using computer-assisted modules in agriscience class is still exciting for students in terms being able to use the actual computer, not necessarily for the modular curriculum. Also referenced in Chapter 2 was the issue of teachers experiencing anxiety when integrating technology into the classroom. In this particular case, Ms. Martin was very comfortable integrating a variety of technology, including the Smart Board, clickers, and software programs such as PowerPoint. When explaining their favorite way to learn in agriscience class, some participants identified the Smart Board to be more exciting as a learning tool than the computer-assisted modules. Because of Ms. Martin’s comfort level with technology, and access to a variety of technological tools, she was able to provide a variety of experiences for her students.

It is also important to note that the learning environment with computer-assisted modules does not necessarily have a negative impact on interactions among the teacher and the students in this particular case. Because of the way Ms. Martin implemented the computer-assisted modules, student-teacher interactions were still encouraged. Students interacted with Ms. Martin on a daily basis as she went around the room to answer questions, and engaged in learning with the students as she would ask questions, engage in conversations, and help with activities. This was also a way for Ms. Martin to provide feedback for the students while they were learning with the modules, since the computers did not provide feedback aside from grades on assessments. Participants agreed that Ms. Martin helped them during modular learning, which confirms the fact that as the teacher, she continued to engage with the learners during their experiences, despite the course design.

Generally, students expressed an appreciation for the trust and independence that Ms. Martin expressed as they engaged with the computer-assisted modules. Participants felt that the learning environment with computer-assisted modules allowed learning to occur independently, yet students still desired learning with Ms. Martin. Participants were observed constantly asking questions, seeking assistance on various activities, or just wanted to discuss what they were doing at the module stations. This confirms the fact that learners of the millennial generation value independence, yet still desire some guidance from the instructor (Hart, 2008). Also, despite the fact that instructions were posted at the front of the room at all times, and that Ms. Martin explained the daily procedures at the start of each class period, students still preferred to talk to Ms. Martin about what they were doing as they engaged in learning activities.

Based on the Phases and Subprocesses of Self-Regulation model by Zimmerman and Campillo (2003), there are three phases of self-regulation. It was proposed by the researcher that the first phase, the forethought phase at the start of a learning experience with computer-assisted modules, the performance phase occurred during the learning experience with computer-assisted modules, and the self-reflection phase occurred at the end of the learning experience. Based on observation and interview data, the overall conclusion is that participants engaged in the subprocesses of each of these phases throughout the learning experience, but most commonly during the performance phase. Each day participants were given instructions, would go to their modules and find the place where they previously left off, and began with the next activity. So, there was little time and opportunity for learners to truly engage in the aspects of the forethought phase, especially goal setting. Participants spent the most time in the class engaged in learning with computer-assisted modules, and would usually work until the very end of the class, some participants finishing after class was dismissed, so there was also little opportunity to engage in self-reflection at the end of the learning experience.

Participants who naturally engaged in self-regulatory processes demonstrated those abilities or spoke of those strategies at different times, in different ways, depending on the situation. Simply put, in this case, participants were self-reflecting, analyzing tasks, experiencing self-motivation, and using task strategies at all phases of a given learning experience with the computer-assisted modules. There were several subprocesses, including goal setting, strategic planning, imagery, and self-experimentation that were not explicitly observed by the researcher or discussed by participants, and were challenging to measure. The most common and significant subprocesses addressed by the majority of participants and observed by the researcher include self-motivation beliefs (i.e. self-efficacy, outcome expectations, intrinsic interest/value), attention focusing, task strategies, self-recording, self-evaluation, and self-satisfaction. However, these self-regulatory processes were not encouraged within the computer-assisted modular curriculum. Participants who engaged in one or several of these processes did so because they naturally had the abilities, personal desire, and knowledge of how to engage in self-regulation, not because it was encouraged by the curriculum during modular instruction.

In regards to self-motivation, there were many factors that influenced how participants perceived themselves as learners. Self-efficacy emerged as a significant indicator of participant's motivation to learn, and this influenced their perceptions of learning with computer-assisted modules as well. Participants who did not think they were good at what they were doing, or that they would achieve a lower grade in agriscience class, appeared to be less engaged and explained that the class was difficult, the modules were difficult, or there was some aspect they did not particularly enjoy. Whereas participants with higher self-efficacy, who predicted a higher grade in the course, generally expressed that agriscience class was easy, the modules were easy, or there were more aspects of the course and experience that they enjoyed. Participants were very aware of how they are motivated to learn, how their motivation impacts performance and effort, and how motivation changes based on interest for a given topic.

Participants expressed many different forms of motivation. However, one commonality was that participants shared the outcome expectation or goal of free time or animal time, as well as the experiments. Participants were eager to complete the computer part of the modules in order to be able to complete the experiments, because they look forward to the experiments. But participants also knew that once they finished the experiments, they could spend time with the animals or have free time. So, participants worked harder to finish their daily assignments because they knew what to expect as an outcome of completing assignments. Participants rarely indicated personal outcome expectations about the learning experience itself, other than the excitement of engaging in experiments or other hands-on activities. But aside from this, participants described other forms of motivation for learning, such as motivation from family members, personal determination, a desire to be successful in school or life, and most importantly, to receive “good grades.” The most important motivational factor for participants was grades, which is also a trait of the millennial generation of learners. As previously mentioned, participants with lower self-efficacy were not as motivated by grades, or expressed that they did not expect to receive an A in the course. Participants with higher self-efficacy predicted to receive an A in the course, and were very driven to achieve high grades in every class.

Intrinsic interest/value is connected with how students engage in self-regulation while learning. This was one of the more measurable self-regulatory processes because participants openly described their feelings about what they were learning with the computer-assisted modules in agriscience class. Participants were aware of how their interest for what they are learning impacts performance on learning tasks. In order for participants to maintain interest in what they were doing in class, and apply what they were learning to other areas of school or life, it was clear from the findings that a true intrinsic interest/value for learning be present. When participants lacked intrinsic interest/value for learning with the modules, it was clear that it became difficult to maintain focused attention and stay engaged in the tasks. Zimmerman (2002) explained that when students are interested in a particular subject, they actually enjoy engaging in the activities, mastering the content, and are more motivated and self-regulated. The findings of the study support this claim, as participants explicitly said that when they were more interested in a topic, they were more engaged, worked harder, and put forth more effort, compared to when they were not as interested in a topic. As discussed in Chapter 5, attention focusing was a significant self-regulatory process observed and discussed during the interviews, and was found to be closely tied to intrinsic interest/value. Participants expressed the fact that their interest in the module topic was related to how well they focused their attention. Yet, attention focusing was significant to participants. Participants felt strongly that because they are students and they have to learn information despite how they feel about it, paying attention is always very important, despite the topic or means of delivery.

As participants engaged in task analysis, there was a similar issue as with the task strategies previously mentioned. Participants engaged in task analysis to determine what they had to do next, or how to answer a question, but not for the true meaning of task analysis. True task analysis would be an activity such as “grouping words into syllables” (Zimmerman, 2002, p.68), or planning to use a specific strategy because the individual knows it will be helpful during the learning experience. There was only one participant, Nicole, who explained the ways in which she engaged in task analysis to learn new information by setting goals and planning strategies. Task analysis was challenging to measure among participants because many did not explicitly identify particular mental goals they might have set during the learning experiences with computer-assisted modules. As for self-recording, there were many observations of a few particular participants who were diligent about keeping track of their personal time on tasks, monitoring how long it would take to complete assignments, and managing time on activities. Clearly, there are students who are more apt to engage in self-recording than others. While the modules have a screen at the end of each video with a clock, this clock does not actually keep track of time on task, and it disappears as soon as students click on the next button. So the computer-assisted modules do not help students engage in self-recording in any way, as was discovered through the curriculum content analysis and observations.

During the interviews, participants self-reflected on their learning experiences. They reflected on their reactions to what they were learning and their satisfaction with performance on different tasks. It was clear that some participants were better able to self-reflect than others. Generally, participants described feelings of satisfaction, accomplishment, achievement, and relief when reflecting on having completed an assignment to the best of his or her ability. When participants were working in teams, there were several occasions where they were observed self-reflecting by engaging in conversations with peers to assess progress on assignments. Yet participants felt like receiving positive feedback from peers or Ms. Martin was an indicator that an assignment was completed successfully. So as part of self-reflection, participants appreciated some form of feedback because feedback had a positive impact on participant's self-efficacy and personal reflection. As previously mentioned, some students worked on finishing assignments directly until class was dismissed or sometimes several minutes beyond the class change, so there were some cases where there was little time or opportunity for learners to engage in self-reflection at the given moment when assignments were completed.

Essentially, participants were divided among their perceptions of learning with computer-assisted modules. While most students preferred a mix of traditional and computer-assisted instruction, many students had strong preferences for computer-assisted modules over traditional instruction, and vice versa. Even so, students agreed that one of the most enticing components of the modules included the hands-on activities that correspond with each daily lesson. Participants engaged in learning with the computer-assisted modules socially, as they naturally gravitated towards each other especially during the hands-on activities. Hands-on activities, the component enjoyed most by participants, do not necessarily require the entire module package in order to occur in an agriscience classroom. The other favored component of learning with computer-assisted modules was the social nature of the learning environment because students truly enjoy learning from each other and the opportunity to socialize. But even with this freedom and independence, students still what the teacher involved in the learning experience. Students want independence, but not total independence because they still want to ask questions and interact with the teacher, which in this case, occurred quite often and was not impacted by the modules.

In terms of the design and content of the computer-assisted modules, significant principles of teaching and learning were identified as lacking from the modules. Such principles include a lack of content reviews, lack of ability to pause, higher order thinking questions, or reading beyond the brief information on the screens, to name a few. Opportunities to encourage self-regulation were absent from the computer-assisted modules, but the findings of this study revealed that students will engage in self-regulation at their own discretion, at different times during the learning experience, and at different levels. So, even though students could be self-regulated without the cues from the modules, students who are less self-regulated are missing opportunities to learn new metacognitive skills and practice being more self-regulated. In this case, the students felt very strongly of the importance of attention focusing, a key self-regulatory process. Most participants agreed that students should pay attention to what they are learning for any topic, in any situation, despite the level of interest or value for the topic.

Recommendations

Computer-assisted modules are an example of a tool that can be used during teaching and learning. Because students in an environment with computer-assisted modules are learning mostly with the modular tools, the design and content directly impacts the learning experience. While computer-assisted modules can be a valuable tool for teaching and learning, based on the findings of this study, there are a variety of improvements that could be made to enhance the appeal and rigor of computer-assisted modules. Yet, as educators, there are also recommended strategies that would create more effective learning experiences for students.

Suggestions for module improvement. A redesign of the software and workbook materials associated with computer-assisted modules is necessary to better integrate the cognitive principles of teaching and learning and encourage learners to engage in self-regulatory processes. Rather than simply incorporating videos and worksheets, the computer software should be upgraded to include interactive features such as reviews, periodic breaks for students to review or reflect, and workbook activities that allow students to apply their own ideas and creativity. The assessments at the end of each module should be modified because they are designed at the lower knowledge level of Bloom's taxonomy. The levels of Bloom's taxonomy include knowledge, comprehension, application, analysis, synthesis, and evaluation. Krathwohl, Bloom, & Masia (1964) described the cognitive domain of the taxonomy of learning, which consists of the design of learning objectives focusing on "remembering or reproducing something" at the lower level, and on problem solving, synthesizing concepts, or creating new ideas at the higher level (p.6). The assessments should be redesigned to assess student learning at higher levels because currently, they simply assess for the identification or recall of facts which does not allow students to synthesize or conclude thoughts about the content. Short answer/essay style questions could be one solution because such questioning techniques allow students to express their ideas on a particular topic by synthesizing concepts through using their own words and concepts. Also, the modules should be redesigned to meet the needs of students with learning differences, and should especially include closed captioning, language translation, or other accommodations for all types of learners. The following recommendations address the module redesign needs based on the sections of the curriculum content analysis evaluation form.

Providing a sense of purpose. Each module should have a clear introduction and conclusion to set the context for the unit as well as summarize the content. As topics transition within each lesson, a summary or review questions should follow to alert learners that a new topic is next, as well as to allow students time to process and rehearse the information they have just learned. Content should be scaffolded and each lesson and activity should build upon one another, showing connections between daily lessons and even modules of different topics. The introductions to the modules attempt to create a sense of purpose, but for a middle school learner, this attempt is not strong. Rather than telling students why the content is important, incorporating a question or activity to engage learners and encourage thinking about the topic and prior knowledge would be beneficial. Smoother transitions between topics within lessons are needed to allow learners time to activate background knowledge and set the stage for the next topic.

Taking account of student ideas. Reading and literacy are critical skills for learners to develop; therefore further opportunities for reading should be integrated throughout the modules. Reading is also a tool that could be used to activate background knowledge or address ideas about a topic. The introduction and content presented throughout the modules should include activities or information to help learners make connections between prior knowledge of the subject and the new information, as well as to acknowledge common ideas. This is especially important since participants described how prior knowledge makes learning easier. Module activities should be challenging and allow students to incorporate their own ideas. The incorporation of more tasks within the computer component may allow learners to use more task strategies while working with the computers.

Engaging students with relevant phenomena. The most important recommendation for this section is to upgrade and improve the multimedia design of the computer component of the modules. The multimedia features including images, video clips, buttons, navigation, and narrated voices should be updated not only to improve the ease of navigation, but to appeal to middle school students, keep up with the latest trends in technology and integrate a variety of interactive activities. This is especially important since many participants explained that it was difficult to stay focused on the videos because they could not relate to the voices they were hearing.

Developing and using scientific ideas. Activities or interactive multimedia features should be integrated throughout the modules to create a learner-centered computer-based learning environment. For all sections despite the content, some type of learning activity should be developed to provide learners with opportunities for practice, demonstration of knowledge, and application. Supplemental activities other than crossword puzzles and vocabulary tests should be integrated throughout the modules. This could include activities that integrate content from other core areas, reading or writing assignments, or a variety of other assignments. Crossword puzzles and vocabulary tests are not ideal for the application of scientific ideas, skills, or new knowledge, nor do they reflect higher level learning.

Promoting student thinking about phenomena, experiences, and knowledge. The modules should be redesigned to allow learners more opportunities for self-evaluation and application of prior knowledge, either through activities, questioning, or an input where students can enter personalized information as part of the lesson. Modules should be redesigned to integrate student input, expression of ideas, and ownership. In addition to the optional journal entries, other activities that encourage critical thinking, reflection, and self-evaluation should be integrated throughout both the computer and hands-on components of the modules (i.e. mind-mapping). As previously noted, learning activities and questioning on assessments should be enhanced using higher levels of Bloom's taxonomy such as analysis, synthesis, or evaluation (Bloom et al., 1956). This would provide learners with opportunities to construct their own knowledge by making connections between prior and new knowledge, and through explaining what they have learned by integrating their own ideas, rather than simply identifying information.

Assessing progress. Feedback is a necessary component that should be incorporated throughout the modules. With the addition of questions and other learning activities, feedback will provide motivation and self-evaluation opportunities for the learner. This can be integrated as an updated multimedia feature where a form of feedback, such as words or symbols, are presented when students complete an activity or answer a question. The design of the modules should include a pause button, where learners can pause during a presentation if they are taking notes or decide to ask questions, or if they need to review information on a prior screen. Ease of navigation should also be updated to allow learners to refer back to a previous screen without having to watch the same information again to get to where they left off. Assessments and student workbook components need a redesign of the pretests, posttests, and daily quiz assessments to create assessments that foster learning and check for understanding instead of rote memorization. In addition, the questions should include more written response format, rather than all multiple choice.

Additional recommendations for computer-assisted modules. The information presented through the computer component of the module should be redesigned to perform at a slower pace. Without the visual information to accompany the audio, the speed should be slower so learners can keep up and have time to comprehend the content. When information is presented on the screens with an accompanying diagram, the text should remain on the screen during the progression of information, rather than flashing on the screen as it is being discussed and then disappearing. The information should remain on the screen even when it is not being directly discussed to allow learners time to processes and rehearse the information.

For the hands-on components, the lab activities are valuable; however they should be reformatted to provide learners with some freedom for determining how to proceed with the exercise, rather than following a rigid set of instructions. With the addition of activities to the computer component of the modules, tracking of time on tasks should be added as a multimedia feature. This feature would allow learners to demonstrate self-regulation. Learners would be able to monitor their progress through identifying the areas where they spent more or less time based on level of difficulty, types of assignments, or amount of effort and motivation related to the task. It would also measure the amount of time learners spend on the assessments. Also, the modules should integrate fewer assessments, as multiple choice quizzes every day become tedious for learners. Unless the assessments are presented in different forms (i.e. open-ended, essay, short answer, summary) as suggested, they should occur less frequently.

Recommendations for educators. Teachers who are currently integrating computer-assisted modules as part of a Career and Technical Education (CTE) program should take into consideration the thoughts and perceptions shared by participants in this study in order to enhance and improve the learning experience. The practice of modifying and integrating additional activities into the module packets, providing students with additional hands-on activities, and building student-teacher discussions into the modules, as demonstrated by Ms. Martin, would enhance the modular learning experience. Additionally, since the modules lack opportunities for students to engage in reading, educators should integrate content area-related articles, passages, or short stories that would allow learners to read for comprehension and literacy.

It is also recommended that teachers with computer-assisted modules integrate other forms of technology and instruction into their courses, and refrain from solely relying on modular instruction, as participants specifically explained they prefer a mix of traditional and modular instruction. The variety of instructional methods proved to keep learners engaged throughout the course. Since Ms. Martin was comfortable using different forms of technology, such as clickers for reviews and assessments, or the Smart Board, which students enjoyed most, she was able to integrate a variety of tools that varied instruction, which provided students with the opportunity to learn with tools that may not frequently be used in other courses. Therefore, educators who have access to additional technological tools but may not necessarily be comfortable in teaching with technology need professional development or opportunities to seek help from more experienced teachers to effectively integrate technology in any classroom. Also, for educators who may be new to teaching and learning with computer-assisted modules, it would be highly beneficial to take advantage of other effective CTE programs implementing modules by making connections and school visits with teachers who have successfully integrated modules into their programs.

In any subject area, educators currently in the classroom are working with the same type of student, described as the millennial generation learner. Specifically in the CTE classroom with computer-assisted modules, it is recommended that students be encouraged to learn socially by interacting with teams and peers for a variety of tasks. Depending on the student population, it may be necessary to strategically pair students, like in the case of Brad, who was hearing impaired. By paring Brad with a student who was willing to help him, Brad was more successful than working on the modules alone or with a partner who was not interested in teamwork. So, even when encouraging students to work in teams and social learning, it is important to consider the learners with special needs, especially since the modules lack accommodations.

At the same time, students should be encouraged to learn independently yet with guidance from the teacher, creating a more student centered learning environment. This is especially important because independent learning will help students become more self-regulated. However, along with this is the need for feedback. Unless modules are redesigned to include different forms of feedback, it is important that teachers provide their students with frequent feedback along the way, since participants expressed their value and appreciation of feedback from the teacher. Methods that were observed in this case, such as circulating around the room to visit with each team of students to assess progress and discuss the content, or providing frequent feedback on other coursework, proved to be helpful in boosting students' confidence and providing guidance throughout the course.

While self-regulation is innate for many students, it is also a metacognitive process that students can develop with the help of educators. Since self-regulatory processes evolve over time as students advance as learners, it is recommended that teachers implementing computer-assisted modules integrate opportunities throughout the course to help learners become more self-regulatory. This can be accomplished by providing opportunities for students to engage in self-regulation during modular learning experiences and throughout the agriscience education course. Examples of such activities might include (1) keeping a self-reflection journal, (2) goal setting exercises at the start of each daily lesson, (3) teaching new strategies during class to help students prepare for assessments, or (4) teaching students different task strategies such as using flash cards, vocabulary techniques, or comprehension exercises. If the modules are lacking opportunities for students to engage in self-regulation, it is up to the teacher to provide supplemental activities for students to practice self-regulation.

Recommendations for Further Research

Based on the findings of the curriculum content analysis, further research is recommended to investigate how the cognitive principles of teaching and learning are integrated throughout modular software developed and distributed by other companies, as well as the updated modular software distributed by the same company involved in this case study. It is also recommended to conduct a content analysis of computer-assisted modules of other grade levels, such as elementary school or high school, to see how those modules compare in terms of the design and integration of teaching and learning principles. Also, further research should investigate how students engage in learning with computer-assisted modules in a class that strictly uses modules. This would be beneficial in exploring if students perceive such an environment to be different from this case, where traditional instruction was integrated throughout the course.

With the strong preference participants identified for the hands-on activities, further research should be conducted to investigate how students respond to the same hands-on activities in a traditional learning environment with that of a computer-assisted modular environment. This would be beneficial in further explaining the phenomenon of the desire for hands-on learning, and if the modules truly make a difference in how students perceive those hands-on experiences.

Self-regulation is vital for learners to develop. Based on this study, there are several aspects of self-regulation that were difficult to measure. Further research exploring how students engage in self-regulation during learning experiences would be beneficial to explore areas such as goal setting, strategic planning, or self-instruction, for example. More specifically, this study took place in a middle school classroom using computer-assisted modular curriculum. Middle school students may be more in the novice stage of development of self-regulatory processes, whereas it is possible that high school students might be more advanced in using self-regulatory processes. A similar study with a population of high school students may provide more insight into how older learners engage in self-regulatory processes with computer-assisted modules.

Computer-assisted modules are a significant development in the curriculum realm, as a tool that integrates crafted lessons, activities, and self-guided instruction. Based on the literature about the path agriscience education has taken over the last several decades, it is clear that science integration and inquiry learning is significant component in agricultural education today. This is especially true with the addition of science credits for agriscience courses, as well as the integration of Science, Technology, Engineering, and Mathematics (STEM) education. Based on this information, as well as the findings from this study, it is suggested that computer-assisted modules lack opportunities for inquiry learning, higher level thinking, and present lessons and activities at a lower cognitive level. Could it be that middle school level computer-assisted modules are not as scientific or inquiry-based as high school level modules? Further research should be conducted to explore how the advanced level modules, such as high school level, integrate scientific components, if the modules meet the standards of achieving science credit, or if the modules are more inquiry-based in nature.

Participants defined the workbook materials that corresponded with the hands-on activities and module videos as “paperwork.” It could be possible that participants chose to describe the workbook activities as paperwork for the simple fact that the assignments required searching for answers and filling in blanks, or that students may have heard such assignments labeled as paperwork in other courses. Would participants still define the workbook activities as paperwork if they were able to think critically, propose their own hypothesis, and design their own experiments? Further research should be conducted to investigate the meaning behind the term “paperwork” and how students perceive such activities as part of any learning experience.

Summary

Teaching and learning using computer-assisted modules has grown in popularity. It has been suggested that computer-assisted modules encourage cooperative learning, while creating an environment where learning occurs at an individualized pace. In recent years, a number of Career and Technical Education (CTE) courses have adopted computer-assisted modular curriculum, including technology education, family and consumer science, and agricultural education. Yet, few studies have been conducted, especially in agricultural education, to examine the use of computer-assisted modules in CTE courses. One particular study by Johnson and Deeds (2002) examined traditional instruction versus instruction with computer-assisted modules for high school students enrolled in an agricultural education program. Beyond achievement on assessments as a result of traditional or computer-assisted modular instruction, little empirical research has been conducted in agricultural education to explore exactly how students engage in learning using computer-assisted modules, or students' perceptions of learning with computer-assisted modules. While teaching and learning with computer-assisted modules is heavily researched in technology education, the research is still weak in exploring the modular concept from a learner's perspective, especially in agricultural education.

The findings of this study have provided an authentic perspective of learning with computer-assisted modules from the point of view of middle school students who were experiencing the modules firsthand. Six significant themes emerged from the data. Computer-assisted modular curriculum truly is a unique tool that can be used to enhance a learning environment. While some students appreciated learning with modules, others found it to be no different from learning with a teacher, or not at all how they would engage in learning if they had a choice. Through the integration of technology into the classroom, students have the ability to find more information during a learning experience as desired.

Even though the desire to learn with modules truly is based on learning style preferences for many students, they valued and desired the social environment created by the modules. The software associated with computer-assisted modules should be redesigned to help learners engage in self-regulatory processes, but it is also up to the teacher to encourage students to engage in self-regulation. Thus, computer-assisted modules should not be a shortcut in curriculum planning or instruction, especially since teaching and learning with computer-assisted modules provides great opportunities for teachers to engage in learning with students. It takes time and effort to create an interactive environment where the teacher is still connected with the students as they engage with the modules, and teachers should consider adding a personal touch to the learning activities. Students' desire interactions with their teachers when learning with modules, they want to ask questions, they want guidance. In this case, students also believe in the value and importance of school, and will pay attention and learn from a variety of experiences, no matter how they feel about a particular topic. Students engage in self-regulation at different levels and in many different ways. As educators, we have the ability to help our students become more self-regulated, and should provide such opportunities for learners, especially in a computer-assisted learning environment.

Computer-assisted modules are just one little trick in a teaching and learning toolbox. Along with modules come a variety of benefits and challenges, but further research can help provide the answers or strategies for minimizing challenges and maximizing student success. As technology continues to advance and new waves of trends meet the field of education, fresh tools will continue to enter America's classrooms. With the potential of further research, proper training for educators, and an enhanced awareness of the importance of the development of self-regulatory processes, teachers have the power and resources to create a rich learning environment for students of the millennial generation and beyond.

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Appendix A

Letter of Permission for Phases and Subprocesses of Self-Regulation Model

PERMISSION INVOICE

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Appendix B

Parent Consent Form

Virginia Polytechnic Institute and State University

Informed Consent for Participants in Research Projects Involving Human Subjects
Parent Permission Form

Title of Project: A case study of student cognitive responses to learning with computer-assisted modular curriculum

Investigators: Ms. Jessica Waknine, Graduate Research Assistant, Virginia Tech
Dr. Donna Moore, Assistant Professor, Virginia Tech

I. Purpose of this Research

Computer-assisted modules are designed as a tool for students to learn the various areas of a subject through interactive media presentations via computer. Students are able to keep track of their grades and progress during the course as part of the modules, making these programs self-regulatory.

Students currently enrolled in two sections of the middle school agricultural education course of the same grade level will be eligible participants for this study. All students who assent to participate in the case study will be observed during class. For the participant interviews, no more than fifteen students who assent to participate will be interviewed. If more than fifteen students assent for interviews, participants will be randomly selected by the reseracher. Particpants will range in age from 11 to 14 years old.

II. Procedures

The researcher will spend six to eight weeks, depending on the module and elective rotation schedules, working with the case study group. The first few meetings will allow the researcher to establish rapport with the teacher and the participants, become familiar with the agricultural education program, as well as to familiarize students with the study and the researcher's purpose for being there. Participant observations will begin when participants begin their first round of modules. Observations will continue through the second module rotation. The researcher will keep a field journal with notes about how students engage in learning with the modules and the classroom learning environment. Participants will not be expected to do anything out of their ordinary routines during the observations.

Participant interviews will begin after participants complete their second module rotation. As a participant, your child will be asked a series of questions about their experience in the course and their experience using computer-assisted modules based on the interview protocol designed by the researcher. The interviews will take place during the students' advisory class or the agriculture class to protect the participant's confidentiality and limit academic disruptions. Interviews will be audio recorded; however at no time will the recordings be released to anyone other than the researchers involved with the project.

III. Risks

This study has been reviewed and approved by the Virginia Tech Institutional Review Board. This study does not pose any risks to participants. Your child's grades in the course will not be impacted by the decision to participate.

IV. Benefits

There has not been any promise or guarantee of benefits to participants from this study. However, benefits of this study will span to people in education including teachers, administrators, school board members, and others who are responsible for making decisions about whether or not computer-assisted modules should be used in the classroom. By participating in this study, your child will have the opportunity to share his or her opinions and experiences of computer-assisted modules, which is valuable information for those who are responsible for designing such curriculum.

V. Extent of Anonymity and Confidentiality

Protecting your child's identity is a top priority of this study. As a participant in this research project, your child's information will be kept strictly confidential. Participants will be identified in the interviews by pseudonyms, and audio recordings will be labeled with a numerical code system. At no time will information be released that allows an individual to be identified. At no time will the researchers release the results of the study to anyone other than individuals working on the project without your written consent.

Observation data including field notes, interview transcripts, and audio recordings will only be accessed by members of the research team, which includes Ms. Jessica Waknine and Dr. Donna M. Moore. Ms.Waknine will be the person responsible for transcribing and coding the observation notes and interviews. Audio recordings will be stored in a locked filing cabinet by the research team. Data and recordings will be destroyed upon completion of the researcher's master's thesis.

It is possible that the Institutional Review Board (IRB) may view this study's collected data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research.

VI. Compensation

Compensation will be given to students enrolled in each course section, whether or not students consent to participate. Compensation will be in the form of Virginia Tech paraphernalia, such as Virginia Tech school supplies including pencils/pens, folders, and/or notebooks. Compensation will be given out when the case study is complete.

VII. Freedom to withdraw

You child is free to withdraw from the study at any time without penalty. Your child is free to not answer any questions without penalty.

VIII. Participant's responsibilities

I voluntarily agree to allow my child to participate in this study. My child's responsibilities are to:

- Do normal classroom activities during observations
- Answer the questions during the interview to the best of their ability and at their comfort level

IX. Participant's Permission

I have read and understand the Parent Permission and the conditions of this project. I have had all of my questions answered. I hereby acknowledge the above and give my voluntary consent for my child:

______ YES   ______ NO

_______________________________   _________________
Parent Signature   Date

Should I have pertinent questions about this research, I may contact:

Dr. Donna M. Moore, Assistant Professor
540.231.8188
mooredm@vt.edu

Ms. Jessica Waknine, Graduate Research Assistant
540.231.7422
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Dr. David M. Moore, Chair of the Institutional Review Board for the Protection of Human Subjects
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Virginia Tech Institutional Review Board: Project No. 09-992
Approved November 18, 2009 to November 17, 2010

Appendix C

Parent Letter

December 10, 2009

Dear Parents or Guardians,

My name is Jessica Waknine and I am a graduate student at Virginia Tech in the Department of Agricultural and Extension Education. I am writing to share information about an exciting research opportunity, and ask for your support with this project. I will be spending the next six to eight weeks visiting in your child's agricultural education course ____ in order to complete a case study for my master's thesis. The purpose of this case study is to understand how students learn while using computer-assisted modular curriculum.

The study will include:

- My observations of the classroom learning environment and how students interact with the computers, each other, and the teacher.
- I will conduct interviews with students to learn about their perceptions of learning with the computer assisted modules.
- I will conduct follow up interviews if clarification is necessary based on the information I learn in the first interviews.

Participation in this case study is voluntary and your child's grades in the course will not be impacted by the decision to participate. Only students who consent to participate will be noted in observations and will be interviewed. Furthermore, you child's identity will be kept strictly confidential throughout this process. Your child will have the opportunity to select a pseudonym to protect their identity during the interview.

If you feel comfortable with your child's participation in this study, please carefully review and sign the enclosed consent form. Also enclosed is a pre-addressed, postage paid envelope for your convenience in returning the consent form. The consent form can also be returned by sending it to school with your child. Please feel free to contact me if you have any questions. I can be reached at 540-231-6836 or jwaknine@vt.edu.

Thank you so much for your support!

Jessica Waknine
Graduate Research Assistant
Department of Agricultural and Extension Education

Appendix D

Assent Form

Virginia Polytechnic Institute and State University

Informed Consent for Participants in Research Projects Involving Human Subjects
Minor Assent Form

Title of Project: A case study of student cognitive responses to learning with computer-assisted modular curriculum

Investigators: Ms. Jessica Waknine, Graduate Research Assistant, Virginia Tech
Dr. Donna Moore, Assistant Professor, Virgina Tech

X. What is the study about?

Computer-assisted modules are an interactive tool schools use to help students learn about a certain subject, and in this case, that subject is agriculture. The modules use videos, sound recordings, pictures, and reading material. Modules are used in all kinds of elective classes, like industrial arts or health. The goal of this study is to explore how students learn when they are using computer-assisted modules, and how students keep track of what they are learning, which is called self-regulation. For example, if you like to take notes while the teacher is explaining a topic that you think is really interesting or because you know the information will be on a test, taking notes is a self-regulated activity. You are keeping track of what you are learning by taking notes to make sure you can remember the important information. Since the module has all the information you need to know, this study is going to help me find out more about how students learn with the module, instead of with the teacher.

XI. Why are you qualified for the study?

Since you are currently enrolled in this agriculture class, which uses computer-assisted modules, you are able to participate in this study. As you complete a few of the modules, you will have enough knowledge of how they work to participate in this study.

XII. This study is voluntary.

This study is completely voluntary. You are not required to participate. You will not receive extra credit if you participate in the study, and your grade will not be affected if you don't participate in the study. There is no consequence for not participating.

XIII. What are the procedures for the study?

First, I will come to your class so I can meet you and spend some time getting to know you, your teacher, and the daily routines of your class. When you begin a new module, I will start making observations. My observations are going to be notes on how the class works while students are using the modules. So, you will just be doing your normal, daily activities and I will either be sitting somewhere around the room or walking around to see what everyone is doing. I will take notes in journal that I plan to keep during my time in your class. I will visit your class every day and make observations during class activities until everyone has completed two modules. Then, I will begin the interviews. Interviews will happen either during your agriculture class when you are finished with your activity for the day, or during your advisory class. We will find a place around school that is safe and quiet for us to talk, like the library, cafeteria, or agriculture shop, so that your friends won't know you are being interviewed. The interview will be recorded, but I will be the only person who is going to listen to it when it is over. Once the interviews are complete with all the students, I will come back a few weeks later, and if I have any more questions, we will have one final short interview.

XIV. What are the potential benefits and potential risks of the study?

- **Benefits:** The best part of participating in this study is that the results will be used to educate people like teachers, principals, and other important school board members, all about how students learn with the modules from your point of view. This means that when it's time to make decisions about whether or not these modules should even be put into schools, this study will be something those people will read to help make their decisions.
- **Risks:** There aren't any risks involved in participating in this study. You will not be punished for participating in the interview, you will not have any extra schoolwork, and your identity will be protected at all times.

XV. Equal treatment during the study.

Everyone in your class will be treated the same if they decide to participate or if they decide not to participate. You will not be punished if you decide you don't want to participate. You will not receive special treatment if you decide you do want to participate.

XVI. What questions do you have?

XVII. You have the freedom to withdraw.

You are free to not participate in the study at any time without any consequences. So if at any time you feel uncomfortable, you don't have to continue if you don't want to. You also don't have to answer questions that may make you feel uncomfortable. There is no consequence for not answering a particular question.

XVIII. Participant's Permission

I have read and understand the Assent and the conditions of this project. I have had all of my questions answered. I hereby acknowledge the above and give my voluntary consent:

______ YES ______ NO

______________________________ ________________
Student Signature Date

Should I have pertinent questions about this research, I may contact:

Dr. Donna M. Moore, Assistant Professor
540.231.8188
mooredm@vt.edu

Ms. Jessica Waknine, Graduate Research Assistant
540.231.7422
jwaknine@vt.edu

Dr. David M. Moore, Chair of the Institutional Review Board for the Protection of Human Subjects
540.231.4991
moored@vt.edu

Appendix E

Teacher Consent Form

Virginia Polytechnic Institute and State University

Informed Consent for Participants in Research Projects Involving Human Subjects
Teacher Consent Form

Title of Project: A case study of student cognitive responses to learning with computer-assisted modular curriculum

Investigators: Ms. Jessica Waknine, Graduate Research Assistant, Virginia Tech
Dr. Donna Moore, Assistant Professor, Virgina Tech

I. Purpose of this Research

Computer-assisted modules are designed as a tool for students to learn the various areas of a subject through interactive media presentations via computer. Students are able to keep track of their grades and progress during the course as part of the modules, making these programs self-regulatory. The purpose of this research is to investigate how students engage in learning with computer-assisted modules, and how students use self-regulation as they engage in learning.

Students currently enrolled in two sections of the middle school agricultural education course of the same grade level will be eligible participants for this study. All students who assent to participate in the case study will be observed during class. For the participant interviews, no more than fifteen students who assent to participate will be interviewed. If more than fifteen students assent for interviews, participants will be randomly selected by the reseracher. Particpants will range in age from 11 to 14 years old.

II. Procedures

The researcher will spend six to eight weeks, depending on the module and elective rotation schedules, working with the case study group. The first few meetings will allow the researcher to establish rapport with you and the participants, become familiar with the agricultural education program, as well as to familiarize students with the study and the researcher's purpose for being there. Participant observations will begin when participants begin their first round of modules. Observations will continue through the second module rotation. The researcher will keep a field journal with notes about how students engage in learning with the modules and the classroom learning environment, as well as the interactions between the teacher and the students and relevant information from personal communications between the teacher and the researcher. Participants will not be expected to do anything out of their ordinary routines during the observations. Data collected from the start of the case study until completion of the study may be used and reported in the findings.

III. Risks

This study has been reviewed and approved by the Virginia Tech Institutional Review Board. This study does not pose any risks to participants.

IV. Benefits

There has not been any promise or guarantee of benefits to participants from this study. However, benefits of this study will span to people in education including teachers, administrators, school board members, and others who are responsible for making decisions about whether or not computer-assisted modules should be used in the classroom. By participating in this study, you will have the opportunity to share opinions and experiences of computer-assisted modules, which is valuable information for those who are responsible for designing such curriculum.

V. Extent of Anonymity and Confidentiality

As a participant in this research project, your information will be kept strictly confidential. You will be identified by a pseudonym or referred to as "the teacher". At no time will information be released that allows an individual to be identified. At no time will the researchers release the results of the study to anyone other than individuals working on the project without your written consent.

Data will only be accessed by members of the research team, which includes Ms. Jessica Waknine and Dr. Donna M. Moore. Ms.Waknine will be the person responsible for transcribing and coding the data. Data and recordings will be destroyed upon completion of the researcher's master's thesis.

It is possible that the Institutional Review Board (IRB) may view this study's collected data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research.

VI. Compensation

There will be no compensation for participating in this study.

VII. Freedom to withdraw

You are to withdraw from the study at any time without penalty.

VIII. Participant's responsibilities

I voluntarily agree to participate in this study. Your responsibility is to run class as normal on a daily basis.

IX. Participant's Permission

I have read and understand the Teacher Consent and the conditions of this project. I have had all of my questions answered. I hereby acknowledge the above and give my consent:

______ YES ______ NO

______________________________ ________________
Teacher Signature Date

Should I have pertinent questions about this research, I may contact:

Dr. Donna M. Moore, Assistant Professor
540.231.8188
mooredm@vt.edu

Ms. Jessica Waknine, Graduate Research Assistant
540.231.7422
jwaknine@vt.edu

Virginia Tech Institutional Review Board: Project No. 09-992
Approved April 16, 2010 to November 17, 2010

Appendix F

Content Analysis Evaluation

Instructional Categories	Module A	Module B	Comments
I. PROVIDING A SENSE OF PURPOSE			
Conveying unit purpose			
Conveying lesson purpose			
Justifying activity sequence			
Encouraging students to set learning goals			
Attending to intrinsic value and interest			
II. TAKING ACCOUNT OF STUDENT IDEAS			
Attending to prerequisite knowledge and skills			
Addressing commonly held ideas			
Encouraging use of task strategies			
III. ENGAGING STUDENTS WITH RELEVANT PHENOMENA			
Providing a variety of phenomena			
Providing vivid experiences			
Captures attention			
Providing audio and visual multimedia			
IV. DEVELOPING AND USING SCIENTIFIC IDEAS			
Introducing terms meaningfully			
Representing ideas effectively			
Demonstrating use of knowledge			
Providing practice			
V. PROMOTING STUDENT THINKING ABOUT PHENOMENA, EXPERIENCES, AND KNOWLEDGE			
Encouraging students to explain their ideas			
Guiding student interpretation and reasoning			
Encouraging students to think about what they've learned			
Encouraging self-evaluation of knowledge and comprehension			
VI. ASSESSING PROGRESS			
Aligning assessment to goals			
Testing for understanding			
Tracking of time on task			
Summary of content and learning objectives			
Providing feedback throughout			
Opportunities to pause, skip ahead, or refer to a previous screen			

■ = Poor (0-1); ⬓ = Fair (1.5); ☐ = Satisfactory (2); = ⬒ Very Good (2.5); ◘ = Excellent (3)

American Association for the Advancement of Science. (2002). Middle grades science textbooks: A benchmarks-based evaluation [On-line]. Retrieved October 26, 2009 from http://www.project2061.org/publications/textbooks/mgsci/report/crit-used.htm. Adaptations by permission.

Appendix G

Letter of Permission from AAAS Project 2061

OCT-29-2009 14:04 From:PROJECT2061 2028425196 To:5402313824 P.2/2

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

October 29, 2009

Jessica Waknine
Graduate Research Assistant
Department of Agricultural and Extension Education
Virginia Tech University
Blacksburg, Virginia

RE: Permission request to adapt AAAS Project 2061 materials for masters thesis

Dear Ms. Waknine:

AAAS Project 2061 grants permission to your request to use adapted portions of the of the Criteria for Evaluating the Quality of Instructional Support from our middle school science textbook evaluation in your masters thesis **WITH THE CONDITION THAT** the following attribution appear on **each** page of all duplicated material:

American Association for the Advancement of Science. (2002). *Middle grades science textbooks: A benchmarks-based evaluation* [On-line]. Retrieved October 26, 2009 from http://www.project2061.org/publications/textbook/mgsci/report/crit-used.htm. Adaptations by permission.

If this is agreeable to you, please sign below and return me at the address below. A countersigned letter will be returned for your files.

* *

AGREED TO:
BY: Barbara Goldstein
Barbara Goldstein
FOR: AAAS Project 2061
DATE: 11/4/09

BY: Jessica Waknine
(Jessica Waknine)
FOR: Master's Thesis
DATE: 10-30-09

Project 2061 – Science Literacy for a Changing Future

American Association for the Advancement of Science
1200 New York Avenue, NW, Washington, DC 20005 USA
Tel: 202 326 6666 Fax: 202 842 5196
http://project2061.aaas.org

Appendix H

Letter of Permission from Module Company

September 22, 2009

Jessica Waknine
Graduate Research Assistant
Department of Agricultural and Extension Education
Virginia Tech

Dear Jessica,

[Name] has copied me on some of the emails you have had going back and forth about the evaluation of some [name] modules for your thesis and class project. We would be happy to help.

This letter shall serve as official authorization from [name] for you to evaluate and use the [Module A] and [Module B] Modules for your project. All that I would like in return is a copy of your findings and authorization from you to use those results for marketing or curriculum development purposes.

Per [name] request, we will either be sending copies of these back with him this week or getting your shipping information and sending them to you directly.

Please let me know if you have any other questions and good luck on your project.

Sincerely,

Vice President

Appendix I

Content Analysis Consent Form

Virginia Polytechnic Institute and State University

Informed Consent for Participants in Research Projects Involving Human Subjects

Title of Project: A case study of student cognitive responses to learning with computer-assisted modular curriculum

Investigators: Ms. Jessica Waknine, Graduate Research Assistant, Virginia Tech
Dr. Donna Moore, Assistant Professor, Virgina Tech

X. Purpose of this Research

The term "module", as defined by Russell (cited by Reed, 2001) describes a specific type of computer-assisted instruction, wherein individualized learning packages are designed to enhance learning by making it possible for students to complete one instructional unit before moving on to the next, thus allowing learning to happen at an individualized pace. Students are able to keep track of their grades and progress during the course as part of the computer-assisted modules, making these programs self-regulatory. As teachers assume the role of facilitator, learners are expected to work independently or cooperatively with a partner using the computer modules, with minimal guidance from the teacher.

Based upon the Phases and Subprocesses of Self-Regulation model, the objective of the study is to explore the cognitive response of students as they engage in learning using computer-assisted modular curriculum. Thus, it is important that the researcher first identify how teaching and learning principles are integrated in the design of computer-assisted modular curriculum. In addition, readability of the modules will be evaluated to determine if the curriculum materials have been designed for the appropriate age group, which is middle school level. The content analysis of computer-assisted modular curriculum will provide insight into the relationship between the design of the modules and students' cognitive response to learning with computer-assisted modular curriculum.

XI. Procedures

The researcher will make appointments with each participant to secure a time when they are available to conduct the content analysis. The computer software will be installed on a laptop computer belonging to the Department of Agricultural and Extension Education at Virginia Tech. The laptop will remain on the Virginia Tech campus, which is where the content analyses will take place. Participants will perform a content analysis of the Animal Science and Soil Science five-day computer-assisted modules using the evaluation form provided by the researcher. Participants will also conduct a readability analysis using the Fry Graph for readability, to determine the grade level of the content. Content for the readability assessment will be randomly selected sections of the text as chosen by participants.

XII. Risks

This study has been reviewed and approved by the Virginia Tech Institutional Review Board. This study does not pose any risks to participants.

XIII. Benefits

By participating in this study, there has not been any promise or guarantee of benefits to participants, since the purpose is only to validate the content analysis evaluation.

XIV. Extent of Anonymity and Confidentiality

Protecting your identity is a top priority of this study. By participating in this research project, your information will be kept strictly confidential. At no time will information be released that allows an individual to be identified. At no time will the researchers release the results of the study to anyone other than individuals working on the project without your written consent. Only the research team, Ms. Jessica Waknine and Dr. Donna Moore will have access to the data.

It is possible that the Institutional Review Board (IRB) may view this study's collected data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research.

XV. Compensation

There is no compensation for participating in this study.

XVI. Freedom to withdraw

You are free to withdraw from the study at any time without penalty.

XVII. Subject's responsibilities

I voluntarily agree to participate in this study:

- Complete the content analysis evaluation form for each of the two, five-day modules and their corresponding student materials
- Complete the readability assessment using the Fry Graph for readability

XVIII. Subject's Permission

I have read and understand the Informed Consent and the conditions of this project. I have had all of my questions answered. I hereby acknowledge the above and give my voluntary consent:

______ YES ______ NO

______________________________ ________________

Participant Signature Date

Should I have pertinent questions about this research, I may contact:

Dr. Donna M. Moore, Assistant Professor
540.231.8188
mooredm@vt.edu

Ms. Jessica Waknine, Graduate Research Assistant
540.231.7422
jwaknine@vt.edu

Dr. David M. Moore, Chair of the Institutional Review Board for the Protection of Human Subjects
540.231.4991
moored@vt.edu

Virginia Tech Institutional Review Board: Project No. 09-992
Approved November 18, 2009 to November 17, 2010

Appendix J

Observation Guide

The purpose of observations is to learn how middle school students engage in learning with computer-assisted modular curriculum, and how the participants use self-regulatory skills during learning with computer-assisted modules.

During class, the following constructs will be used to guide the researchers' observations.

How do students engage in the classroom learning process using computer-assisted modules?

a. What are students doing as they start the module and engage in learning?
b. How long does it take before they begin the assigned activity?
c. Is student attention kept on the module throughout or are students distracted?
d. Are there behavior or classroom management issues that arise while students are using the modules?
e. How are students completing the computer module? For example, do students skip around in the module to the parts they like or the parts that are easy, instead of completing the assignment in order?
f. How are students interacting with the computers? For example, are they excited to use computers? Are there issues with the technology?
g. What is the nature of the learning environment?

How are students using self-regulatory skills while learning with computer-assisted modules?

a. Are students asking the teacher questions about the computer module assignments?
b. Are students asking each other questions about the computer module assignments?
c. When students talk to each other, are they talking about the class assignments or socializing about irrelevant topics?
d. How are students setting learning goals?
e. What are the expectations for completing assignments with computer modules? For example, are there incentives for completing assignments early? Are there consequences for not finishing an assignment within the class period?
f. When do students take notes on the information they are learning from the computer modules?
g. How are students receiving feedback during class?
h. How are students motivated to complete the assignments with the computer module?

Appendix K

Interview Guide

To start, I am going to ask you a few questions about being enrolled in agriculture this term and your background experiences in using computer modules in your classes.

Tell me about your agriculture class.

Is agriculture an easy or hard subject for you? Why?

What grade do you expect to get at the end of this course?

What topics in agriculture have you learned about so far?

a. How important are those topics to you?
b. How do you feel about what you are learning in this class? Why?
c. How do you react when you are learning about topics you are not interested?
d. How do you react when you are learning about topics you really like?
    - When you are interested, do you put forth more effort than when you are not interested?

Is this your first time using computer modules?

a. Yes: What are your first impressions of learning with the computer modules?
b. No: Tell me about your past experiences learning with the modules?
    i. How many times in the past have you used computer modules like the ones in this class?
    ii. What were the other classes where you used computer modules?

Describe a typical day using the computer modules in agriculture class.

a. How are your other classes different from agriculture class?

How many modules did you complete in this class?

a. Did you complete all the modules your teacher expected you to complete?

What does the teacher do while you are working on the modules?

Great, now I am going to ask you some questions about your specific learning experiences with the computer modules in this class.

Describe what you thought about using the computer modules.

a. How do you feel about using computers in class?

Did you work with a partner?

If yes: How many partners?

a. Have you helped each other with quizzes or other assignments?
b. How do you feel about taking the tests when your partner can see it?
c. When you were working with your partner, did you ever feel excluded or did it distract you?

If you could have picked your modules, which would you have picked and why?

Do the computer modules keep your attention? How? Why?

What makes you want to complete the computer modules?

Describe the steps you take in order to complete a computer module.

a. What is the first thing you do when you start the computer module?
b. How difficult is the computer part of the module?
c. How long does it take for you to complete the computer part of the module? Why?
d. What do you do when you come across something you don't understand?

What is the best part about learning with computer modules?

What is the worst part about learning with computer modules?

Let's switch to a new topic. Now I am going to ask you a few questions about your study habits and class assignments.

How much time outside of class do you spend on agriculture class?

What kinds of activities are you doing to study or complete assignments in or out of class? (These will only be asked if applicable)

a. How do you study for quizzes or tests?
b. How do you go about completing homework assignments?
c. Which habits or skills work best to help you learn the material?

How often do you receive feedback on assignments you have completed in this class?

a. Describe how the teacher provides feedback for class?
b. What kind of feedback is provided by the computer module? By the teacher?

How do you apply the information you learn with the modules to everyday life?

Added Questions for Round 2 of Interviews
How did you keep your team on task?

What made you want to complete the project?

How did you determine your role on the team?

How did you pick your team?

How did you use the computers to help with your projects?

What motivates you?

How do you feel when you complete assignments or projects?

How do you know when you did well on a project?