AN EXAMINATION OF THE IMPLEMENTATION OF THE INTEL ESSENTIALS PROJECT-BASED LEARNING MODEL ON MIDDLE AND SECONDARY READING AND LANGUAGE ARTS FCAT STUDENT ACHIEVEMENT AND ENGAGEMENT

by

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This dissertation was prepared under the direction of the candidate's dissertation advisor, Dr. Gail Burnaford, Department of Curriculum, Culture, and Educational Inquiry, and has been approved by the members of his advisory committee. It was submitted to the faculty of the College of Education and was accepted in partial fulfillment of the requirements for the degree of Doctor of Education.

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ABSTRACT

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The purpose of this study was to identify (1) the effectiveness of the Intel Essentials model of project-based learning based on student Florida Comprehensive Assessment test (FCAT) reading scores; (2) the differences in student engagement between students in classes with teachers trained in the Intel Essentials model of project-based learning and teachers not trained in the model as measured by the Beliefs about Classroom Structures Survey; (3) the level of implementation (high, average, or low) of teachers trained in the Intel Essentials model of project-based learning; and (4) any correlation between the level of implementation and the level of student engagement.

A total of 32 teachers participated in the study. The teachers were split into 2 groups: the experimental group (N = 16) that participated in the Intel Essentials Training, and the control group (N = 16) that did not participate in the training. The results for this

study were mixed. The students of the experimental group teachers (*N* = 780) had significantly higher ($p < .05$) FCAT scores than that of the control group students (*N* = 643). The control group with the exception of Motivating Tasks subscale had significantly higher levels of engagement. The correlation between level of implementation and student engagement produced a moderate negative correlation, meaning that the Intel trained teachers with the highest levels of implementation had the lowest levels of engagement.

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Chapter 1

Introduction

As schools attempt to prepare students to succeed in the 21st Century and to achieve on various high-stake examinations, it has become increasingly necessary to rethink traditional classroom teaching methods. This has led to a recent surge in popularity for the project-based learning method. Many studies have found that project-based learning, under the right conditions, is an effective teaching methodology. Yet the current emphasis of breadth of coverage over depth is leading us to "once again failing to realize the educational potential of these reemerging approaches" (Barron, Schwartz, Vye, Moore, Petrosino, Zech, and Bransford, 1998, p. 272). As Page (2006) points out, "critical thinking, goal setting, problem solving, and collaborative skills all come into play in project-based learning, helping to build the skill sets considered essential for knowledge workers in the 21st century" (p. 1).

Technology may also play an important role in increasing student engagement and developing critical thinking skills (Carr & Jitendra, 2000; Cohen, 2001; Lee & Tsai, 2004; Liu, 2003). For instance, as Blumenfeld, Soloway, Marx, Krajcik, Guzdial, and Palincsar (1991) note "because technology allows students to explore, construct, and easily alter representations as well as control the process, motivation is likely to be affected positively" (p. 386). Furthermore, student engagement will likely be more mindful allowing the full potential of project-based learning to be realized (Blumenfeld et al., 1991).

In many ways, technology and project-based learning are complementary. When properly integrated, technology and project-based learning may produce impressive results especially in student engagement and depth of learning (Blumenfeld et al., 1991, Gibson, O'Reilly, & Hughes, 2002; Grant & Branch, 2005; Gubacs, 2004;). The wealth of information available through the integration of technology allows students to merge theory and practice seamlessly (Gibson et. al., 2002). Furthermore, technology may create interactive environments that allow people to construct meaning from difficult concepts (Bransford, Brown, & Cocking, 2006). Technology may provide the link to a vast amount of information necessary for real-world classroom applications and project-based learning may provide the vehicle for students to learn and disseminate that information.

The promise of success of incorporating project-based learning with technology has led the School District of Kaye County to adopt the Intel Essentials model of technology enhanced project-based learning. The district will invest more than $6 million dollars over the next 3 years to train all teachers in the Intel Essentials Project-Based Learning model. In return, teachers will each receive a standard technology package consisting of 3 computers, a projector, audio/voice enhancement hardware, and a document camera to fully implement the program. Therefore, it is essential that the district be able to measure both quantitatively and qualitatively the impact that this approach has on student achievement and student engagement.

Statement of the Problem

Various state and federal reforms have created a focus on standardized reading test scores especially at the middle and high school level (Flowers, 2007; Hamilton, 2003; Moore, Bean, Birdyshaw, and Rycik, 1999; National Association of State Boards of Education, 2005;). This has led administrators and teachers to seek to utilize the most viable instructional methods to improve reading instruction. Likewise, a renewed emphasis on best practice has produced calls for a more student-centered, experiential, and constructivist curriculum (Zemelman, Daniels, & Hyde, 1998). Project-based learning is one such pedagogical method that has shown much promise in terms of motivating students towards high levels of achievement. The majority of the research has centered on project-based learning in science, math, and social studies classrooms (Lee & Tsai, 2004; Meyer, Turner; & Spencer, 1997; Park, Ertmer, & Cramer, 2004; Toolin, 2004). More research needs to be done to identify the specific ways in which project-based learning may improve student achievement and engagement, particularly at the middle and high school levels (Blumenfeld et al, 1991; Gültekin, 2005; Mergendoller, Markham, Ravitz, & Larmer, 2006; Thomas, 2000).

Studies show that increased student engagement leads directly to gains in student achievement (Carini, Kuh, & Klein, 2006; Jones, Rasmussen, & Moffitt, 1997). Students who are engaged in authentic, real-world activities from a technology enhanced project-based learning environment may achieve greater levels of engagement, which ought to lead to improved student learning. Studies investigating these variables in relation to student learning are worthy of pursuit.

Any district effort to increase student achievement and engagement relies on teacher implementation. However, conventional professional development provides little chance for meaningful interaction or follow-up (Feiman-Nemser, 2001). This creates problems for school districts to adequately measure whether school-wide reforms are having the intended effect. Districts must create specific procedures to monitor implementation and ensure quality. These procedures should include the creation of a collaborative and collegial environment. Such activities may include peer coaching, collaborative work teams, action research, and faculty study groups (Gordon, 2004). These activities should all be driven by teacher leaders. Professional development and school improvement should aim to improve teaching and learning for the entire teaching profession.

Purpose of the Study

The study has several general purposes. First, it has provided the school district the ability to assess the effectiveness of the Intel Essentials curriculum as it relates to student achievement and student engagement providing important data to inform instruction. In addition, the lesson plan evaluation, focus group/interview data, and teacher survey provided important information relating to the level of implementation.

This two-phase mixed methods study sought to identify (a) the effectiveness of the Intel Essentials model of project-based learning based on student Florida Comprehensive Assessment test (FCAT) reading scores; (b) the differences in student engagement between students in classes with teachers trained in the Intel Essentials model of project-based learning and teachers not trained in the model, as measured by the Beliefs about Classroom Structures Survey; (c) the level of implementation (high, average, or low) of teachers trained in the Intel Essentials model of project-based learning; and (d) any correlation between the level of implementation and the level of student engagement.

Design of the Study

This study was designed to provide information regarding the implementation of the Intel Essentials Curriculum from a combination of data sources. The quantitative first phase of the study utilized student Florida Comprehensive Assessment test scores as the dependent variable and whether the teacher completed the Intel Essentials course or not as the independent variable. A matched pairs sampling method was utilized. In addition, data from the Student Engagement Questionnaire w**ere** employed to measure student engagement in the target classrooms.

The second phase of the study involved both quantitative and qualitative data. First, quantitative data in the form of a pre and post-survey developed by Intel Corporation were administered to all trained teachers. The first survey was administered to all participants immediately following the completion of the training. The second survey was administered after approximately one full school year of implementation. The qualitative phase had teachers participate in either a focus group or interview to answer questions regarding the implementation of the Intel Teach Essentials program. Finally, teachers also submitted two lesson plans that were coded for individual characteristics of project-based learning.

Delimitations

The study centered solely on the middle and secondary implementation (Grades 6-10) of a technology-enhanced project-based professional development package for teachers in a small, Central Florida school district. The middle and secondary levels were purposely selected for several reasons. First, district-wide middle and secondary FCAT scores are lowest at the middle and secondary levels, leaving distinct need for improvements in teaching practices. In addition, focusing on middle and secondary implementation allowed the researcher access to FCAT scores from previous years to see growth. This is not fully possible at the elementary level. The study participants were reading and language arts teachers. This group was selected based on the emphasis on reading across the state of Florida. Focusing on reading and language arts teachers alone allowed for greater control in the dissemination of FCAT score data as each teacher is responsible to prepare a set group of students.

Limitations

All empirical studies are limited in some way (Galvan, 2006). The study only addressed reading and language arts test scores and therefore did not provide a full picture regarding the efficacy of the Intel Essentials course in other courses such as mathematics, science, and social studies. Also, the study only addressed middle and secondary implementation of project-based learning. In addition, the researcher is a trained master teacher in the Intel Teach Essentials model of project-based learning and trained most of the participants in the study.

Although this study is looking at teacher implementation of the Intel Teach Essentials course, observational data were not collected. The researcher decided against direct observation due to time and resources. Another limiting factor is the reliance on self-report data to measure student engagement and level of teacher implementation. Self-report data collection is widely used across many disciplines and is popular because of the ability to collect a great deal of data at a relatively low cost (Pohlmann & Beggs, 1974). There are also several weaknesses associated with the usage of self-report data including bias, recall limitations, misunderstanding of ambiguous terms, and response rates. To mitigate these concerns and lead to greater validity, the data collected were triangulated with a focus group or interview protocol and document analysis. Nevertheless, the student engagement measure and teacher implementation remained self-report.

Significance of the Study

No single teaching method should be used as a panacea. Yet, world-wide, project-based learning is growing in popularity (Frank & Barzilai, 2004; Gibson et al., 2002; Gil & Julia, 2006; Gültekin, 2005). This popularity is important because increasingly, teachers are required to develop lessons that recognize that learning is dependent upon educational experience, opportunities for practice, social interaction, prior knowledge, and the ability for learners to construct understanding (Eggen & Kauchak, 2006). Project-based learning is a specific model that recognizes student learning depends on these variables. As a method, project-based learning may provide students with distinct educational experiences while building on prior knowledge through an interactive environment. Concurrently, our information rich society demands students who are technologically adept and have the ability to utilize technology as a tool for learning. In 1995, the Office of Technology Assessment recognized the importance of technology in the future of education. The Office of Technology Assessment asserted that helping:

> The 2.8 million teachers in public and private kindergarten- through twelfth-grade (K-12) schools effectively incorporate technology into the teaching and

> learning process—is one of the most important steps the nation can take to make the most of past and continuing investments in educational technology. (U.S. Congress, 1995, p. 8)

Having students with the technological know-how requires teachers that are equally competent in the usage of technology. This requires solid professional development aimed specifically at integrating various technologies within the classroom.

Researchers have investigated the impact of professional development and increased teacher learning on classroom practice as well as student achievement (Darling-Hammond & Bransford, 2005; Little, Gearhart, Curry, & Kafka, 2003; Gordon, 2004). As Feiman-Nemser (2001) points out, the quality of our schools directly depends on the quality of our teachers. She also emphasizes the importance for teachers to have a basic repertoire to promote student learning. This repertoire includes the ability to "lead discussions, plan experiments, design interdisciplinary units, hold debates, assign journals, conference with students, set up classroom libraries, organize a writer's workshop, take field trips, and so on" (p. 1018). These skills may require research-based professional development aimed at improving teacher practice to provide project-based learning and technology integration in the classroom.

The study also contributed to the overall knowledge base of project- based learning. As a field, project-based learning is rather new (Thomas, 2000). Therefore, there are very few studies that examine technology-enhanced project-based learning and its impact on student achievement particularly in the subject area of high school reading instruction. In addition, the study offered recommendations to the participating school district with respect to the use of project-based learning. as a district initiative.

As a result of this study, the School District of Kaye County may empirically measure the impact that a project-based learning curriculum may have on standardized test scores and student engagement. This might allow the district to determine additional professional development opportunities that should to be offered and may provide guidance for future efforts.

Research Questions

1. What effect does the implementation of a technology-integrated, project-based learning model have on standardized test scores in language arts and reading classrooms in grades 6-10?
2. To what extent does the implementation of a technology-integrated project-based learning model affect student engagement in language arts and reading classrooms in grades 6-10?
3. To what extent are middle and secondary reading and language arts teachers who have voluntarily received professional development training in a technology-integrated, project-based learning model implementing the training in their curriculum?
4. What is the relationship, if any, between student engagement and the level of teacher implementation of the Intel Essentials technology course in their classroom?

Null Hypotheses

1. There will be no statistically significant difference in student FCAT reading scores in classrooms where project-based learning is implemented and those where it is not.

2. There will be no statistically significant difference in student engagement in classrooms where project-based learning is implemented and those where it is not.
3. There will be no statistically significant difference between teachers in their perception of efficacy in the implementation of the Intel Essentials model of project-based learning.
4. There will be no statistically significant difference between student engagement and teacher implementation.

Definitions of Terms

Project-Based Learning**.** "Project-based learning is an instructional model that involves students in investigations of compelling problems." (Intel Corporation, 2007, n.p).

Intel Essentials.

> The goal of the Intel® Teach Essentials Course is to help classroom teachers develop student-centered learning through technology integration and project-based models. The training consists of 32 hours of hands-on instruction to be delivered via eight curricular modules. Through those modules, teachers develop a standards-based curricular unit that promotes 21st century skills, specifically encouraging student self-direction and higher-order thinking through problem-solving, collaboration, and the use of productivity strategies and tools. In Intel Teach Essentials Course, teachers learn to use the power of computer technology to spark student imagination and ultimately move students toward greater learning. Teachers reflect on questions about how their students can best use computers to enhance learning. Throughout the course and specifically in the showcase, teachers work to answer the Essential Question of the course: How can technology be used most effectively to support and assess student learning? (International Society for Technology in Education, 2007)

Florida Comprehensive Assessment test (FCAT).

> The Florida Comprehensive Assessment test® (FCAT) is part of Florida's overall plan to increase student achievement by implementing higher standards. The FCAT, administered to students in Grades 3-11, contains two basic components: criterion-referenced tests (CRT) measuring selected benchmarks in Mathematics, Reading, Science, and Writing from the Sunshine State Standards (SSS) and norm-referenced tests (NRT) in Reading and Mathematics measuring individual

> student performance against national norms. (Florida Department of Education, 2005)

Technology Integration.

> Technology integration is the incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools. Technology resources are computers and specialized software, network-based communication systems, and other equipment and infrastructure. Practices include collaborative work and communication, Internet-based research, remote access to instrumentation, network-based transmission and retrieval of data, and other methods. This definition is not in itself sufficient to describe successful integration: it is important that integration be routine, seamless, and both efficient and effective in supporting school goals and purposes. (U.S. Department of Education, 2003).

Student Engagement. Student use of "strategies that involve meaningful (i.e., elaborative) processing attempt to connect or integrate new information with existing knowledge in an effort to form a richer, more coherent mental representation" (Greene, Miller, Crowson, Duke, & Akey, 2004, p. 462).

Program Evaluation. Program evaluation is designed and conducted to assist some audience to judge and improve the worth of some educational object (Stufflebeam & Webster, 1980, p. 6).

Professional Development. Characteristics of effective professional development includes:

A focus on content and how students learn content; in-depth, active learning opportunities; links to high standards, opportunities for teachers to engage in leadership roles; extended duration; and the collective participation of groups of teachers from the same school, grade, or department. (Desimone, Porter, Garet, Yoon, & Birman, 2002)

Implementation. The systematic usage of project-based learning models in the classroom. This includes the creation of activities to facilitate student success, multiple assessment strategies, technology integration, the creation of projects, and the development of 21st Century skills (Intel Corp, 2007; Mergendoller & Thomas, 2000).

Experimental Group. Experimental group teachers have received training to utilize Intel Essentials in their classroom.

Control Group. Control group teachers have not received training to utilize Intel Essentials in their classroom.

Overview of the Study

Chapter 2 provides a review of relevant literature related to the fundamental components of this study including a broad view of the Intel Teach Essentials model of: (a) project-based learning; (b) an operational definition of project-based learning; (c) technology integration; (d) the implementation of project-based learning; e) barriers to the implementation of project-based learning; f) project-based learning and student achievement; and g) project- based learning and student engagement. Chapter 3 describes the methodology, research design, and procedures used to implement the study. Chapter 4 presents the analysis and interpretation of the data, with respect to the research questions. Finally, Chapter 5 presents a discussion of the findings, implications of this study, and possible recommendations for future research.

Chapter 2

Literature Review

In the current age of accountability, a great deal of emphasis has been placed on effective teaching practices that are innovative but still address the required components of the curriculum (Toolin, 2004). Yet, with this new accountability, there are no consistent methods to improve student achievement for all students. Teachers are increasingly expected to teach meaningful content that meets the standards through authentic, real-world activities (Davis & Krajcik, 2005) from which students will subsequently be tested in the form of a high-stakes examination. In order to meet this increased demand, teachers must employ alternative techniques of teaching that focus on proven methods of instructional design geared towards improving student motivation (House, 2007). Project-based learning is one promising pedagogical approach that may meet the needs of both teachers and students (Kucharski, Rust, & Ring, 2005).

Current research suggests that project-based learning is an effective teaching methodology (Ferretti, MacArthur, & Okolo, 2001; Gültekin, 2005; Kucharski et al., 2005; Liu, 2003). Even more promising is the addition of the technology integration component of project-based learning, although it is important to note that project-based learning is still in the developmental stage and in need of future research (Mergendoller et al., 2006).

This review of literature will provide an overview of project-based learning including the history, related terms, and a definition of project-based learning for this study. The Intel Essentials project-based learning model served as the focus for this study. The literature review examines this particular model's theoretical underpinnings and provides current research in the integration of technology in the K-12 classroom as required in the Intel Essentials course. Another area of focus is the implementation of project-based learning. Next, the effects of project-based learning on student achievement, engagement, and standardized testing are examined.

A History of Project-Based Learning

The idea of project-based learning can be traced to the Progressive Era, although incorporating projects into the curriculum was not new, William Heard Kilpatrick's article, *The Project Method,* is generally credited for bringing a project/experienced-based curriculum into the mainstream (Kliebard, 1995). Kilpatrick advocated for a child-centered curriculum: "wholehearted purposeful activity in a social situation as the typical unit of school procedure is the best guarantee of the utilization of the child's native capacities now too frequently wasted" (Kilpatrick, 1918, p. 334).

John Dewey, like Kilpatrick, was a strong proponent of an experiential curriculum. Dewey (1938) claimed that education should build upon present experience. This was in sharp contrast to the studies of the traditional school where the subject matter was disconnected and delivered in distinct units. Dewey's stance was that curriculum integration would occur through natural child curiosity and that all subjects of study frame ordinary life experience. He believed in the concept of the school as a miniature community. The community was held together by participation in common activities by students, which in turn led to overall growth and development of the individual.

Later, Bruner (1977) argued that :

> Mastery of the fundamental ideas of a field involves not only the grasping of general principals, but also the development of an attitude toward learning and inquiry, toward guessing and hunches, and toward the possibility of solving problems on one's own. (p. 20)

Bruner felt that schools need to provide students with an opportunity to discover new ideas through experimentation. Similarly, Eisner (1979) called for schools to teach children how to learn by providing them opportunities to "use and strengthen the variety of intellectual faculties that they possess" (p. 51). These distinct viewpoints laid the foundation for the values that are central to the field of project-based learning as a whole.

The first large-scale implementation of a problem-based learning model came from McMaster University's College of Medicine in the 1960s (Neufeld & Barrows, 1974). The school decided to create a curriculum that sought to have students recognize and define problems and then evaluate potential solutions. This was in stark contrast to the traditional medical school approach of the time that focused on the accumulation of knowledge (Kendall & Reader, 1988). According to Neufeld and Barrows (1974), the school identified eight goals of the student:

1. To identify and define health problems and to search for information in order to resolve or manage these problems.
2. Given a health problem, to examine the underlying physical or behavioral mechanisms. A spectrum of phenomena might be included, from molecular events to those involving the patient's family and community.
3. To recognize, maintain, and develop personal characteristics and attitudes required for professional life.
4. To develop the clinical skills and to learn the methods required to define and manage the health problems of patients, including their physical, emotional, and social aspects.

5. To become self-directed learners, recognizing personal educational needs, selecting appropriate learning resources, and evaluating their own progress.
6. To be able to assess critically the professional activity related to patient care, health care delivery, and medical research.
7. To be able to function as a productive member of a small group which is engaged in learning, research, or health care.
8. To be aware of, and able to work in, a variety of health care settings. (p. 289)

Since then, other disciplines have experimented with the implementation of a project-based learning model, including physical education, mathematics, social studies, science, and accounting (Ferretti & Okolo, 1996; Gubacs, 2004; Lightner, Bober, & Willi, 2007; Meyer et al., 1997; Pike, Shannon, Lawrimore, McGee, Taylor, & Lamoreaux, 2003). Project-based learning has seen application at all levels from elementary school to higher education. Many individual programs have emerged that have their roots in project-based learning. For example, programs like Expeditionary Learning/Outward Bound focus on “rigorous academic content and real world projects – learning expeditions – with active teaching and community service” (Expeditionary Learning Schools Outward Bound, n.d.). Another similar teaching method, problem-based learning, has students actively design and implement solutions to specific problems within the curriculum. Finally, several university-based applications in cognition and cognitive science applications have emerged (Thomas, 2000). In addition, the integration of technology to support project-based learning has become increasingly more common (Blumenfeld et al., 1991; Carr & Jitendra, 2000; Frank & Barzilai, 2004; Liu 2003). This has led to programs like the Intel Teach Program.

Project-based Learning Defined

A project may have many forms, depending on teacher, grade level, and subject. This has led to problems when discussing project-based learning (Thomas, 2000).

Therefore, it is essential to be aware of the various definitions that encompass project-based learning. Thomas (2000) provided a comprehensive definition of project-based learning. He wrote that:

> Projects are complex tasks, based on challenging questions or problems, that involve students in design, problem-solving, decision making, or investigative activities; give students the opportunity to work relatively autonomously over extended periods of time; and culminate in realistic products or presentations. (p. 1)

In order for a project to be considered an example of project-based learning, Thomas (2000) offered the following criteria:

1. Project-based learning projects are central, not peripheral to the curriculum. In the case of project-based learning, projects are the curriculum.
2. Project-based learning projects are focused on questions or problems that 'drive' students to encounter (and struggle with) the central concepts and principles of a discipline. The definition of the project (for students) must be 'crafted in order to make a connection between activities and the underlying conceptual knowledge that one might hope to foster.'
3. Projects involve students in a constructive investigation. An investigation is a goal-directed process that involves inquiry, knowledge building, and resolution.
4. Projects are student driven to some significant degree. Project-based learning projects are not, in the main, teacher-led, scripted, or packaged.
5. Projects are realistic, not school like. Projects embody characteristics that give them a feeling of authenticity to students. (pp. 3-4)

Project-based learning is defined by Van Den Bergh, Mortelmans, Spooren, Van Petegem, Gijbels, and Vanthournout (2006) as "a pedagogical innovation which integrates theory and practice by means of problem solving of working life issues" (p. 347). In addition, they provided a definition that conveys the core of project-based education:

> Project-based education is an educational activity in which a group of students – a task-oriented group from one or different years and branches of study, working together during a longer period of time, receiving instructions and feedback from a permanent or different instructors and if necessary from a commissioner of a practical organization – work on an assignment or (practical) problem acquiring

> knowledge (including insights and meta-cognition), skills and attitudes. The students make the assignment or problem more concrete, rephrase it and devise a structured approach of the problem. They draw up a potential solution using theoretical and practical knowledge. (p. 347)

Unlike the previous definitions, Blumenfeld et al. (1991) focus on the role of the teacher in promoting project-based learning. They characterize project-based learning as a framework that focuses on teaching through the engagement of students. In a project-based class, students actively search for answers to authentic problems through debate, questioning, data collection, and the creation of artifacts. A project requires two components: 1) a question or problem; and 2) the opportunity for students to construct their learning through the creation of artifacts.

The study utilized the definition of project-based learning, as outlined by the Intel Corporation (2007):

> Project-based learning is an instructional model that involves students in investigations of compelling problems. Projects that make for stronger classroom learning opportunities vary significantly in subject matter and scope, and may be delivered at a wide range of grade levels. Projects put students in an active role, such as:
>
> - Problem solver
> - Decision maker
> - Investigator
> - Documentarian
>
> Projects serve specific, significant educational goals. Projects are not diversions, add-ons to the real curriculum, or merely activities with a common theme. Project-based learning is driven by important questions that tie content standards and higher-order thinking to real-world purpose. Students often take on real-life roles and have meaningful tasks to complete.

This definition provided by Intel is consistent with the definitions outlined above. Project-based learning focuses on a central question or problem that drives student learning. Each definition emphasizes the importance of student collaboration with the teacher assuming the role of guide. The Intel version varies from traditional project-based learning in that technology integration is central to the development of a project.

As shown in Table 1, Intel provides a checklist that outlines the essential components of a project. Effective projects include the following characteristics:

Table 1

Project Characteristics Checklist

1. Students are at the center of the learning process.
2. The project focuses on important learning objectives aligned with standards.
3. The project is driven by Curriculum-Framing Questions.
4. The project involves ongoing and multiple types of assessment.
5. The project has real-world connections.
6. Students demonstrate knowledge and skills through products and performances that are published, presented or displayed.
7. Technology supports and enhances student learning.
8. Thinking skills are integral to project work.
9. Varied instructional strategies support multiple learning styles.

Note. Adapted from Intel Teach Program Essentials Course Master Teacher Edition v.10. Copyright 2007 Intel Corporation. Used with permission of Intel Corporation.

Theoretical Framework

The Intel Essential model of Project-Based Learning provided the basis of the study. Although project-based learning centers in large part on the work of John Dewey and others, the Intel model draws upon the research of Thomas, Boaler, SRI, and Railsback. Another important aspect of the Intel program is the focus on depth of coverage versus breadth (Bransford et al., 2006). The focus on depth is complemented through the use of the backwards design model popularized by Wiggins and McTighe (2001). The entire Intel course has teachers plan with the end in mind. In addition, the work of McCombs, Pintrich and Schunk, and Newmann, Bryk, and Nagaoka provide the foundational research for authenticity and purposeful learning (Intel Corporation, 2007). The final component of the course, student-centered assessment trains teachers to successfully assess students through (a) checklists, (b) reflective questions, (c) goal setting, (d) problem identification, and (e) giving and providing feedback.

The Intel Teach program was established in 1999. Since that time, over 4 million educators in 35 countries have received the free training. The course materials are developed by the Institute of Computer Technology (ICT), a non-profit organization that provides K-12 curriculum development and technology training services for corporations, nonprofit agencies, and the education community. The training consists of 32 hours of hands-on instruction delivered via 8 curricular modules. The goal of the Intel Teach Essentials Course is to help classroom teachers develop student-centered learning through technology integration and project-based approaches (Intel Corporation, 2007).

There are 5 themes central to the Intel Teach Essentials Course:

- Using technology effectively in the classroom to promote 21st century skills
- Identifying ways students and teachers can use technology to enhance learning through research, communication, collaboration, and productivity strategies and tools
- Providing hands-on learning and the creating of curricular units and assessments, which address state and national academic and technology standards
- Facilitating student-centered classrooms that encourage student self-direction and higher-order thinking

- Collaborating with colleagues to improve instruction by problem solving and participating in peer reviews of units (Intel Corporation, 2007).

Project-based Learning and Professional Development

Professional development is a crucial component to the overall success of any educational innovation. One of the most challenging tasks that school leaders face is selecting resources and programs for classroom use (Kingsbury, 2006). Regardless of the program, professional development is central to nearly every proposal designed to improve education (Guskey, 1986). This requires systematic change in policy and buy-in from all stakeholders. Cohen (1995) points out that “despite this focus on policy, systemic reform aims to change teaching, for without that most students' learning would not improve” (p. 11). Therefore, it is essential that professional development leads to improved student achievement. The Intel Teach Essentials program recognizes that “student learning and achievement are, of course, the ultimate goals of all education reform programs, even professional development programs” (Intel Corporation, 2006a).

Educational leaders have recently begun to understand the importance of teacher learning to improve student achievement (Borko, 2004; Darling-Hammond & Bransford, 2005; Grossman, Wineburg, & Woolworth, 2001). With project-based learning, it is critical to continually support teacher learning due to the challenging nature of introducing, implementing, and maintaining a project-based learning environment (Solomon, 2003). Although there are few studies that examine the professional development process in the implementation of project-based learning, many best practices in professional development would benefit these efforts.

Quality professional development begins with a commitment to increase pedagogical content knowledge (Shulman, 1986). The passage of the No Child Left Behind Act has further stressed the importance of highly qualified and knowledgeable teachers (U. S. Department of Education, 2006). Teacher pedagogical content knowledge involves using teacher knowledge of content, teaching, and learning, and being able to apply that knowledge to make instructional decisions that are appropriate (Davis & Krajcik, 2005). Too often, educators operate in isolation. Therefore, the benefit of a high quality professional development plan is that it will "reduce variability in implementation and produce outcomes that are better than what could be expected from a significant subset of teachers if they were left to their own devices" (Darling-Hammond & Bransford, 2005, p. 363).

In a meta-analysis, Knapp (2003) found the following activities to be vital in building pedagogical content knowledge:

1. Concentrate on classroom teaching that emphasizes high learning standards and on evidence of students' learning to standard.
2. Focus on building teachers' pedagogical content knowledge.
3. Model "preferred" instructional practices (e.g., active learning), both in classrooms and in adult learning situations.
4. Locate professional learning in collaborative, collegial-and generally school based-learning environments.
5. Offer rigorous and cumulative opportunities for professional learning over time.
6. Align with reform initiatives. (pp. 119-120)

Professional Development and Teacher Learning Communities

Another component of increasing pedagogical content knowledge comes from the development of teacher learning communities (Grossman et al., 2001; Hughes & Ooms, 2004; McLaughlin & Talbert, 2003). The Intel Teach Essentials course recognizes the importance of teacher collaboration and emphasizes sharing, collaboration, and cross-content investigations. Professional development schools have embraced the notion of creating a collaborative work environment (Grisham, Berg, Jacobs, & Mathison, 2002). The goal of a learning community is to provide a venue for intellectual renewal, new learning, cultivating leadership, and to benefit overall student achievement (Grossman et al., 2001). Little (2003) believes that this is accomplished through the development of a strong teacher community built on collaboration, discourse, and teamwork.

Fullan, Bertani, and Quinn (2004) refer to this as collective moral purpose, which means that every stakeholder is on the same page and understands the expectations. This requires communication and strong professional development. As McLaughlin and Talbert (2003) assert, reform requires changes in curriculum, standards for student performance, and professional development. When implementing new programs, Knapp (2003) identified several strategies that districts should adhere to when implementing professional development, including: (a) providing opportunities for schools to collaborate, (b) developing skills for instructional leadership, (c) working with external partners on professional development, (d) diversifying opportunities and venues for professional learning, and (e) offering incentives for staff to participate.

The Implementation of Project-based Learning

There has always been great debate on the implementation of any educational teaching practice. "Project-based learning, like many innovative and high-level teaching approaches, is not easily implemented" (Meyer et al., 1997, p. 517). Many variables affect the successful implementation of project-based learning. Perhaps most important is the notion of thorough planning in order to provide a comprehensive education

(Kucharski et al., 2005). Thorough planning requires a cohesive effort from each of the stakeholders.

The Intel Teach website (Intel Corporation, 2006, a, b, & c) provided several case studies outlining successful implementation efforts from specific local and state education agencies. Several states, including Alabama, Arizona, and North Carolina, have partnered with Intel to offer the Intel Teach program to local school districts statewide. In addition, Chicago Public School District (IL) and Greenville Public School District (SC) have outlined their implementation strategies. There is no doubt that these studies were selected on the basis of the successful implementation of the Intel methodology; however, valuable information may be gleaned from each implementation effort.

From the case studies, several key implementation themes emerged. In district-wide implementations, continuous professional development, investment in new technology, and establishing broad teacher support were essential to the successful implementation of the Intel program. In addition, the state-wide programs utilized existing models already in place to scale the program and improve service to teachers including:

1. State-sponsored trainers who already work closely with local school districts (and understand their particular requirements) that blend Intel Teach with state and local resources to serve local needs.
2. State and local investments in online resources for teaching and assessment that are used for program registration and resource sharing.

Non-Intel Project-Based Learning Implementation Examples

The findings from the above case studies are consistent with other non-Intel implementations of project-based learning. Toolin (2004) identified several factors that appeared to play a significant role as to whether teachers adopted project-based models to teaching science. These factors include the number of years teaching, the number of project-based learning workshops attended, and the opportunity to collaborate and co-teach with other teachers. In the study, the author discussed the implementation of New York City's Community of Science Educators (COSE), which included science teachers in many of New York City's public schools. The primary goal of the community was to provide staff development in the project-based model to science teachers. Teachers had access to a district-level trainer, a listserv, and quarterly professional development sessions. Toolin's study focused on the implementation efforts of six teachers from two schools.

Similarly, the Detroit Public School System established a project-based science focus for Detroit Public Schools (MI) through the Center for Learning Technologies in Urban Schools. Tal, Krajcik, and Blumenfeld (2006) described the process of establishing the program. During the first year of implementation (1998-1999 school year), 13 teachers across 10 schools utilized one of the prepared curriculum units. In 2003-2004, the number increased to 63 teachers in 26 schools. The goal of the project was to work formally with teachers and administrators to ensure high quality teaching materials, focused professional development, and encouraging continued teacher usage of materials. The above study addresses the impact of professional development on the implementation of project-based learning within a school system.

School and Classroom Implementation

District efforts withstanding, the school is critical in establishing a culture for project-based learning. Mergendoller et al., (2006) assert that:

> Although projects can be completed in a variety of environments, it is easier to implement a successful project within a school context that values and supports project-based learning. Longer class periods, flexibility in scheduling, a culture of inquiry, instructional understanding, leadership from the principal, like-minded colleagues, and school-wide expectations for student performance all contribute to successful project enactment (p. 609).

Equally, Boudria (2002) described the process of establishing The Women in Technology Program for Bristol Community College. The Women in Technology program sought to encourage women to take part in a project-based learning curriculum in the traditionally male-dominated field of engineering. He attributed the success of the program to the ongoing communication between the various stakeholders and strong administrative support.

Classroom implementation of project-based learning requires a substantial shift from more traditional teaching methods. "Following a project-based learning approach for instruction rather necessitates an immediate change not only in the curriculum, but also in the instruction and assessment parts for instructors and students" (Gulbahar & Tinmaz, 2006, p. 310). Projects require more time to complete by focusing on depth as opposed to breadth. In addition, the project-based model strives to create authenticity in learning.

In a follow-up to a previous study, Mergendoller and Thomas (2000) interviewed approximately 50 secondary classroom teachers who reported implementing a form of project-based learning in their classroom. They focused exclusively on the design and implementation of successful projects. From the interview data, the researchers identified

7 themes, 18 sub-themes, and 53 principles that lead to successful implementation of project-based learning. See Appendix G for a complete listing of themes.

The various themes, each of which is incorporated in some form throughout the Intel Essential coursework, include: (a) using effective time management which encompasses the scheduling of projects and holding to timelines; (b) getting project-based learning started by orienting students and providing explicit instructions; (c) establishing a culture that stresses student self management through setting standards and training students on the process; (d) developing a culture of self-management in the classroom; (e) managing student groups by establishing the appropriate grouping patterns, addressing the handling of problems within groups, and keeping track of group progress; (f) getting the most out of available technological resources like the Internet and computers; and (g) assessing and evaluating student work, which requires training teachers in the process of grading students, troubleshooting projects, and debriefing projects.

Barriers to Project-based Learning Implementation

There will always be challenges associated with the implementation of any school reform. According to Solomon:

> Undeniably, more proof is needed that project-based learning is the key to improved student learning. Yet the evidence so far is encouraging despite the host of significant obstacles such as fixed and inadequate resources, time constraints, inflexible schedules, incompatible technology, class size and composition, and district curriculum policies. (2003, n.p.)

In addition, it is important to note that "project-based learning is not appropriate as a method for teaching certain basic skills such as reading or computation; however, it does provide an environment for application of those skills" (Markham, Larmer, & Ravitz, 2003, p. 6). Table 2 lists common barriers to the implementation of project-based learning.

Table 2

Summary of Challenges to the Implementation of Project-based Learning

Challenge: Teachers	Researcher(s)
Time (Organization, and Administration)	Helle, Tynjala, & Olkinuora (2006) Frank & Barzilai (2004) Solomon (2003)
Not applicable for all teaching styles and subjects.	Toolin (2004) Markham, Larmer, & Ravitz (2003)
Sacrifice breadth of coverage over depth.	Ferretti & Okolo (1996)
District curriculum policies	Solomon (2003)
Limited technology access	Intel Corp (2006abc) Solomon (2003)
Limited technology support	Intel Corp (2006abc)
Professional development considerations	Barron, et al. (1998)

Challenge: Students	Researcher(s)
Project-based learning requires "considerable knowledge, effort, persistence, and self-regulation on the part of the students" Blumenfeld, et al. (1991)	Blumenfeld et al. (1991) Frank & Barzilai (2004) Mergendoller et al. (2006) Solomon (2003)
Cooperative learning groups may lead to issues.	Ferretti & Okolo (1996)

These barriers must be accounted for prior to the implementation of a project-based curriculum. Barron et al. (1998) argue for extensive professional development designed to provide both in-service and pre-service teachers with clear models of project-based learning. With strong professional development, many of the organizational and administration issues would be mitigated. When addressing student issues, Barron et al. suggest the formation of teacher learning communities that look at the various artifacts that students create as a way to build an awareness of what concepts students understand and fail to understand as well as to build pedagogical content knowledge.

There are other factors that affect implementation of curricular reforms. Implementing a new staff development program is not an overnight process, especially at the high school level. For example,

> Reforms are easier to implement in elementary schools, probably because high schools are more complex organizations, and therefore more resistant to change. In addition, younger and less experienced teachers report higher implementation, perhaps because they are more open to change than veteran teachers. (Desimone, 2002, p. 464)

There have been several surveys conducted to ascertain teacher opinion on effective professional development. In a national survey of 1,027 mathematics and science teachers, Garet, Porter, Desimone, Birman, and Yoon (2001) found that sustained and intensive professional development has the greatest impact as reported by teachers. In addition, staff development should focus on academic subject matter, allow teachers time for hands-on, active learning, and should be integrated into the school experience. Similar results were reported in a separate survey of 207 math and science teachers (Desimone, Porter, Garet, Yoon, & Birman, 2002). The results demonstrated a benefit in technology professional development that included collaboration of teachers from the same school, department, or grade-level. The results also suggested that teachers enjoyed the fact that the professional development provided active learning opportunities.

In a study focusing on collaborative inquiry, a version of problem based learning, Goodnough (2005) found that a problem-based learning environment provides excellent opportunities for educators to collaborate and discuss practice as a whole. At the end of the two year study, teachers understood why they needed to work together and how to work together. She also called for improved professional development opportunities that stress teacher collaboration. Bridges and Hallinger (1996) also call for intensive professional development highlighted by teacher collaboration and administrative support.

Teacher learning and staff development principles have informed much of the Intel Teach Essentials Course. The course, developed by the Institute of Computer Technology, a non-profit organization that specializes in providing technology training services to the education sector, created the Intel course to meet many of the best practices listed above. First, the course consists of a minimum of 32 hours of training and strives to enhance learning through "research, communication, collaboration, productivity strategies, and tools" (Intel Corporation, 2007). This is accomplished through the use of technology, discussion of essential pedagogical practices, hands-on learning, and collaboration with peers.

Project-Based Learning and Technology Integration

For more than 20 years, the use of computer-based instructional technology in education has increased dramatically and now includes office productivity suites, simulation software, multimedia applications, and the World Wide Web (Bebell, Russell, & O'Dwyer, 2004; Debevec, Shih, & Kashyap, 2006). Despite huge investments and improvements in technology, the U. S. Congress, Office of Technology Assessment

(1995) found that relatively few of the nation's 2.8 million teachers use technology effectively in their classrooms. Thirteen years later, many of the same barriers exist (Franklin, 2007). The fact is that effective integration of these technologies in teaching, learning, curriculum, and policy planning remains vague in many educational contexts (Brogden & Couros, 2007). Therefore, "it is fair to say that, by and large, teachers are intimidated by the new technologies, and the costs of maintaining the technical infrastructure of Web-based instruction are proving prohibitive for local schools" (Pinar, 2003, p. 41).

Technology is readily integrated into the project-based learning model (Gibson et al., 2002). As access to various technologies has improved, there has been a renewed interest in project-based learning for K-12 education (Liu, 2003). In a technology integrated project-based learning environment, "students use tools such as word processors, spreadsheets, and databases to perform tasks like outlining, drafting essays, analyzing numerical data, and keeping track of collected information" (Solomon, 2003, p. 20). As a result of this increased interest, a need for further empirical and qualitative research examining the effectiveness of a technology integrated project-based learning environment has emerged.

Barriers to Technology Integration

The integration of technology into the curriculum is becoming an inseparable part of good teaching (Pierson, 2001). In a national survey of over 3,600 K-12 classroom teachers, Norris, Sullivan, & Poirot (2003) found that "teachers' use of technology for curricular purposes is almost exclusively a function of their access to that technology" (p. 25). Access is obviously vital for teachers to integrate technology in the classroom.

However, teachers need to develop skills that go beyond access, to develop units that effectively integrate technology while teaching the necessary curriculum (Means, Olson, & Singh, 1995).

In a study addressing the barriers to effective technology integration, Ertmer (1999) identified several first and second-order barriers. First-order barriers to technology integration "include lack of access to computers and software, insufficient time to plan instruction, and inadequate technical and administrative support" (p. 48). In contrast, "second-order barriers are intrinsic to teachers and include beliefs about teaching, beliefs about computers, established classroom practices, and unwillingness to change" (p. 48).

National Educational Technology Standards and Intel Essentials

In order to overcome these barriers, uniformity of technology integration must occur. As technology evolves, K-12 teachers must provide students with certain requisite technological skills. In a survey prepared for the Partnership for 21st Century Skills (2006), 77% of the 400 companies surveyed believed that information technology skills would increase in importance over the next 5 years. This fact has led to the development of baseline standards aimed at improving teacher practice in the area of technology integration. The National Educational Technology Standards for Teachers (International Society for Technology in Education, 2000, 2007) outlines 6 standards that all classroom teachers should meet to prepare students in the using technology. The Intel Teach Essentials course is fully aligned to these standards:

1. Technology Operations and Concepts: Teachers demonstrate a sound understanding of technology operations and concepts.

2. Planning and Designing Learning Environments and Experiments: Teachers plan and design effective learning environments and experiences supported by technology.

3. Teaching, Learning, and the Curriculum: Teachers implement curriculum plans that include methods and strategies for applying technology to maximize student learning.

4. Assessment and Evaluation: Teachers apply technology to facilitate a variety of effective assessment and evaluation strategies.

5. Productivity and Professional Practice: Teachers use technology to enhance their productivity and professional practice.

6. Social, Ethical, Legal, and Human Issues: Teachers understand the social, ethical, legal, and human issues surrounding the use of technology in PK-12 schools and apply those principles in practice. (ISTE, 2000)

Students must also leave school with the knowledge of how to effectively utilize technology. The Partnership for 21st Century Skills, in collaboration with Intel Corporation and other companies, has developed a comprehensive list of skills that they believe all students need to compete in the 21st Century. The Partnership for 21st Century Skills (2006) lays the foundation for “the skills, knowledge and expertise students should master to succeed in work and life in the 21st century.” These skills are stressed throughout the Intel Teach Essentials course. See Table 3 for a complete list of skills.

Table 3

Partnership of 21st Century Skills

List of 21st Century Skills
1. Accountability and Adaptability
2. Communication Skills
3. Creativity and Intellectual Curiosity
4. Critical Thinking and Systems Thinking
5. Information and Media Literacy Skills

6. Interpersonal and Collaborative Skills
7. Problem Identification, Formulation, and Solution
8. Self-Direction
9. Social Responsibility

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Project-Based Learning and Student Achievement

A great deal of the empirical research conducted by Intel for the Intel Teach Essentials Course focuses on teacher implementation and technology integration. This leaves a distinct need for further research in the area of student achievement. However, there are several recent non-Intel studies that have demonstrated that project-based learning has the potential of increased student achievement across content areas. The following non-Intel supported studies highlight increased student achievement in Social Studies classrooms.

In one study, Delaware fifth grade students, with and without disabilities, participated in an eight week project-based unit. Each group made significant gains ($p < .05$) on the post test. In addition, both the students with disabilities and without disabilities had a greater sense of self-efficacy after the unit was completed (Ferretti et al., 2001). In a separate study of student achievement in social studies and project-based learning, Gültekin (2005) found that project-based learning makes learning meaningful and permanent. In this mixed-methods study, Gültekin concluded that the project-based learning model significantly affected student achievement for students in the social sciences.

In a study of 5th-grade math students and project-based learning, Barron et al. (1998) reported the results of three separate measures of student learning. The sample consisted of five classrooms and a total of 111 students. In the first task, students were asked to design a chair using graph paper. Students in the low, average, and high achievement groups significantly improved from the pre to the posttest. The second measure had students complete a traditional test on various geometrical concepts after receiving project-based instruction. Again, students in all three groups made significant gains in their ability to answer questions on a standardized test. Finally, the third measure asked students to design and prepare a playhouse. Working in groups, students submitted 37 different designs. Of the 37 designs, 84% were deemed to be sufficient for building. Across the three measures, students demonstrated substantial gains in the understanding of geometric concepts.

Although limited, there is a growing amount of research that indicates that student achievement on standardized test scores improves with the utilization of the project-based learning method. For example, outside evaluations for Co-nect schools "whose reform-based model relies heavily on project-based learning and technology integration, found that students who develop project-based learning skills also perform well on standardized tests" (Solomon, 2003). According to the Co-nect Schools (n.d.), schools in Miami-Dade, Broward, and Palm Beach Counties had improvement in the school averages as measured by the Florida Comprehensive Achievement test (FCAT). Based on FCAT scores released in July 2000, 11 of 12 Co-nect schools in Broward County, Florida had overall achievement gains in reading, writing, and mathematics. In addition, most Co-nect schools had improvements in their school grade, with six of the eight schools in South Florida earning an “A” rating. Co-nect had similar results across nine states.

Similar results have been reported in middle and high schools. In a study of 75 6th- grade students in Turkey, Ozdener, and Ozcoban (2004) used the Multiple Intelligence Theory to identify students and place them in 2 groups. For each group, the researchers utilized the project-based learning method in their computer courses. Each student was administered a pre and a posttest. The results demonstrated that the project method is more effective than traditional methods, as both groups of students made significant gains. In addition, the researchers found that students retained the information after experiencing the project-based curriculum.

Rhode Island’s North Kingston High School, rated as low-performing in 2002, implemented an alternative classroom, called the Cross-Curricular Academy (CCA) to meet the needs of 9th- and 10th-grade at-risk students. The CCA focused on the project-based learning model. The following chart illustrates the success of the program (Royal, 2007). The chart (Table 4) demonstrates that the CCA students scored higher on the 2005 Rhode Island New Standards Reference exam in comparison to the rest of the students at North Kingston High School and the state. The scores indicate that the project-based learning model could have a positive effect on the test scores. However, more demographic information and a discussion regarding other intervening variables would be necessary to make a full interpretation.

Table 4

Percent of CCA Students Meeting/Exceeding the Standard 2005 Rhode Island New Standards Reference Exam

NSRE Skill Tested	North Kingston High School Score	Cross Curricular Academy Disaggregated Score	State of Rhode Island Score
Reading – Basic Understanding	78%	94%	49%
Reading-Analysis and Interpretation	77%	81%	45%
Writing Effectiveness	77%	82%	50%
Writing Conventions	92%	94%	69%
Mathematical Skills	78%	100%	58%
Mathematical Concepts	64%	82%	39%
Problem Solving	65%	88%	36%

In another study, 78 low-achieving 10th grade students from 5 schools in Israel participated in a technology-enhanced project-based learning curriculum for 3 years. The study found that there was a significant increase in student motivation. In addition, a large percentage of students passed the examination necessary for college entrance. The test required passing scores in electronics, English, math, and literature (Doppelt, 2003).

Technology, when integrated with project-based learning, may also have considerable impact on student achievement. In a conceptual paper, Blumenfeld et al. outlined several traits that shape project-based classrooms. They asserted that technology may enhance student interest in a subject area and provide access to key ideas and concepts. In addition, increased access to the key ideas and an interest in them will lead to increased understanding. Technology also provides a structure that allows students to actively demonstrate conceptual knowledge through the creation of artifacts. This, in turn, provides all students with a built-in support mechanism that may account for the varying abilities in the classroom. Finally, Blumenfeld et. al. (1991) state that technology allows students to share their work with others in a collaborative environment which ultimately leads to increased comprehension of the material.

The above traits of a technology enhanced project-based learning classroom have translated to increased student learning across several studies. Based on observational and informal interview data of nine 10^{th}-grade at-risk students, Carr & Jitendra (2000) found that computer technology and project-based learning provided an opportunity for students to connect new information with previous knowledge. This led to an increase in comprehension. Likewise, in a study focusing on pre-service physical education teachers, students developed a deeper understanding of content knowledge because of the ability to collaborate, discuss, and then create a project using technology (Gubacs, 2004).

Other findings suggest that project-based learning and technology integration may lead to improvement of student critical thinking skills. Liu (2003) had elementary, middle, and high school students design various multimedia projects depending on grade level. At the high school level, the results indicated that “student understanding was significantly increased for planning, searching for information, connecting ideas, understanding the importance of audience, and collaboration” (p. 32). The middle school students achieved similar results, demonstrating an increase in planning, designing, and testing. Overall, the results suggested that a project-based learning environment encourages creativity and the development of higher-order thinking skills. These results are consistent with Doppelt (2003) where low-performing Israeli students made similar gains in critical thinking. However, it is important to note that teachers were also frustrated by the perceived lack of technology available.

Project-based learning and Student Engagement

Project-based learning may be highly engaging for students and teachers. Engagement, as defined by Gubacs (2004), means “that students meaningfully partake in learning activities within a nurturing and supportive environment that is student-centered and that involves cooperation and active learning” (p. 33). As one of the central tenets of project-based learning, student engagement is a vital and necessary component for project-based learning to be successful. In a project-based environment, students complete projects that focus on authentic, real-world issues created in part by students. This contributes to students taking ownership in the learning process, greater choice, and ultimately higher levels of engagement (Jones et al., 1997). Research demonstrates that authentic intellectual activity helps to engage and motivate students to learn (Newmann, Bryk, & Nagaoka, 2001).

The study utilized a questionnaire developed by Greene, Miller, Crowson, Duke, and Akey (2004) to measure cognitive engagement and self-efficacy. In a study of 220 high school English students, Greene et al. (2004) sought to determine the impact that student perceptions of particular classroom structures have on student cognitive engagement and ultimately achievement. The results demonstrated that student perceptions of classroom structures are important for improving engagement. In addition, the study found that students must perceive the class work as necessary for future success.

Student engagement also plays an important role in student success. "Engaged students pay close attention to ongoing classroom activities, are interested in the content of classroom lessons, and may also experience heightened states of awareness, confidence, and performance" (Uekawa, Borman, & Lee, 2007). Additionally, student engagement is a good predictor of learning and personal development (Carini et al., 2006). In general, students who are highly engaged learned more and experienced future success. In a study of student engagement in math and science classrooms, Carini et al. established a positive link between engagement and student performance in the areas of critical thinking and grades. The results demonstrate that if students are challenged to critically think in the classroom, grades and engagement will improve.

Researchers have also found that student motivation and learning increased in the project-based science classrooms. Marx, Blumenfeld, and Krajcik (1994) found that student collaboration and the use of technology increased as teachers enacted several aspects of project-based science in their teaching practice. Stratford and Finkel (1995) reported that project-based science improved student engagement and led to greater motivation in science courses. Yarnall and Kafai (1996) reported that project-based teachng improved student motivation and commitment to learning while developing ocean software design projects. Liu (2003) also found that project-based learning had a positive impact on students' motivation toward learning, increased creativity and enhanced the development of cognitive skills, and helped students learn design skills in addition to the content and computer knowledge.

Kelly (2007) examined the role of testing in the engagement of students. The researcher concluded that teachers who focused on analysis and student thought and postponed evaluation increased student engagement. Kelly attributed this to providing authority to students, taking students seriously, and reducing the risks of negative evaluation. The notion of providing authority to students is common in project-based learning research. For instance, many researchers found that project-based learning leads to engaged students (Gulbahar & Tinmaz, 2006; Jones et al., 1997; Liu, 2003; Marx et al., 1994; Stratford & Finkel, 1995). This is due to the student-centered nature of project-based learning (Intel Corporation, 2007). In addition, he found that teachers who focused on building dialogue-driven classrooms by asking questions that focused on evaluation and analysis rather than quizzing students had equal levels of engagement between the high and the low students. Therefore, an authentic environment may lead to engaged students.

A large part of student engagement depends on classroom practice. In another study, Patrick, Ryan, and Kaplan (2007) found that a student's success depends on the level of engagement in classroom learning tasks. There is strong evidence to suggest that classroom context and practice play a significant role in student success. Therefore, it is important for the teacher to provide emotional support and encouragement and peers to provide academic support for the students. If that occurs in a classroom, students are more likely to engage in classroom interaction. Other studies have found that classroom and social contexts lead to increased engagement. In a study of second language learners, Ivey and Broaddus (2007) indicated that:

> Flexibility and variety in the selection of materials would be essential features of instructional programs designed for adolescent second-language literacy

acquisition. Second language learners need to be exposed to a wider range of culturally relevant materials that both resonate with their own experiences and are comprehensible to them as they develop their knowledge of a new language. (p. 539)

Project-based learning, by its very nature, promotes collaboration and team-work (Gil & Julia, 2006). In addition, collaboration is an essential piece of the Intel Essentials Model. Although there is limited research on the role of collaboration and task engagement, it has been predicted that collaborative groups would spend more time on task than individuals (Azmitia, 1988). This has been attributed to the fact that when solving complex problems, groups will spend more time attempting to solve the problem. Research shows that students get disturbed in the early stages of the implementation of project-based learning into their courses, but as time elapses most students adapt to the new environment and increased motivation results (Gulbahar & Tinmaz, 2006). Therefore, it is important to study the role of collaboration in student engagement in a project-based learning environment.

Standardized Testing in Education

Standardized test scores have been utilized for evaluating and classifying children for years in education (Shapiro and Derr, 1987). Testing is reality. Therefore, no effort to reform and improve our schools should ignore testing. Testing determines in large part what states, schools, teachers, and students do (Hirsch, 2007). There are many reasons why testing is so prominent in today's society. Linn (2000) identifies a number of factors, including (a) low cost of test administration; (b) government mandates and control; (c) fast test implementation; and (d) results-driven testing.

The Intel Teach Essentials Course focuses on standards-driven teaching. In a project-based learning environment, students demonstrate knowledge of standards through projects or performances (Intel Corporation, 2007). With standards-driven projects, students must apply their learning to the existing standards. Wiggins and McTighe (2001) suggest a backwards design model to accomplish this end. Wiggins and McTighe chose the backwards design model because:

> Many teachers begin with textbooks, favored lessons, and time-honored activities rather than deriving those tools from targeted goals or standards. We are advocating the reverse: One starts with the end—the desired results (goals or standards)—and then derives the curriculum from the evidence of learning (performances) called for by the standard and the teaching needed to equip students to perform. (p. 8)

It is important to note that no single examination can answer all questions of student achievement. Hamilton (2003) has outlined several unintended consequences as a result of high-stakes accountability. There are a number of reasons why this is the case: (a) Accountability systems typically pin too many hopes on a single battery of tests, and we know that overemphasis on a single set of measures may produce negative consequences; (b) other factors in addition to the testing system will influence what students, parents, educators, and policymakers do, and it is impossible to design a system that controls the responses of all of these actors; and (c) despite the large body of research and the growing consensus among professionals regarding the negative effects of testing and how to prevent them, there is little evidence that points conclusively to one particular approach or another, and we simply do not know enough to design a bulletproof system.

Secondary Reading, Standardized Testing and Technology

There is a growing amount of evidence that shows that American children are not mastering essential reading skills (National Reading Panel, 2001). This has led to a nationwide increase in accountability for schools, especially in the subject of reading. Consequently, as part of the No Child Left Behind Act, the U. S. Department of

Education has implemented high-stakes testing as the singular form of accountability (McGill-Franzen & Allington, 2006). This has led to school districts seeking research-based but innovative methods to teach reading effectively to all students. However, Schumaker, Deshler, Woodruff, Hock, Bulgren, & Lenz (2006) assert that many secondary school students are not reading on grade level.

One innovative method of teaching distinct reading skills is through the use of assistive technology (Hasselbring & Goin, 2004; Mastropieni, Scruggs, & Graetz, 2003; Shraw, 2007). Technology has the potential to improve several skills essential to effective reading. These skills include complex cognitive skills such as meta-cognitive monitoring, global planning, and critical reasoning (Schraw, 2007). Several software programs have shown promise in the development of reading comprehension. Students who used the software program Inspiration learned significantly more than those students who did not (Mastropieni, et al., 2003). In addition, Hasselbring and Goin (2007) found that a technology-enhanced reading program led to significant gains in reading scores on the Stanford Diagnostic Reading Test ($p < .05$).

Many educators have not realized the potential of technology integration in the classroom (Peck, Cuban, & Kirkpatrick, 2002). Recently, there has been an emphasis on classroom organization to provide students with greater opportunities to learn through interaction with both the teacher and other students (Langer, 2001). This requires teachers to rethink traditional teaching practices. As Birr-Moje (2002) asserts, the field of education must learn from the youth in order to solve many of the problems relating to adolescent literacy.

Models of Program Evaluation

The study is in part a program evaluation study. Therefore, there is a distinct need to establish the context in the field of program evaluation. Stufflebeam and Webster (1980) defined the purpose of educational evaluation study as "one that is designed and conducted to assist some audience to judge and improve the worth of some educational object" (p. 6). In order to conduct an evaluation study, a theoretical framework or approach must be established.

Studies that utilize the objectives-based model essentially involve the collection and analysis of performance data relative to specified objectives (Stufflebeam & Webster, 1980). Chatterji (2002) defines an objective study as the documentation of the extent of impact a particular program, service, or policy achieved. Worthen, Sanders, and Fitzpatrick (2004) define an outcome study as one concerned with:

> Describing, exploring, or determining changes that occur in program recipients, secondary audiences (families of recipients, coworkers, etc.), or communities as a result of a program. These outcomes can range from immediate impacts (for example, satisfaction of learners) to final goals and unintended consequences. (p. 21)

As Chatterji (2002) explained, evaluation research must be conducted within the organization. Therefore, it may be necessary to adapt the evaluation design to the environment of the program or service being evaluated. This is especially true when the researcher is an internal evaluator. The internal evaluator must exercise caution when evaluating sensitive issues within organizations. Adams (1983) suggested four strategies when conducting internal evaluative research:

1. pressure to downplay negative and emphasize positive findings
2. reinforcement for nonthreatening evaluation activities

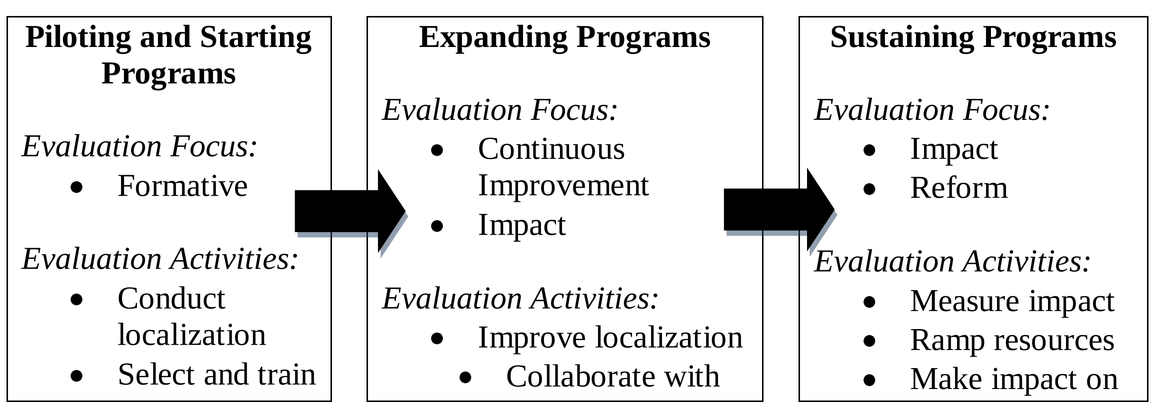
3. greater interest in making the evaluation unit "visible" than in using evaluation results
4. access to privileged information and political innuendos.

The Intel Evaluation Life Cycle

The Intel Corporation (2006) developed a framework for program evaluation based on various contexts such as program maturity and country/school needs. The evaluation framework consists of a program life cycle and has three evaluation phases. The life cycle consists of the Piloting and Starting Programs, Expanding Programs, and Sustaining Programs. A key characteristic of the piloting phase is the focus on formative evaluation. Intel suggests the following evaluation activities: (a) conduct an analysis of local needs; (b) select and train evaluator(s); and (c) ensure high quality expectations for evaluation (Figure 1). In the expanding program phase, continuous improvement and impact studies create the evaluation focus and begin to measure learner and school outcomes. Finally, in the sustaining programs phase the evaluation focus is impact and reform centered. Activities include measuring overall impact of the program and setting high-level policies to drive standards and improve student achievement.

Figure 1

Evaluation Phases and Program Maturity Program Life Cycle



evaluator • Ensure high quality expectations for evaluation	evaluators • Measure learner outcomes • Measure impact in school	school ecosystem: affect high-level policies, drive standards

Adapted from Intel Teach Program Essentials Course Master Teacher Edition v.10. Copyright 2007 Intel Corporation. Used pending permission of Intel.

The evaluation phases are Pilot Phase, Training Phase, and the Impact Phase. See Figure 2 for a visual representation. The Pilot Phase takes place early in the program and requires time before a more rigorous evaluation of the implantation and the results. The training phase occurs when global training indicators are measured; data are collected, compiled, and analyzed; and a report is generated based on the training data. This phase allows for further changes to the implementation. Finally, the impact phase begins after training sessions have been in place for no less than 6 months. This involves following up with teachers and survey results found in the training phase. Intel suggests that impact studies are not appropriate until the second year of the program. These phases are important because they provide the rationale for evaluation of the current study.

Figure 2

Evaluation Phases

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Intel suggests the implementation of qualitative studies throughout the program life cycle. Data collection methods include interviews, focus groups, and observations to understand the full impact of the program. Further areas may be studied based on needs.

Conclusion

Schools are continually being asked to improve student achievement. Although many models of instruction exist, there is increased emphasis on the creation of student-centered learning environments, including project-based learning (Grant & Branch, 2005). As technology becomes more prevalent in schools, it too has the potential to change instruction (Berg, Benz, Lasley, & Raisch, 1998; Carr & Jitendra, 2000; Solomon, 2003). Therefore, the integration of technology within a project-based learning environment has the potential to improve not only student learning but increase engagement and motivation in the process (Blumenfeld et al., 1991; Ferretti et al., 2001; Liu, 2003).

As is the case with all school reform, implementation is vital for success. The Intel model of project-based learning requires extensive staff development led by certified master teachers (Intel Corporation, 2007). This requires a commitment from the district, the school, and the teachers to implement the program with fidelity. The evaluation of the program, when implemented properly, ought to lead to positive gains in student achievement and engagement. In conclusion, using a technology integrated, project-based learning model is vital to enhance student achievement, and engagement will lead to positive gains by stakeholders in today's educational environment.

CHAPTER 3

Methodology

According to Johnson and Onwuegbuzie (2004), “mixed methods research offers great promise for practicing researchers who would like to see methodologists describe and develop techniques that are closer to what researchers actually use in practice” (p. 15). This chapter addresses the methods used to obtain the data to address the research questions. The chapter consists of the following sections: (a) demographics; (b) sampling method; (c) procedures; (d) instrumentation; and (e) statistical techniques used to analyze the data.

This two-phase mixed methods study sought to identify (a) the effectiveness of the Intel Essentials model of project-based learning based on student Florida Comprehensive Assessment Test (FCAT) reading scores; (b) the differences in student engagement between students in classes with teachers trained in the Intel Essentials model of project-based learning and teachers not trained in the model as measured by the Beliefs about Classroom Structures Survey; (c) the level of implementation (high, average, or low) of teachers trained in the Intel Essentials model of project-based learning; and (d) any correlation between the level of implementation and the level of student engagement.

The quantitative first phase of the study utilized student Florida Comprehensive Assessment Test scores as the dependent variable and whether the teacher completed the

Intel Essentials course or not as the independent variable. A matched pairs sampling method was utilized. In addition, data from The Beliefs about Classroom Structures Survey developed by Greene et al. (2004) was administered to all participating teachers to measure student engagement in each of the participating classrooms.

The second phase of the study involved both quantitative and qualitative data. The Intel Implementation Survey was administered to all experimental group teachers during the study period. The survey attempted to determine the extent to which teachers have implemented the Intel Training in their classrooms. Sample questions included:

Please describe the extent in which you do the following in your classroom:

- Focus on integration of technology into your teaching.
- Illustrate effective uses of technology with students.
- Use project-based models in your teaching.

See Appendix B for a complete list of questions.

The qualitative phase had the participating experimental group (Intel-trained) teachers participate in a focus group or interview to answer questions regarding classroom implementation of project-based learning. The overall purpose of the focus group or interview was to further assess teacher implementation. Questions included: How do you know that students learn the material you teach? How do you incorporate technology in the classroom? How do you create a lesson? See Appendix C for a complete list of questions. Finally, experimental group (Intel Trained) teachers were asked to submit two lesson plans that were coded for individual characteristics of project-based learning using the Portfolio Rubric developed by Intel. The Portfolio Rubric measured four key areas vital to success in project-based learning: (a) technology integration; (b) student learning; (c) assessment; and (d) implementation. Please see Appendix H for the complete Intel Portfolio Rubric.

Research Design

This study utilized predominantly a quantitative research design. Research questions 1 and 2 relied on test score and self-report survey data respectively. The various instruments administered in the study are considered reliable and valid measures (Blackburn, 1998; Florida Department of Education, 2001; Greene et al., 2004). It is important to note that self-report instruments are valid and reliable when properly constructed and administered under the proper conditions (Pohlmann and Beggs, 1974).

Although primarily quantitative in nature, in order to address research question number 3, a deeper understanding of implementation was useful to provide guidance to inform district-wide implementation efforts. A focus group or interview and document analysis was conducted in addition to the administration of the Intel Teacher Survey. Finally, question number 4 used the results from the Beliefs about Classroom Structures Survey and individual teacher scores from the Intel Teacher Survey in order to quantitatively measure the correlation between level of implementation and student engagement. In addition, qualitative analysis was utilized to further describe the results.

Demographic Information

A school district in Southeast Florida served as the location of this study. Kaye County is located on the East Coast of Florida. Rio Belle and Jayton Beach are the two main cities of Kaye County. There are 21 schools in Kaye County: 14 elementary, 3 middle, 2 high, an Alternative Education Center, and a special needs school. In addition, there are 4 charter schools; 2 elementary, 1 middle, and 1 high school.

For the 2005-2006 school year, the district served approximately 16,831 students. Three ethnic groups account for over 98% of the population. Overall, 69.3% of the students are White, 15.8% Black, and 13.5% Hispanic. The percentage of economically disadvantaged (ED) students as defined by the Florida Department of Education is 45.8% at the elementary level, 40.1% at the middle schools, and 34% at the high schools. See Tables 5 and 6 for a more detailed listing of district demographic data.

Table 5

School District of Kaye County Demographic Data 2005-2006

Year	Students with Disabilities (%)	Dropout Rate (%)	Free and Reduced Lunch (%)	Number of Students	Teacher's Average Years of Experience
Elementary	13.8	N/A	45.8	7,777	12.6
Middle	13.4	N/A	40.1	3,874	12.6
High School	11.9	1%	42.0	5,180	12.6

Table 6

School District of Kaye County Demographic Data by Ethnicity

Ethnicity	Percentage
White	69.3
Black	15.8
Hispanic	13.5
Asian/Pacific Islander	1.2
American Indian/Alaskan Native	.2

Sampling Method

The School District of Kaye County has trained approximately 400 teachers from grades K-12 in the Intel Teach Essentials Model of project-based learning. These teachers volunteered to take the training over the summer or throughout the 2006-2007 or 2008-2009 school years. The Intel-trained (experimental group) participants for this study came from this cohort. This study focused on middle and secondary FCAT reading scores (Grades 6-10). From the original group of 400 teachers, a total of 36 teachers were eligible to participate, of whom 16 reading and English teachers agreed to participate. The sample size is consistent with Charles and Mertler (2002) suggestions that in experimental research the sample size should be no smaller than 15 participants. In addition, for research involving entire classrooms, a minimum of 5 classrooms per different research treatment is acceptable.

To summarize, from the core group of 16 teachers, there were a total of 780 middle school and high school students for the experimental group. In order to qualify for the pool, teachers had to meet the following criteria:

- Complete the Intel Essentials Course
- Agree to implement the training in their classrooms
- Be responsible for the FCAT Reading scores of the students assigned to their classrooms

Middle and secondary reading and language arts teachers were selected for several reasons. First, middle and secondary reading and language arts teachers are solely responsible for their students’ FCAT Reading test scores. This procedure provided for consistent measurement across all five grade levels. Next, standardized reading test scores receive a great deal of emphasis across the state of Florida, particularly at the middle and secondary level where scores are consistently lower than those of the primary grades. This study provided important information on the efficacy of the project-based learning model, culminating in a report to the district about whether project-based learning may lead to increased student achievement at the middle and secondary level.

In addition, a matched sample of 16 reading and language arts teachers who are not trained in the Intel Essentials model were utilized in the analysis of Research Questions 1 and 2. Careful consideration was used in selecting the matching group, including looking at school, years of teaching experience, classroom demographics, and prior FCAT achievement levels. According to Rosenbaum and Ruben (1985), matched sampling is effective when:

> There is a relatively small group of subjects exposed to a treatment and a much larger group of control subjects not exposed. When the costs associated with obtaining outcome or response data from subjects are high, some sampling of the control reservoir is often necessary. Matched sampling attempts to choose the controls for further study so that they are similar to the treated subjects with respect to background variables measured on all subjects. (p. 33)

Instrumentation

The Florida Comprehensive Assessment Test.

The Florida Comprehensive Assessment test (FCAT) is the test utilized by the state of Florida to assess student achievement. The examination has three basic components measuring selected benchmarks in reading, writing, and mathematics from the Sunshine State Standards. The FCAT is both a valid and reliable test (FCAT Brief, 2001). All of the FCAT reliability indices at grades 4, 5, 8, and 10 are above .90. Furthermore, the FCAT test has content validity as it is developed by the Florida

Department of Education. Because the FCAT consists of two parts, FCAT Sunshine State Standards and the FCAT Norm-Referenced Test, there is a degree of concurrent validity. Correlations for the 4, 5, 8, and 10 grade test are between .70 and .81. Finally, there is no indication of bias in any of the FCAT items (Florida Department of Education, 2001).

The Beliefs about Classroom Structures Survey.

Greene et al. (2004) adapted The Survey of Classroom Goals Structures as a measure of student cognitive engagement to improve student motivation and achievement at the high school level. The instrument was originally validated by Blackburn (1998) and is based on the TARGET model of classroom structures (tasks, autonomy, recognition, grouping, evaluation, and time) (Greene et al.). The Beliefs about Classroom Structures Survey consists of 34 items using a 4-point Likert scale (Strongly Disagree to Strongly Agree) to measure student engagement. The instrument measures three separate factors: motivating tasks, mastery evaluation, and autonomy (Greene et al.). Some of the items include:

1. Students can work together on assignments in this class;
2. The teacher in this class uses more than one way to determine grades (tests, projects, presentations, journals, etc.; and
3. Due dates for projects/assignments are flexible in this class.

The engagement score is calculated by averaging each of the three dimensions. The Beliefs about Classroom Structures Survey is both a valid and reliable instrument for measuring student engagement according to Greene et al. (2004). The instrument had reliability factors at an alpha of .76 - .92. See Appendix A for a complete copy.

The Intel Teacher Implementation Survey.

The Intel Teacher Implementation Survey was adapted from the Intel Essentials Course Completion Survey. The survey consisted of 20 questions developed from Intel that are necessary components to the successful implementation of project-based learning. Upon completion of the Intel Essentials Course, teachers completed a survey answering questions such as “Overall, how comfortable were you using the technology included in the course?” and “Will the ideas and skills you learned from the Intel Teach training help you successfully integrate technology into your students’ activities?” This provided information relating to the overall degree of implementation. See Appendix B.

Intel Portfolio Rubric.

The Intel Portfolio Rubric served as the tool to objectively rate teacher lesson plans. Developed by Intel Corporation, the rubric is intended for teachers to use when creating their lesson plans. The rubric measures four separate areas using a 4-point scale. The areas include technology integration, student learning, assessment, and implementation. Each area has concise descriptors and is tied directly to course expectations. See Appendix H.

Teacher Focus Group Protocol.

The Teacher Focus Group Protocol assessed teacher implementation of the Intel Essentials course. The Teacher Focus Group Protocol was adapted from the Characteristics of Project-Based Learning as outlined by Intel (2007). The Teacher Focus Group Protocol was developed and tested by the researcher. Sample questions included: “What is the role of the student in the learning process?”; “How do you create a lesson?”;

and “What are your thoughts regarding assessment?” See Appendix C for a complete list of questions. The Teacher Focus Group Protocol was field tested prior to actual use.

Procedures

An application for Florida Atlantic University Institutional Review Board approval was submitted after formal acceptance of the proposal for the study. Upon receiving IRB approval, the researcher gained consent from the School District of Kaye County to initiate the study. A formal written consent form to complete this study was submitted and returned from each principal of the five participating schools. After receiving permission from the school and district, the researcher contacted each teacher participating in the study with a consent form. Finally, based on classroom counts provided by the teachers, all students received a consent and assent form to complete with their parents. The same process was repeated for the matched sample.

The 16 participating teachers were trained in the implementation of project-based learning between November 2006 and August 2008. Participating teachers were advised to teach their normal curriculum within the frameworks of the district pacing guides. Moreover, the district offered several follow-up training sessions to ensure implementation and to discuss further technology integration, lesson planning, and standards-based instruction. Due to contractual obligations, the training was voluntary.

The following sections will address the specific procedures for each of the 4 research questions:

1. What effect does the implementation of a technology-integrated, project-based learning model have on standardized test scores in language arts and reading classrooms in grades 6-10?

The FCAT Reading Test is administered to all students in grades 3-10 annually in the spring. FCAT results are released to Florida school districts by the end of May. Once the FCAT testing data were released, district personnel responsible for data management provided the researcher with an Excel spreadsheet of test scores for participant teachers including all students involved in the research study. The data for participant teachers provided by the district included teacher name, student FCAT scores by class, prior year FCAT scores, grade, gender, ethnicity, and SES. All student names were removed prior to the researcher receiving the data to ensure anonymity.

The FCAT results for the students of the 16 experimental group teachers were compared to the control group teachers by grade level using the *t* test of independent means. In order to compare student achievement gains, students must have had at least 2 years of FCAT test data to qualify for the study. The variance between the dependent variable, FCAT scores, were compared to the independent variables, trained in Intel Essentials, or not trained.

2. To what extent does the implementation of a technology-integrated project-based learning model affect student engagement in language arts and reading classrooms in grades 6-10?

The Beliefs about Classroom Structures Survey was utilized to assess individual student perceptions of cognitive engagement. Greene et al. (2004) asserted that student achievement is driven in large part by the cognitive strategies that students use to learn. These strategies lead to engaged learning. The questionnaire was administered to all students participating in the study during final exams. This provided an opportunity for students to reflect on the entire year and the various teaching methods utilized within their reading and language arts courses. The *t* test of independent means was utilized in data analysis.

3. To what extent are middle and secondary reading and language arts teachers who have voluntarily received professional development training in a technology-integrated, project-based learning model implementing the training in their curriculum?

The above research question employed both qualitative and quantitative data collection. As outlined by Creswell (2003), mixed method research should begin with a broad survey in order to generalize results to a population and then focus, in a second phase, on detailed qualitative, open-ended interviews to collect detailed views from participants. First, all experimental group teachers completed the Intel Teacher Implementation Survey. In addition, a semi-structured interview/focus group protocol was designed to look specifically at the implementation efforts of teachers. The focus group transcript was coded and quantified as outlined by Chi (1997). Chi suggests an 8-step process:

1. Reducing or sampling the protocols.
2. Segmenting the reduced or sampled protocols (sometimes optional).
3. Developing or choosing a coding scheme or formalism.
4. Operationalizing evidence in the coded protocols that constitutes a mapping to some chosen formalism.
5. Depicting the mapped formalism (optional).
6. Seeking pattern(s) in the mapped formalism.
7. Interpreting the patterns.

8. Repeating the whole process, perhaps coding at a different grain size (optional).

In order to further ensure reliability, data triangulation included lesson plan evaluation for each participating teacher. The Intel Portfolio Rubric for Lesson Plans was utilized to score the presence of technology in lesson plans (Appendix H). To ensure accuracy, a separate researcher scored the lesson plans to ensure inter-rater reliability. These three items were then converted to quantitative data providing each teacher with a level of implementation: (high, average, or low).

4. What is the relationship, if any, between student engagement and the level of teacher implementation of the Intel Essentials technology course in their classroom?

The final question utilized the data from the student engagement questionnaire and the level of teacher implementation based on the Intel Survey data, focus group or interview responses, and lesson plan evaluation. A Spearman's Rank-Order correlation test then determined if there was any relationship between the level of student engagement and the level of implementation based on the Intel Teacher Level of Implementation Survey. In addition, a qualitative correlation was provided.

Statistical Techniques

For all statistical analyses in this study, an alpha of .05 served as the level at which findings are considered to be significant. Salkind (2004) suggests the use of .05 as the level of significance to minimize the risk of Type 1 error. Several statistical tests were employed. First, a *t* test for independent means was utilized to examine if any differences existed in the means of FCAT scores and student engagement between the experimental and the control groups. For this test, the dependent variables were student FCAT scores or student engagement and the independent variable was whether the participating teacher was trained in Intel Essentials or not trained in Intel Essentials. Next, descriptive statistics were utilized to determine the level of implementation. Finally, a Spearman Rank-Order correlation determined the relationship between student engagement and the level of implementation for the experimental group. The following sections will provide more in-depth discussion regarding the statistical tests.

Research Question #1

What effect does the implementation of a technology-integrated, project-based learning model have on standardized test scores in language arts and reading classrooms in grades 6-10?

Ho1: There will be no statistically significant difference in student FCAT reading scores in classrooms where project-based learning is implemented and those where it is not.

Ha1: Students who are taught by teachers trained in the Intel Essentials Project-Based Learning model will show significant academic achievement as measured by scores on the FCAT Reading Test, when compared to students in classrooms where teachers have not received the training.

A *t* test for independent means was the statistical method utilized to determine if there is a difference between the average scores of student FCAT scores (dependent variable) compared to the teachers who received the Intel Training and the teachers who did not (independent variable). The *t* test for independent means assumes that there is no variability between groups (Salkind, 2004).

Research Question #2

To what extent does the implementation of a technology-integrated, project-based learning model affect student engagement in language arts and reading classrooms in grades 6-10?

Ho2: There will be no statistically significant difference in student engagement in classrooms where project-based learning is implemented and classrooms where it is not.

Ha2: Students who are taught by teachers trained in the Intel Essentials Project-Based Learning model will show significant differences in student perceptions of autonomy as measured by scores on the Learning Climate Questionnaire when compared to students in classes where teachers have not received the training.

A *t* test for independent means was the statistical method utilized to determine if there is a difference between the average scores of student engagement (dependent variable) as measured by The Beliefs in Classroom Structures survey. The survey measures 3 factors: (a) motivating tasks; (b) mastery evaluation; and (c) autonomy. The *t* test compared the teachers who received the Intel Training and the teachers who did not (independent variable).

Research Question #3

To what extent are middle and secondary reading and language arts teachers who have voluntarily received professional development training in a technology-integrated, project-based learning model implementing the training in their curriculum?

Ho3: There will be no statistically significant difference among teachers in their perception of efficacy in the implementation of the Intel Essentials model of project-based learning.

Ha3: There will be a statistically significant difference among teachers in their perception of efficacy in the implementation of the Intel Essentials model of project-based learning.

A three-tiered approach was utilized to determine the level of teacher implementation (high, average, or low). First, descriptive statistical analysis was used to measure individual implementation from the Teacher Implementation Survey results. The Teacher Implementation Survey employed a 6-point Likert scale from which the mean, median, and standard deviation for the survey was calculated and discussed. The average level of implementation was calculated for each teacher. In addition, lesson plans from each of the 16 experimental group teachers were collected and evaluated using the Portfolio Rubric provided by Intel (See Appendix H). Again, scores were calculated for each teacher based on the level of implementation of the Intel Essentials model found in the lesson plans. To increase reliability, a separate Intel-trained rater scored the same lesson plans.

The final measure of teacher implementation included a series of three focus group interviews in addition to four individual interviews with each of the 16 participating experimental group teachers. During the focus group or interview session, the researcher followed a loosely formatted process, The Teacher Focus Group Protocol, designed by the researcher, which was based on the key points of the characteristics of project-based learning from Intel. The protocol focused on specific points that are necessary to successfully implement the Intel Model of project-based learning. Each session was audio taped, transcribed, and then coded. Specific themes were then determined based on the Indicators from the Intel Teacher Portfolio Rubric and coded using the Focus Group/Interview Scoring Guide (See Appendix L). Each instance of effective implementation was awarded a point, and final teacher scores were averaged.

Research Question #4

What is the relationship, if any, between student engagement and the level of teacher implementation of the Intel Essentials technology course in their classroom?

Ho4: There will be no statistically significant difference between student engagement and teacher implementation.

Ha4: There will be a statistically significant difference between student engagement and teacher implementation.

After the implementation score was determined, the researcher compared the level of student engagement to the level of implementation. A Spearman's Rank-Order Correlation was the statistical method utilized to determine the relationship between student engagement and the level of teacher implementation obtained in Research Question 3. In addition, a qualitative correlation was also included.

Conclusion

The study utilized both qualitative and quantitative data collection. This was achieved through: (a) analysis of student FCAT growth; (b) student engagement scores; (c) focus group data analysis; (d) teacher interviews; (e) lesson plan evaluation; and (f) survey results. The data provided information relating to the overall effects that the Intel model of project-based learning has on reading test scores for a district.

Chapter 4

Presentation of the Findings

This two-phase mixed methods study sought to identify (a) the effectiveness of the Intel Essentials model of project-based learning based on student Florida Comprehensive Assessment test (FCAT) reading scores; (b) the differences in student engagement between students in classes with teachers trained in the Intel Essentials model of project-based learning and teachers not trained in the model as measured by the Beliefs about Classroom Structures Survey; (c) the level of implementation (high, average, or low) of teachers trained in the Intel Essentials model of project-based learning; and (d) any correlation between the level of implementation and the level of student engagement.

Specifically, the study focused on the following questions:

1) What effect does the implementation of a technology-integrated, project-based learning model have on standardized test scores in language arts and reading classrooms in grades 6-10?
2) To what extent does the implementation of a technology-integrated project-based learning model affect student engagement in language arts and reading classrooms in grades 6-10?
3) To what extent are secondary reading and language arts teachers who have voluntarily received professional development training in a technology-integrated, project-based learning model implementing the training in their curriculum?

4) What is the relationship, if any, between student engagement and the level of teacher implementation of the Intel Essentials technology course in their classroom?

Demographics

An e-mail was sent to all middle and secondary English and Reading teachers in grades 6-10 in the School District of Kaye County. A total of 32 teachers volunteered to participate in the study. Of the 32 teachers, 16 were trained in the Intel Essentials course, and 16 were not trained. Table 7 provides a summary of all participants and their home school. A survey to gather demographic information was administered online to all participating teachers both trained and not trained. The control group had 12 teachers (75%) who teach language arts and 4 teachers (25%) who teach reading. The experimental group was divided evenly between language arts and reading, with 8 in each group. In addition, it is worth noting that the researcher is employed at North County High School, which may have influenced the fact that 14 of the 32 participants come from the school.

Overall, the number of years of experience between the two groups is relatively even. The control group had three teachers with fewer than 3 years of experience compared to the experimental group that had one teacher. The experimental group had four teachers with 10 -20 years of experience and the control group had only one. Table 8 displays the years of experience distribution between the two groups by school.

Findings: Question 1

What effect does the implementation of a technology-integrated, project-based learning model have on standardized test scores in language arts and reading classrooms in grades 6-10?

Table 7

Demographic Information for Intel Trained and Non-Intel Trained Groups

School Name	Total Participants	Intel Trained	Non-Intel Trained
Midland Middle	3	1	2
Southland Middle	3	0	3
Northland Middle	9	4	5
North County High	14	8	6
South County High	3	3	0
Total	32	16	16

Table 8

Years of Teaching Experience by Experimental and Control Group

Experience	Intel Trained	Non-Intel Trained
Less than 3 years	1	3
3-9 Years	6	7
10-20 Years	4	1
Over 20 Years	5	5

The Florida Comprehensive Achievement Test of Reading was the measure selected to determine the differences in learning gains between the control and the experimental groups. To ensure equity between the two groups and grade levels, a percentage of the developmental scale score (DSS) gain in relation to the yearly acceptable progress gain was utilized. The following formula was used to calculate results as follows:

FCAT 2009 DSS – FCAT 2008 DSS / Points Required for Gain (Appendix K) * 100

Example: If a 7th grade student scored 1800 in 6th grade and 1910 in 7th grade, the learning gain would equal 110 points. The researcher then took the 110 points and divided it by the required grade level gain and multiplied it by 100. In the above example, the percentage of gain would be 100%. See Appendix K for a complete breakdown of Developmental Scale Scores and by grade level and points required to demonstrate a year's gain.

The control group (not trained in Intel) had an overall mean percentage gain of 80.07% (*SD* = 185.95) compared to 80.59% (SD = 198.68) for the experimental group (Intel trained). The small effect size of .001 shows that both groups tend to be very similar and overlap a great deal. See Table 9 for a complete listing of descriptive statistics.

Levene's test evaluated the homogeneity of variances (F = 2.81) which was not significant (.094), meaning that equal variances can be assumed. The t score of -.069 was also not significant (.945, two-tailed). Although there is a slight difference in the mean growth percentage between the control (80.59) and the experimental (80.07) groups, the results show no statistically significant difference between the means. Therefore, the researcher accepts the null hypothesis that there is no statistically significant difference in student FCAT reading scores between the treatment and the control group classrooms. Table 10 displays the complete *t* test statistical outcomes.

Table 9

Descriptive Statistics for Student FCAT Scores by Percentage Gained for the Experimental and Control Groups

Flag	*N*	*M*	*SD*	Standard Error Mean
Experimental Group	780	80.0721	185.94996	5.27213
Control Group	643	80.5878	198.67850	5.21575

Table 10

T test of Independent Means for Student FCAT Scores by Percentage Gained for the Experimental and Control Groups

Levene's Test for Equality of Variances			*t* test for Equality of Means				
Equal	*F*	Sig	*t*	*Df*	Sig (2- Tailed)	Mean Difference	Std. Error Difference
Variances Assumed	2.81	.094	-.069	1421	.945	-.52	7.45

Examination of the scale score alone (100-500 point range across all grade levels) shows (a) the experimental group had a mean of 318.18 (*SD* = 50.52); and (b) the control group had a mean of 312.12 (*SD* = 53.66). Table 11 provides a detailed summary of the statistics. The *t* test of independent samples (Table 12) revealed an *F* score of 1.56 which was not significant (.21), meaning that equal variances can be assumed. The *t* score was -

3.14 and was significant at .002. Therefore, in this case the experimental group had significantly better scores than the control group ($p < .05$).

Table 11

Descriptive Statistics for Student Scaled FCAT Scores for the Experimental and Control Groups

Flag	*N*	*M*	*SD*	Std. Error Mean
Intel Trained	780	318.18	50.52	1.29
Non-Intel Trained	643	312.12	53.66	1.45

Table 12

T test of Independent Means for Student Scaled FCAT Scores for the Intel and Non-Intel Trained Groups

Levene's Test for Equality of Variances			*t* test for Equality of Means				
	F	Sig	*t*	*df*	Sig (2- Tailed)	Mean Difference	Std. Error Difference
Equal Variances Assumed	1.56	.212	-3.14	1421	.002	-6.06	1.93

Findings: Question 2

To what extent does the implementation of a technology-integrated, project-based learning model affect student engagement in language arts and reading classrooms in grades 6-10?

The Beliefs in Classroom Structures Survey (See Appendix A) was administered to students in order to assess the level of engagement of the 32 participating teacher's classrooms. The number of students participating in each class depended on the teacher's schedule and persistence in collecting permission slips. For instance TP, JH, and DD are all Self-Contained Exceptional Student Education teachers and do not have as many students as a general education Language Arts teacher. Other teachers reported difficulty in getting the student permission forms returned in a timely manner and therefore have lower overall response rates.

The Beliefs in Classroom Structures Survey was designed to measure student engagement in three measures; Motivating Tasks, Mastery Evaluation, and Autonomy. The survey consists of 34 items and utilizes a 4-point Likert scale ranging from Strongly Agree to Strongly Disagree. The researcher distributed the same survey to each of the 32 control and experimental groups. A total of 780 experimental group surveys and 643 control group surveys were returned and completed by students either online or on paper. The following sections will detail the results of each individual subscale based on descriptive statistics, individual items, and by teacher.

Motivating Tasks Subscale

Overall, the mean of the Motivating Task subscale was 2.94 (*SD* = .90) (See Table 15) for the experimental (trained) and 2.93 (SD = .95). for the control group (not trained). In addition, individual teacher scores revealed (See Table 13) that the three top scoring teachers came from the experimental group. However, the two lowest scoring teachers were also from the experimental group. Teacher BG scored exceptionally low on the motivating tasks and might be considered an outlier. Her score of 2.396 was .544 points below the mean of the experimental group. Finally, when looking at the means of the survey by individual items, the control group had higher means than the experimental group in 10 out of 15 items (See Table 14), yet the overall mean was greater for the experimental teachers.

A *t* test for independent means was conducted to determine if there was a significant difference between student engagement for the control and the experimental groups based on the Beliefs about Classroom Structures Survey. For the Motivating Tasks Subscale, the results were not significant, $t(20,117.5) = .49$, $p = .622$. Accordingly, neither group provided more engaging tasks than the other. The 95% confidence interval for the difference in means ranged from -.0187 to .0312 (See Table 16).

Table 13

Student Survey Results by Experimental and Control Group: Motivating Tasks Subscale Means Organized from Highest to Lowest

Experimental Teacher Name	*N*	Motivating Tasks Subscale Mean	Control Teacher Name	*N*	Motivating Tasks Subscale Mean
1. MW	38	3.512	1. FA	16	3.279
2. OD	16	3.442	2. BK	12	3.272
3. GA	19	3.305	3. HT	14	3.167
4. KF	7	3.234	4. KN	33	3.146
5. LK	55	3.219	5. QA	42	3.084
6. SQ	4	3.167	6. TU	59	3.08
7. DC	48	3.119	7. ED	82	3.069
8. HM	38	3.109	8. MD	20	2.997
9. SL	35	3.084	9. AD	61	2.97
10. TM	45	3.013	10. WG	11	2.92
11. SA	102	2.933	11. NK	77	2.909
12. OF	94	2.907	12. ZY	61	2.755
13. CL	15	2.884	13. ZD	15	2.742
14. NI	63	2.84	14. CK	89	2.697
15. CY	92	2.829	15. MA	29	2.676
16. BG	109	2.396	16. TE	22	2.655

Note. 1 = Strongly Disagree, 2 = Somewhat Disagree, 3 = Somewhat Agree, 4 = Strongly Agree

Table 14

Beliefs about Classroom Structure Results by Item: Motivating Tasks Subscale

Item	Experimental Group	Control Group
1. Students can work together on assignments in this class.	3.201282	3.2056
2. In this class, making mistakes is a part of learning.	3.215385	3.3536
3. The teacher explains ideas in this class in ways that make the information meaningful to the students.	3.198718	3.3396
4. In this class, the teacher focuses on how to pass tests. *Reversed	2.501282	1.9579
5. Students learn in this class by participating in class activities and discussions.	3.220513	3.2352
6. In this class, activities and assignments are interesting.	2.721795	2.7243
7. The teacher in this class values creative thinking and original ideas.	3.271795	3.1760
8. In this class, the teacher emphasizes learning the material to gain understanding.	3.215385	3.2773
9. In this class, the teacher introduces material in ways that are relevant, interesting, and familiar to students.	3.014103	3.0607
10. The teacher shows how the activities in this class are related to students' everyday lives or future careers.	2.860256	2.6417
11. In this class, students learn mainly by listening to the teacher and taking notes. *Reversed	2.501282	2.3100
12. In this class, the teacher tries to find out what each student wants to learn about.	2.280769	2.2492
13. Students are given a chance to correct their mistakes in this class.	2.887179	3.0405
14. Students know it is OK to make mistakes in this class.	2.99359	3.2648
15. The teacher helps us understand how the activities and assignments in this class will be useful to us.	2.985897	3.1386

Note.1 = Strongly Disagree, 2 = Somewhat Disagree, 3 = Somewhat Agree, 4 = Strongly Agree

Table 15

Descriptive Statistics of Student Survey Results: Motivating Tasks Subscale

Teacher Type	*N*	Motivating Tasks	*SD*	Std Error Mean
Intel Trained	780	2.94	.90	.0083
Non-Intel Trained	643	2.93	.95	.0097

Note. 1 = Strongly Disagree, 2 = Somewhat Disagree, 3 = Somewhat Agree, 4 = Strongly Agree

Table 16

Student Survey Results: T test of Independent Means for the Motivating Tasks Subscale

	Levene's Test for Equality of Variances		*t* test for Equality of Means				
	F	Sig	*T*	*Df*	Sig (2- Tailed)	Mean Diff	Std. Error Diff
Equal Variances Assumed	42.45	.000	.50	21328	.62	.00628	.01267
Equal Variances Not Assumed			.49	20118	.62	.00628	.01274

Mastery Evaluation Subscale

Overall, the mean of the Mastery Evaluation subscale was 3.10 (*SD* = .85) for the experimental group and 3.19 (*SD* = .86) for the control group (See Table 17). In addition, individual teacher scores revealed (See Table 18) that the two top scoring teachers came from the experimental group. However, the lowest scoring teacher, BG, came from the Intel Trained group and had a 2.616 mean. The means of the survey by individual items revealed that the control group had higher means than the experimental group in 9 out of 12 items (See Table 19). This translated into a higher overall mean for the control group teachers.

A *t* test for independent means was conducted to determine if there was a significant difference between student engagement for the experimental and the control group teachers based on the Beliefs about Classroom Structures Survey. For the Mastery Evaluation Subscale, the results were significant, $t = -7.02$, $p = .000$. This means that the control group provided significantly more opportunities for students to be evaluated in a variety of methods at the .000 level. The 95% confidence interval for the difference in means ranged from -.11828 to -.06664 (See Table 20).

Table 17

Descriptive Statistics for The Beliefs of Classroom Structures Student Survey Results: Mastery Evaluation Subscale

Teacher Type	*N*	Motivating Tasks	*SD*	Std Error Mean
Experimental	780	3.10	.85	.0088
Control	643	3.19	.86	.0098

Note. 1 = Strongly Disagree, 2 = Somewhat Disagree, 3 = Somewhat Agree, 4 = Strongly Agree

Table 18

The Beliefs of Classroom Structures Student Survey Results by Experimental and Control Teacher: Mastery Evaluation Subscale Means Organized from Highest to Lowest

Experimental Group Name	*N*	Mastery Evaluation	Control Group Name	*N*	Mastery Evaluation
1. KF	7	3.679	1. FA	16	3.563

2. OD	16	3.661	2. BK	12	3.493
3. MW	38	3.498	3. CS	14	3.429
4. GA	19	3.482	4. KN	33	3.361
5. HM	38	3.428	5. QA	42	3.343
6. DC	48	3.333	6. TU	59	3.304
7. TM	45	3.278	7. ED	82	3.29
8. SQ	4	3.208	8. AD	61	3.212
9. SL	35	3.198	9. NK	77	3.171
10. LK	55	3.142	10. MD	20	3.146
11. SA	102	3.124	11. WG	11	3.108
12. OF	94	3.088	12. CK	89	3.106
13. NI	63	2.918	13. ZD	15	3.05
14. CL	15	2.9	14. ZY	61	3.022
15. CY	92	2.844	15. MA	29	2.971
16. BG	109	2.616	16. TE	22	2.682

*Note.*1 = Strongly Disagree, 2 = Somewhat Disagree, 3 = Somewhat Agree, 4 = Strongly Agree

Table 19

The Beliefs of Classroom Structures Student Survey Results by Item: Mastery Evaluation Tasks Subscale

Item	Experimental Group	Control Group
16. Students are encouraged to use different methods for completing tasks in this class.	2.928205	3.0405
17. The teacher in this class uses more than one way to determine grades (tests, projects, presentations, journals, etc.).	3.25641	3.1978

18. In this class, the teacher praises students for genuine effort.	3.080769	2.9813
19. The tests in this class match what we learned in class.	3.375641	3.5623
20. In this class, assignments and tests are returned in a way that keeps individual student grades private.	3.169231	3.1636
21. The teacher grades fairly in this class.	3.302564	3.5140
22. Students are given a chance to correct their mistakes in this class.	2.892308	3.0530
23. In this class, the teacher pays attention to whether I am improving.	3.051282	3.2025
24. Students' responses are treated with respect in this class.	3.160256	3.2882
25. Only students with the highest grades can keep up with the pace of this class. *Reversed	2.820513	2.9517
26. When students make mistakes they are treated with respect in this class.	2.991026	3.0935
27. Students are provided with guidelines for how they will be tested on quizzes or other assignments in this class.	3.155128	3.2445

Note. 1 = Strongly Disagree, 2 = Somewhat Disagree, 3 = Somewhat Agree, 4 = Strongly Agree

Table 20

Student Survey Results: T test of Independent Means for the Mastery Evaluation Subscale

Levene's Test for Equality of Variances			*t* test for Equality of Means				
	F	Sig	*t*	*df*	Sig (2- Tailed)	Mean Diff	Std. Error Diff
Equal Variances Assumed	41.0	.000	-7.03	17062	.000	-.0925	.01316
Equal Variances Not Assumed			-7.02	16371	.000	-.0925	.01317

Autonomy Subscale

Finally, the mean for the Autonomy Subscale was 2.97 (*SD* = .92) for the experimental and 3.03 (*SD* = .92) for the control group (See Table 21). In addition, individual teacher scores revealed (See Table 22) that the two top scoring teachers came from the experimental group. A total of 11 teachers scored above 3.2, with 7 of them from the experimental group. Once again, there were two experimental group teachers with a large percentage of the participants, BG (2.43) and SA (2.398), who had the lowest scores by at least .265 points in comparison to the lowest control group teacher TL (2.695). The means of the survey by individual item revealed that the control group had higher means than the experimental group in 5 out of 7 items (See Table 23). This translated into a higher overall mean for the control group teachers.

A *t* test for independent means was conducted to determine if there was a significant difference between student engagement for the experimental and the control group based on the Beliefs about Classroom Structures Survey. For the Autonomy Subscale, the results were significant, t (9952) =-3.20, p=.001. This indicates that the control group provided significantly more opportunities for student autonomy than the experimental group. The 95% confidence interval for the difference in means ranged from -.11828 to -.06664. Table 24 presents the complete results below.

Table 21

Descriptive Statistics for The Beliefs of Classroom Structures Student Survey Results: Autonomy Subscale

Teacher Type	N	Autonomy	SD	Std. Error Mean
Intel Trained	780	2.97	.92	.01243

Non-Intel Trained	643	3.03	.92	.01380

Note. 1 = Strongly Disagree, 2 = Somewhat Disagree, 3 = Somewhat Agree, 4 = Strongly Agree.

Table 22

The Beliefs of Classroom Structures Student Survey Results by Experimental and Control Group Teachers: Autonomy Subscale Means Organized from Highest to Lowest

Experimental Teacher Name	N	Autonomy	Control Teacher Name	N	Autonomy
1. MW	38	3.598	1. BK	12	3.488
2. OD	16	3.571	2. KN	33	3.442
3. KF	7	3.36	3. HT	14	3.286
4. GA	19	3.338	4. ED	82	3.207
5. DC	48	3.313	5. QA	42	3.17
6. HM	38	3.282	6. FA	16	3.375
7. TM	45	3.276	7. MD	20	3.136
8. SQ	4	3.143	8. NK	77	3.102
9. SL	35	3.139	9. WG	11	2.857
10. LK	55	3.122	10. CK	89	2.665
11. OF	94	2.968	11. AD	61	3.091
12. CL	15	2.84	12. TU	59	2.988
13. NI	63	2.828	13. MA	29	2.892
14. CY	92	2.632	14. ZY	61	2.874
15. BG	109	2.43	15. TE	22	2.714

16. SA	102	2.398	16. ZD	15	2.695

*Note.*1 = Strongly Disagree, 2 = Somewhat Disagree, 3 = Somewhat Agree, 4 = Strongly Agree.

Table 23

The Beliefs of Classroom StructuresStudent Survey Results by Item: Autonomy Subscale

Item	Experimental Group	Control Group
28. Due dates for projects/assignments are flexible in this class.	2.765385	3.0187
29. In this class, the teacher wants us to take responsibility for our learning.	3.384615	3.4252
30. The teacher tells us how we can plan to meet our goals for this class.	3.029487	3.1807
31. Students get to choose projects/topics they want to work on in this class.	2.469231	2.3022
32. The teacher provides suggestions and guidance for organizing and managing the activities and assignments in this class.	3.071795	3.0685
33. Individual thinking and students' ideas are accepted in this class.	3.194872	3.2072
34. In this class, the teacher changes the pace of instruction to meet the needs of the students.	2.853846	2.9829

Note. 1 = Strongly Disagree, 2 = Somewhat Disagree, 3 = Somewhat Agree, 4 = Strongly Agree.

Table 24

Student Survey Results: t test of Independent Means for the Autonomy Subscale

Levene's Test for Equality of Variances			*t* test for Equality of Means				
	F	Sig	T	Df	Sig	Mean	Std. Error

					(2- Tailed)	Difference	Difference
Equal Variances Assumed	.444	.505	-3.20	9952	.001	-.0595	.01856

Findings: Question 3

To what extent are middle and secondary reading and language arts teachers who have voluntarily received professional development training in a technology-integrated, project-based learning model implementing the training in their curriculum?

A three-tiered, mixed-methods approach was utilized (surveys, interviews/focus groups, and lesson plan evaluation) to answer the above question. Each area was addressed first in isolation and then as a group. Each experimental group teacher was assigned a level of implementation based upon their individual scores in each of the three areas scored. To determine the rating, the five top scores represented the high level of implementation group, the middle six scores represented the average level of implementation group, and the lowest five scores represented the low level of implementation group. This was repeated for each of the three measures. The teachers were placed in three groups to facilitate discussion.

Survey Results: Research Question 3

An e-mail was sent to all experimental group teachers (n = 16) with a link to the Intel Teacher Implementation Survey, which had them report their level of implementation of the Intel Training in their classroom. The survey consisted of 9 items (See Appendix B) and asked teachers to rate themselves on technology integration in the classroom. A total of three teachers rated themselves as expert users, two of whom gave themselves perfect scores on the survey instrument (5.00: Expert User). All teachers reported that they used the training at least "somewhat often" with the lowest score being TP at 3.44. Four teachers stated that they never used technology in the classroom before the Intel coursework. An additional three stated that they were new users. Table 25 displays the complete results.

Qualitative Results: Research Question 3

A total of 3 focus group interviews were conducted with 4 participants in each group. In addition, 4 individual interviews were conducted with one participant from each school. However, Southland Middle School did not have a trained teacher participate; therefore, a second teacher was selected from Northland Middle School for an individual interview. The interviews and focus groups were transcribed and coded based on the coding guide (See Appendix L) adapted from the Intel Portfolio Rubric. Teacher responses were coded based on the following criteria: (a) integration of technology; (b) student learning; (c) implementation; and (d) student assessment. The Intel Portfolio Rubric was used to facilitate the coding of the interview and focus group data as well as the lesson plan evaluation.

Table 25

Intel Trained Teacher Survey: Self-Report Data Detailing the Extent in which teachers are implementing the training in the classroom

Control Group Teacher Name	Mean	User Rating (Technology Integration)	Level of Implementation
SA	5.00	Expert User	High
NI	5.00	Expert User	High

CY	4.88	Expert User	High
TM	4.56	New User	High
OD	4.20	Intermediate User	High
OF	4.12	Advanced User	Average
BG	4.12	Intermediate User	Average
CL	4.04	Never Used Before	Average
LK	3.96	Expert User	Average
HM	3.96	Never Used Before	Average
SL	3.8	Advanced User	Average
MW	3.76	New User	Low
GA	3.56	Never Used Before	Low
DC	3.48	Intermediate User	Low
KF	3.48	New User	Low
SQ	3.44	Never Used Before	Low

Note. 0 = Not at All, 1 = Rarely, 2 = Not Really, 3 = Somewhat Often, 4 = Often, 5 = To a great extent
SD = .528621
*See Page 81 for Explanation of High, Medium, and Low Level of Implementation

At least two lesson plans were collected from each teacher and were subjected to document analysis using the Intel Portfolio Rubric. Each lesson plan was scored by two Intel-Trained Master Teachers on a 3 point rubric (excellent, good, or poor) looking at the areas of technology integration, student learning, implementation, and student assessment. A formal training session was conducted to ensure a consistent scoring procedure between the two raters. This ensured a consistent grading scheme and allowed for simplified comparison between the lesson plans and the interviews/focus groups.

Adaptation of Chi Model to Focus Group/Interview Results

The Chi Model of Qualitative Research Design utilizes the method of quantifying qualitative data (Chi, 1997). This method produced an objective look at coding and the assignment of values for each participant and their implementation of the Intel Training. Data from the interview and/or focus group was transcribed and attached codes to the data according to the coding guide (See Appendix L). The results were added together to create a mean score based on the areas of: (a) integration of technology; (b) student learning; (c) implementation; and (d) student assessment. Throughout the interview, if the teacher discussed one of the above categories, the teacher was assigned one point for each instance.

The mean for each teacher was calculated, with RS scoring a 7 (High Level of Implementation), DC and CL scoring a 3.75 (Average Level of Implementation), and GA scoring .75 (Low Level of Implementation). The remaining teachers were classified as high, average, or low level of implementation based on their ranking with the five top scores being assigned to the high level of implementation group, the six middle scores to the average level of implementation, and the five lowest scores to the low level of implementation group. The researcher purposely classified these teachers as high, average, or low level of implementation for discussion and grouping purposes only. This allowed the researcher to easily discuss various levels of implementation. The important items to note are the overall implementation scores for each of the three measures: teacher survey, lesson plan evaluation, and interview/focus group. Several teachers had one area that stood out which caused their overall mean to be inflated. For example, MW had 10 instances of student learning and only 2 in the other three areas.

Only 5 teachers of the 16 scored higher than the mean (3.79). This suggests that a majority of the teachers were not fully implementing the training in their classrooms based on interview/focus group results. See Table 26 for the complete list of teacher scores. Additional qualitative analysis will be found in the Individual Teacher Implementation Section in the coming pages.

Document Analyses

Two lesson plans were collected from each teacher and scored on a 3-point rubric (Excellent, Good, Poor). The Intel Portfolio Rubric was utilized to score lesson plans using the following four criteria; Integration of Technology, Student Learning, Implementation, and Student Assessment. The Intel Portfolio Rubric was developed by the Intel Corporation and is utilized for teachers to self-assess their lesson plans to ensure fidelity within professional development. See Appendix H for sample rubric.

Table 26

Frequency of Coded Items by Experimental Teacher

Control Group Teacher Name	Int. of Tech	St. Learn	Implement	St Assess	Mean	Level of Imp
SA	9	7	5	7	7	High
CY	6	9	1	3	4.75	High
LK	3	8	4	3	4.5	High
SL	5	4	5	2	4	High
MW	2	10	2	2	4	High

DC	4	2	4	5	3.75	Average
CL	3	8	2	2	3.75	Average
OD	2	2	4	6	3.5	Average
NI	7	2	3	1	3.25	Average
OF	3	4	2	3	3	Average
HM	1	3	2	5	2.75	Average
BG	4	2	1	3	2.5	Low
TM	3	3	1	3	2.5	Low
SQ	1	1	2	4	2	Low
KF	2	2	0	1	1.25	Low
GA	1	1	0	1	0.75	Low

Note. *SD* = 2.309777 Int. of Tech = Integration of Technology; St. Learn = Student Learning; Imp = Implementation; St Assess = Student Assessment

Each teacher provided two different lesson plans. In total, 32 lesson plans were evaluated by two separate scorers. The researcher first scored each of the lesson plans. Next, an Intel-Trained, Master Teacher who is employed for the district scored the same plans. Each scorer assessed the lesson plans in the four areas outlined above. In total, of the 128 items scored, there were 13 instances in which the researcher and the master teacher didn't agree on scoring of the lesson plans. This resulted in 89.8% agreement (Appendix M). The overall mean of the level of implementation per the lesson plan evaluation was 2.29 for all teachers (See Table 27). A total of 7 out of 16 teachers scored above the mean. Of the 7 teachers who scored above the mean, 4 teachers scored above a 2.8 (Excellent). Likewise, a total of 4 teachers scored below a 2.0 (Good).

Overall Individual Teacher Implementation

To address the implementation variable, qualitative data from each of the interviews/focus groups was collected to classify the implementation ranking of each of the 32 teachers. The experimental group teachers were assigned a level of implementation (High, Average, or Low) based upon their responses to the Intel Teacher Survey, lesson plan evaluation, and the interview/focus group. Page 81 has a detailed explanation of the ranking procedure.

To objectively measure overall teacher implementation, the researcher utilized a 3-point system that awarded 3 points for each measure on which the teacher scored a high level of implementation. Teachers with an average level of implementation in any of the 3 measures were awarded 2 points. Additionally, teachers with a low level of implementation in any of the 3 measures were awarded 1 point. For example, NI (Table 28) achieved a high level of implementation for the Intel Teacher Survey and the lesson plan evaluation. NI scored an average level of implementation for the focus group/interview portion. NI received a total of 6 points for the 2 high level of implementation and 2 points for the average level of implementation giving this individual a total of 8 points. Teachers with over 7 points were therefore selected for the high level of implementation group. Teachers with 6 points were selected for the average group. Finally, the teachers with 5 or less points were considered in the low group.

Table 27

Document Analysis Mean Score

Teacher Name	Combined Mean of Both Lesson Plans	Level of Implementation
DC	3	High

NI	2.9375	High
SA	2.875	High
MW	2.8125	High
KF	2.75	High
CY	2.625	Average
HM	2.375	Average
TM	2.1875	Average
OF	2	Average
CL	2	Average
OD	2	Average
BG	2	Average
SQ	1.9375	Low
LK	1.75	Low
SL	1.6875	Low
GA	1.625	Low

Note. 3 = Excellent, 2 = Good, 1 = Poor

Table 28

Experimental Teachers with an Overall High Level of Implementation

Teacher Name	LOI: Teacher Survey	LOI: Interview / Focus Group	LOI: Document Analysis	Total Points	LOI: Overall
SA	High	High	High	9	High
NI	High	Average	High	8	High
CY	High	High	Average	8	High
OD	High	Average	Average	7	High
MW	Low	High	High	7	High

Note. Scoring: 3 Points = High, 2 Points = Average, 1 Point = Low

Five teachers were assigned to the high level of implementation group. Each of the members had at least one area where they were designated with a high level of implementation. Only one teacher (SA) achieved a high level of implementation for each measure. All but one (OD) received a high level of implementation for two of the three measures. The following sections will look at the level of implementation for each group.

The teachers in this group demonstrated a high level of proficiency in the integration of technology. Three of the five teachers with a high degree of implementation (SA, NI, and CY) rated themselves as experts in the area of technology integration according to the survey. OD rated herself as intermediate and MW as a new user. These data are consistent with the findings in the other areas with SA and NI each earning perfect scores in technology integration on the document analysis, and both were ranked number 1 and 2 on the Interview/Focus Group analysis. CY was scored a 2.75 on the document analysis in the area of technology integration and was third to SA and NI in integration of technology. Technology integration would be the relative weakness of OD and MW with each scoring in the low to average range.

Teacher 1: SA.

SA is a middle school language arts teacher. She has been teaching for 8 years. SA has students constantly using the computer. She stated that:

> I am always using computers in my class to get the kids thinking. We have all of this information available at the tips of our fingers and it is just great to have them weed through it all and make a decision about any topic really.

She uses computer software and websites, such as blogging and Wiki sites, Microsoft Power Point, Publisher, and other programs to "incorporate a lot more topics throughout the year. Technology allows me to blend various topics into one."

SA is a strong advocate for choice in the classroom. She provides students with the freedom to choose the type of project that they are going to complete. She believes that students are active participants in the learning process. She believes that students

> Must be active learners and not afraid to take risks. I somewhat leave the direction of the course up to the students. I allow them to collaborate and come up with different project ideas. I try to give many different options for the students in my class and they get to choose what interests them the most.

SA was the leader in overall implementation. As an Intel Trained Master Teacher, she was provided by the district a class set of laptop computers with wireless internet access for her students. She demonstrated through the interviews, lesson plans, and teacher survey a very high level of implementation. When describing the process she uses to plan for lessons she outlined:

> I look at the standards and what needs to be taught. I then create a pretest and see what the students know about the topic. I generally create an advanced organizer of some sort and then an essential question for the unit. I also provide time for students to research on the internet and in the media center if necessary. We like to go in-depth and we do a lot of writing.

She utilizes a variety of project-based methods in the classroom. This was evidenced by her statement that:

> I have the students create PowerPoint's in class, I have them complete presentation boards, I have them sing, I have them act out the lesson. I use a variety of teaching methods to instruct them. I always have the students creating something. I have them collaborate in the classroom. I have them perform real research on the computer and have them make real decisions. For instance, I have my students read newspaper articles on issues that affect their daily lives and then have them take a stance and use research from the internet to back up their opinions.

SA also believes in assessing her students regularly. She utilizes a combination of formative and summative assessment throughout each lesson. She stated that "I am constantly assessing my students. I love assessing by assigning formal projects at the end of the unit. Then after a unit is complete I have them reflect on what they learned through journaling or blogging."

Teacher 2: NI.

NI is a high school language arts teacher. She is the English Department Chair at North County High School. NI spoke about the computer as a tool for research and collaboration. Like SA, she uses software like PowerPoint for her students to create projects summarizing their research. She also utilizes websites such as Google Docs for student collaboration. She states:

> Well, I have kids use the computer to search for items. They write a lot in my class so they use the computer to type their notes. Kids are using the lab as we speak to conduct research and submit a research paper to me. They will be responsible for creating a PowerPoint summarizing their research papers. Some of my kids use Google notes to collaborate.

NI had the lowest level of student learning based on the student interviews of all teachers in the high level of implementation group. However, the lesson plans and the survey demonstrated that she utilizes projects in her classroom. She also encourages students to present their ideas in the classroom. She is also a strong proponent of student choice. She stated, regarding her lesson plans, that "the framework is open-ended so they choose what they want to do. Whatever is up their alley. I give them the choice."

NI also uses a variety of assessments in the classroom. Her lesson plans revealed that she utilizes rubrics and checklists on a regular basis. This was supported by her statement in the interview "I also assess all of the time. I use everything that CY does like rubrics and checklists, but I would add that I have kids do presentations that will give them a grade."

Teacher 3: CY.

CY is a 9th grade Language Arts teacher. She has over 20 years of experience. CY also uses the Internet primarily as a research tool that allows students to collaborate. She stated “I had a project on global poverty where they had to go and do research on the internet together and they had to come up with an oral presentation and a visual explaining aspects of global poverty to the class.” She has also created a Wiki where kids are assigned one or two words and must find the definition of the word and to use it in a sentence and share that with the rest of the class. She found that:

> One of the things that is neat is they don't have to do all 60 or 40 words but it also affects how well (they) do (their) words because it may also impact how (their) colleagues can do a word. So they are learning to look up word roots to find them and then to put them in a responsible location in a responsible form with the proper formatting. The kids really seem to like that they are on their own and it gives them a way to apply the things that are out there on the internet.

CY also demonstrated a high level of student learning within her classroom. Her lesson plans utilized many of the traits of project-based learning, including the use of projects and essential questions. In her interview she discussed a project where:

> The only requirements are that you have to come to class with some kind of donation, something that you can share. It was amazing the diverseness of items that students brought in to share. You were only allowed to have one visual and some of the things were three dimensional, some of the things were flat, some were hand-drawn, some were all words, and some were all charts and graphs. Even though it was a visual you could really tell who were the math kids, who were the kids that like to draw, who were the really creative kids, who were the kids that were really comfortable with words. It was usually a group presentation, but I made this an individual presentation and it took a really long time but the kids were all amazed with what everybody did. The kids were all talking like you did that, you did that. There was so much variety in letting the kids pick their project with just a basic framework for the assessment and letting them decide what to do.

CY also strives to assess students regularly. She stated that “I believe in continuously evaluating students in the class. Every assignment I give is a form of assessment. I provide students with KWL charts, rubrics, and checklists with every assignment. Students need to know what is expected of them at all times."

Teacher 4: OD.

OD is a middle school reading teacher. This year was her 3rd year of teaching. She currently works with 6th grade students. Overall, OD was in the average range for technology integration. She tends to use technology in the classroom as a tool to improve their teaching. She does not actively use technology for student research. OD stated that "I use the projector that I received from my Intel class to post items; I started to create PowerPoint's to go over what I am teaching. I also use the document camera and my computers to have students perform research and look up the things on the internet." OD also believes in using technology "as a tool to help students learn. They respond to it."

OD is a strong proponent of providing students with authentic activities. Using current events such as the Iranian nuclear situation, she attempts to create excitement in the classroom. She asserted,

> I really try to provide students with real-world activities. I think they are vital to keeping the attention of our students. It is not easy to do at times but they are well worth it. Like I mentioned when I was talking about my Iranian essay, I try to bring real-world items to my lessons. It is all about the kids making connections to the real-world and seeing how what we are learning applies to their lives.

This also translates into her assessment. In the interview, she was among the leaders in student assessment. She provides a combination of formative and summative assessments in her classroom. As she explained:

> I have rubrics available for the students. I have kids write, I have kids talk to each other and discuss with each other what they learned. I ask questions at the beginning of the day, I have tests and quizzes that give me an idea what the students know. I use their FCAT scores and Benchmark test scores to see how they are doing. It is really a combination of various different assessments.

Teacher 5: MW.

MW is a high school language arts teacher. She has been teaching for 9 years, all at the high school level. Like OD, MW tends to use technology in the classroom as a tool to improve her teaching. For example, MW states that

> I use PowerPoint, I use the LCD projector, I require computer work. Well, I expect computer work; I can't require it because inevitably there is that one student that doesn't have a computer, so I do what I can. I have the 4 computers in my classroom when they work. So, getting to the lab is very difficult so I usually would rather just use the ones that are in my classroom.

However, MW's scores on the survey did not fully support that she is fully utilizing the Intel training/technology in the classroom.

MW did demonstrate the highest level of student learning of all teachers found in the interview and document analysis. In her classroom, students are exposed to various methods of instruction. For instance, she stated "since I grew up mostly as a combination learner (visual/auditory), it is easy for me to do that in my class, and what I try to do is incorporate read-alouds, writing, and do a lot of modeling." She also believes that students should "have a very active role in my classroom." In addition, authentic activities are a large part of her classroom. She stated that:

> Authentic activities like projects, portfolios, and brochures, and PowerPoint's and that sort of stuff I do that throughout the year. My biggest assignment is my second semester author's dinner party where they have to do a book report and research an author for the semester and then it culminates in a dinner party where they become the author for the day.

When assessing students, MW believes in developing student knowledge. In the interview she stated:

> I think assessment should be ongoing. We all can improve in life and we need to build on what we know. I am always looking at what the kids know and what they need to know. I use a variety of assessments in my class everything from rubrics to the good old fashioned test.

Intel Trained Teachers with an Average Level of Implementation

A total of seven Intel Trained teachers fell into the average category. The teachers were either average across all measures or were high, average, and low across all three measures. See Table 29 for a complete list. Overall, the seven teachers demonstrated the beginning of implementing project-based learning into the curriculum; however, they reported that they did not fully adopt all of the key components of the Intel Teach Training into their practice. The following sections will detail the specifics that each teacher spoke about regarding project-based learning in their classroom.

Table 29

Intel Trained Teachers with an Average Level of Implementation

Teacher Name	LOI: Teacher Survey	LOI: Interview/Focus Group	LOI: Document Analysis	Total Points	LOI: Overall
TM	High	Low	Average	6	Average
OF	Average	Average	Average	6	Average
CL	Average	Average	Average	6	Average
LK	Average	High	Low	6	Average
HM	Average	Average	Average	6	Average
SL	Average	High	Low	6	Average
DC	Low	Average	High	6	Average

*Note.*Scoring: 3 Points = High, 2 Points = Average, 1 Point = Low

Teacher 1: TM.

TM is a middle school reading teacher. On the teacher survey, TM gave herself high ratings (Table 25). However, the focus group and document analysis did not support that rating. Therefore, she was classified with an average level of implementation rating.

Throughout the interview, TM spoke at length regarding incorporating projects in her classroom. She described "Authentic activities play a huge role in my classroom. I always have my kids working together, collaborating, and discussing a wide range of topics. I feel that authentic activities provide kids a real world way to learn." However, in describing a project she explained that:

> We are going to do a lesson where we are discussing the topic of homelessness as in *The Outsiders* and they are going to go into the various websites that this lesson on the internet that I have already investigated and found as a resource and then visit each of these websites and then comment accordingly how it affects them and then answer the questions according to the pictures and the website itself.

This example, although utilizing technology and the internet, is not an example of project-based learning. This is not an example of somebody with a high level of implementation.

She did speak of the importance of connecting the subject matter to everyday life. For example "Bring in the internet, bring in current events. Having kids, one of the big things is part of the reading process itself in learning it is connecting it to everyday life." In addition, she believes in regular assessments. When asked, how do you know that students learn the material that you are teaching, she stated "observation, actual testing, including hands-on testing material, quizzes, tests, and things like that, and sometimes through projects also." Again, the Intel model of project-based learning calls for rubrics, checklists, and reflective assessment.

Teacher 2: OF.

OF has been teaching Language Arts for over 20 years. She is currently employed at North County High School and works with the 9th grade team. She was rated average across all three measures; lesson plans, document analysis, and teacher survey (Table 29). OF provided in-depth examples of how she utilizes technology in the classroom. She described how she uses the Internet to teach various stories. For example:

> When we do Maya Angelou we can literally see Maya Angelou talking about *I know Why a Caged Bird Sings*. She is right there in front of you and they can identify with that. It (The Internet) zaps you into the past and it zaps you into the future just right here in class.

Again, like TM, OF utilized technology as a group teaching tool. For example,

> I like that I can work and the kids can watch Cyrano de Bergerac and Jane Eyre. That is here and I can still be here but I can still monitor them and what they are doing also. They can take 3 scenes that they like and provide details I need to get specific details. That helps me.

OF also creates many interdisciplinary units with other teachers who have received the Intel training. She will work with the math and science teachers on her team and each will take a component of a novel. In one novel about crustaceans, she explained "we do interdisciplinary types of units. I will do the novel, the vocabulary, (our math teacher) will do the graphing of the scorpion. (Our science teacher) will do the crustaceans; she will also do the life of the scorpions and stuff." She strongly believes in connecting with kids at their level and meets the standards. In describing the process she uses to create a lesson, OF explained that:

> We ask how can the kids benefit from the whole process from the beginning of something. We may talk about your first love, your first romance. But there is tragedy in that? We may look at families and I got a boyfriend or a girlfriend and what if there is a death in the family? How does it go together? Do they have deaths in their families? Do they have boyfriends or girlfriends? Yes they do. But how am I meeting that standard also?

OF believes in continually assessing her students. As the Exceptional Student Education Teacher for the 9th grade team, she makes assessment a priority. For instance, she explained

> I ask questions of students, I work individually with students. I conference with students, I discuss questions with students. I give them rubrics, checklists, written and oral directions or instructions. I also have them working together to check their work. I try to make everything transparent. There are no surprises, no hidden agendas. I have clear expectations and assess them that way.

Teacher 3: CL.

CL has been a Language Arts/French teacher for over 20 years. She is employed at North County High School. Currently, she has three 9th grade Language Arts Honors Courses. Like OF, she was rated as average across all measures (See Table 29). She has made great strides incorporating technology and project-based learning in the classroom. Like OF, she also uses technology, specifically the Internet, to demonstrate key story points to her students. When describing how she uses technology in the classroom, she explained that she uses:

> Clips from Romeo and Juliet and there was a theater, the Globe Theater. A visual of the Globe Theater was shocking and beautiful when you put it on the big screen. How could a kid not love that? They are absolutely enthralled. And that is a big enough impact that kids today are hard to impress, but they are impressed. It makes me feel great.

She also talked about getting kids to take control of their learning when creating a lesson. She stated:

> Students need to have buy-in in order to learn and progress. I try to provide students with stories that will grab their attention and then allow them to decide where they want to go. We have to find activities that appeal to the majority of students.

She strongly believes that hands-on activities are one way to establish student buy-in. She asserts:

> We always have a hands-on project of some sort because when kids get together and they actually have something that they created and it is a real life example of the purposefulness of the activity. Seriously, I mean it is something like even what *The Old Man and the Sea* they look for different parts of wisdom, different things, and they designed like a poster board. And they said here is what I found in this book and maybe it is a reason to win a Nobel Prize or whatever because the book itself is pretty simple, but they had to come up with that would be a symbol of wisdom or whatever, they had to do that themselves. They had to make their own projects and it just sort of brought it all together.

Finally, CL really tries to establish an active, inquiry-based class. She has kids work together to create projects and solve problems. She referred to her classroom as "a true learning community." In addition, she uses a variety of assessments to evaluate students. She stated that:

> I use a variety of tools to evaluate my students. I always use rubrics to spell out my expectations. That is the best way. That way if they don't have a piece of the puzzle they know automatically what was expected of them. They generally don't come to me and complain if they miss something.

Teacher 4: LK.

LK has been teaching for 20 years at South County High School. She is the English Department Chair and is known around the county as the writing expert. She refers to students as "the masters of their own learning." She continually challenges all of her students to succeed, as evidenced by the statement "I have kids create, analyze, and then make value judgments based on the information present." In addition, she utilizes technology to drive students. For example, when asked how she incorporates technology into her lessons she stated:

> I love exposing my kids to a variety of different computer programs, the web, and anything else that I can get my hands on. I want the kids to leave my class and be ready to collaborate and work with others. That is how it is in the real world.

In addition, she is currently working on a project where students are creating their own websites aimed to critically analyze a contemporary book.

When planning lessons, LK focuses on the desired educational outcomes. When planning a lesson she stated that:

> Usually I have to go and see what I want the end result to be and then whatever that is I ask myself what is it that I want them to learn. So if at the end I want them to be able to understand symbolism and I want to work through it and as we are reading the novel, then of course I have a lot of exercises on symbolism. If I want them to understand the power of language then I do that, so it just depends on what I want the final objective to be.

It is evident that she plans according to the main tenets of project-based learning; however, in the example provided, she did not provide students with a final project regarding symbolism. She did discuss the incorporation of authentic activities in the classroom, stating:

> I am a strong believer in creating authentic activities in the classroom. We are constantly doing things that kids will use when they "quote unquote" grow up. As I said, I have the kids create things. I like to incorporate the 21st Century skills into my classroom.

She cited a specific example of this:

> I had a class last year who, they were the lowest quartile in reading 2 classes and one of the objectives was to do a research paper. And instead of doing a boring research paper we went through the process and they developed brochures on a favorite topic of theirs, whatever it was. Some did bull riding, some did Michael Jordan; I didn't care as long as they created this brochure and they had a works cited panel on the back.

LK uses multiple assessment strategies to assess students. She encourages peer feedback and reflection. When asked about assessment, she responded:

> For my assignments, I provide students with rubrics and checklists so I know that they know what I expect. If that makes sense? I also have students work together to make sure that they are on the right track. Anytime I have a writing assignment, I have the kids read and comment on each other's work. It just varies. We have tests, too. Sometimes I give them multiple choice tests, believe it or not. Sometimes when we are reading novels, I give them a quizzie that you know and I say, "I expect you to read this much," and they all hand in answers to questions. And I don't know how many times the answers have gone around the school, so I give them a little quiz to make sure that I am not the only one reading.

Teacher 5: HM.

HM is a first-year teacher at North County High School. She teaches 10th grade language arts. She took the Intel Essentials course prior to the start of the school year as part of the new teacher program. She is still learning various issues such as classroom management, assessment, and the teaching process, but she was effective in her role as a teacher, being named "Rookie of the Year" for North County High School. Overall, she scored at the average level for all three measures: Intel Teacher Implementation Survey, lesson plan evaluation, and interview/focus group questions. When asked about integrating technology in the classroom, HM stated "I use my document camera almost every single day. I do everything on it, like showing them things. It is just so easy to have. I actually show them a lot on the camera." HM, like many of the average and low level of implementation teachers, confuses technology usage with using technology as a tool for students to learn. She also is a proponent of creating an environment of inquiry. She asserted:

> I believe that a student must be an active participant in the classroom in order to have any success at all. Students nowadays need to be doing something all of the time; they need to be challenged to ask questions and answer tough questions.

When asked how she plans a lesson, she declared:

> We are somewhat bogged down with the amount of material we have to cover with our pacing guide and all of the benchmarks. I am still learning. But what I do is this – First, I look at what we need to learn. I try and prescribe based on my students but I am not yet perfect. So once I decide the benchmark to cover, I find an appropriate piece of text. I choose the text based on whether or not it is in the book, if I feel comfortable teaching it, etc. I then write the lesson and adapt!

She also believes in regularly assessing students. According to HM, she stated "I assess students all of the time. I use rubrics, tests, quizzes, essays, benchmark tests. You have to constantly grade students. It just can't happen at the end of lessons. It is an ongoing process." Providing a specific example, she stated:

> With English, you can't just give true and false tests or multiple choice or whatever. I think a lot of the ways I do my assessments are through discussions in classrooms, trying to get them to think and to speak about how they understand the material, and then to write about it too I would say is still a big thing. I really like reflection papers and essays and stuff like that.

Teacher 6: SL.

SL is an English Teacher at North County High School. He has been teaching Language Arts for 7 years. SL was rated average according to the teacher implementation survey, high implementation in the focus group and interview, and low based on the document analysis. He was rated average overall for implementation.

SL maintains his own website and posts assignments and notes on the site for students to access. On his website, he detailed:

> I post everything from notes to assignments to schedule for them to keep on track. I have a lot of different links. I want to put more on there. But basically, I want to make the resources available to the student. A little bit more of looking there, I post an agenda now and everything is on the agenda so they click there and they can go through it and it is really nice because I tell my students that it is on the website, it is on the website. I do it that way.

> He views the student as facilitators in the classroom. He believes:
> As much as we are facilitators, they (students) are facilitators themselves, and I think that the more that you give them an opportunity to not only teach themselves but to teach others. And like DC said, you sometimes, you know, I think that is the role of the student plus everyone else.

He therefore believes strongly in providing authentic activities in the classroom. "Authentic activities play a major role in my classroom. I believe that authentic activities allow students to learn in other ways. I feel it is my duty to prepare kids for life outside of school." Citing a specific example, SL affirmed:

> I try to pull as much information from other areas. For example, the Library of Congress' website is an amazing resource for students to be able to go and use and try to get more information. And to provide them with, I guess as many avenues as possible, but not doing it yourself. Like, here are the websites, now go and do it.

However, this viewpoint was not present in his lesson plans and is not having kids actively pursue information. Additionally, SL provides choice for students. Speaking about choice, he stated:

> I think it is good for all of us too, because if we can say here is the assessment, here is where I want so and so, and because you can kind of gear your assessment to each particular kid. I know when I make my projects; I have one for the kid that doesn't like to stand up in front of the class. It is always the essay. Or the kid that likes to talk all of the time, a 10-minute presentation.

Therefore, the assessment is tailored to the particular student. When he described assessment, he stated:

> I have played around with it a lot this year. I really don't like tests because English being so fluid. Am I really supposed to ask where they met Boo Radley first in *To Kill a Mockingbird*? Or you know, how many houses down do they live? Because that is not really delving down into the text.

Teacher 7: DC.

DC is also a teacher at North County High School. He has been teaching Language Arts at SRHS for the past 8 years. He is currently working with the upper level students (International Baccalaureate Program). Based on the Teacher Survey results, he was assigned to the low group. However, in looking at his lesson plans, he was assigned to the high group. In fact, he received the highest score possible from both raters. The interview had him placed in the average group. Overall, he was assigned to the average group.

Throughout the interview, DC spoke a great deal at how he incorporates technology into the classroom. When questioned, he asserted:

> Let's count the ways. Let's see, every day I post the agenda on the screen. PowerPoint slides going through the box light projector. I use a lot of times You Tube videos converted through Zamzar and show them that way. There is a lot of great stuff, a lot of educational clips. I have a class blog site. Students have their own blogs to communicate and comment with each other. I use Word and PowerPoint.

Like SL, DC provides students with various options to demonstrate mastery of his objectives. For instance, DC asserted that: "I try to open it up to choice. I try to give opportunities to show creativity through music, performance, through building things with their hands, as long as they demonstrate an understanding of a concept through 10 different ways." He also believes that students should be continually active participants in the learning process. He declared:

> I guess a student is a participant in a transaction that occurs every day in a classroom, as a student isn't solely in receive mode; but there's got to be a constant back and forth clarification and build up in the whole conversation in the class. So it goes both ways.

Although DC does provide choice in the demonstration of concepts, he does utilize the essay as the primary assessment tool. When asked about assessment, he stated

> Nothing beats the essay. You know as far as critical thinking, digging in deep. It is a lot harder to grade than a Scantron multiple choice test, but you know it is the only way to determine if they really get it.

He also uses some components of the Intel Assessment model. He stated "I give students rubrics, we talk about my expectations. I tell them that I have high expectations but it is my job to teach them to you." Overall, DC is beginning to utilize project-based learning in the classroom with more frequency. This was found in his statement "I would also add that I try and use more of a project-based learning approach in my class. I started incorporating essential questions into my lessons and it has really helped with the kids and getting them actively participating."

Intel Trained Teachers with an Low Level of Implementation

The following 4 teachers were assigned to the low level of implementation group (Table 30). Two of the teachers (GA and SQ) did not really adopt many of the project-based learning principals into their classroom. Three of the four teachers (KF, GA, and SQ) on the low list are self-contained special education teachers. These teachers were hesitant in allowing their students to have autonomy in their educational pursuits.

Table 30

Intel Trained Teachers with a Low Level of Implementation

Teacher Name	LOI: Teacher Survey	LOI: Interview / Focus Group	LOI: Document Analysis	Total Points	LOI: Overall
BG	Average	Low	Average	5	Low
KF	Low	Low	High	5	Low
GA	Low	Low	Low	3	Low
SQ	Low	Low	Low	3	Low

Note. Scoring: 3 Points = High, 2 Points = Average, 1 Point = Low

LOI =Level of Implementation

Teacher 1: BG.

BG is an English Teacher at South County High School. She has been teaching Language Arts for 12 years. She was rated as average on both the lesson plan and document analysis and low on the interview. The fact that she was low on the interview led to her low overall rating.

BG has started the process of trying to incorporate project-based learning and technology into the classroom. However, she is not using it to complete meaningful projects and conduct research. For instance, she stated:

> I like to use the computer lab to give kids the chance to look up information online. I have them type up all of their assignments. When they go to college or the work world they are going to have to use the computer to do that.

When asked how she utilizes technology in the classroom, she spoke more about the barriers to using technology in the classroom than actually doing it. For example:

> I mean, like I am still struggling with some things like Wikis and blogs because it is a lot, I feel like I have to keep real close tabs or they will just talk about their latest dress or fashion or whatever, they just start talking about. So I find that challenging because I really like that medium and I think the kids they are 21st Century kids and they are really good at using that medium, but trying to keep them focused is hard. So it is still challenging for me, but I really like using technology.

BG does make attempts to work on projects in the classroom. She stated that she believes “The student takes the major role in the learning process. So I act as the facilitator in their learning. It is much of a discovery process in the student/teacher relationship.” She outlined her quarterly research project where she has students partner up and create a poem or story that “makes sense with what we have been learning.” She added that “kids really go all out for this type of assignment.”

BG tries to have students reflect on the learning process. She responded when asked about assessment that “I am always trying to get them to reflect on what they learn and then I reflect on what they do, but some of it is just that teacher/student observation.” She does use a variety of assessments in the classroom. She utilizes everything from the paper/pencil test to the rubric. She does involve students in the assessment process. For example, if :

> They (the students) are writing an essay we will create a rubric. We sort of talk about what I am looking for, what we are hoping that they are learning, and then I have a process in mind, but I will often align my rubrics to what they want to learn and what I think they need to learn.

Teacher 2: KF.

KF is a self-contained Exceptional Student Education (ESE) Instructor at North County High School. His responsibilities include teaching all Emotionally Handicapped (EH) students all of the core subjects during the day. He was named a finalist for the Kaye County Teacher of the Year. Based on the three measures, he was low in both the interview and the teacher survey. He was ranked in the high level of implementation for the document analysis section. He is beginning the process of incorporating technology and project-based learning, but has not dedicated himself to the process as of yet.

Instructional technology is a relative weakness for KF. During the focus group he mentioned that:

> I can appreciate technology and I am always so humbled when I see what everybody else is doing. I must say that I will try to do things differently. I recently won a Smart Board and I am looking forward to learning how to use it. I will start using the web with my kids once I get my computers.

In addition, he mentioned that he was looking forward to learning how to blog. He stated "I also started a blog; I got as far as registering. I haven't put it together yet." KF strongly believes in prepping kids to succeed on the FCAT test. He understands the need to branch out and teach other topics but has yet to relinquish that. He stated "I do believe that I need to start incorporating the 21st Century skills into the class. But, my first and foremost concern is the FCAT test. I have to place that first."

In the classroom, KF believes that "The student is an active participant, somewhat of an equal, and brings a lot to the table and somebody who I put high expectations on to participate and learn." In order to accomplish that goal he believes in:

> Constant praise, constant excitement, no matter what they come up with. Even if it is not as good as what the group came up with and again lots of excitement, and passion, and love of subject and just pull them all along.

He does try to create lessons that:

> Will inspire my students. I do teach Emotionally Handicapped children, so keeping and maintaining their attention is always important for me. I try find out what motivates the students so we play games and debate topics and create things. So I would say that they play a large role in my class.

KF focuses his assessment using FCAT style questions. When questioned how he assesses students, he stated "There are good old fashioned tests; there are projects for the students to present to the class." He was lacking student involvement in the process. He did not provide students an opportunity to self-assess or with rubrics, checklists, or reflective questions.

Teacher 3: GA.

GA, like KF is an ESE reading teacher. She is employed at Midland Middle School and teaches reading to her students as a Scholastic Read 180 instructor. She has over 20 years of experience. She was rated as low across all three measures; lesson plans, interview/focus group, and document analysis. GA has rejected many of the items from the Intel Essentials training.

GA had a fear of technology prior to taking the Intel course. She added "Well, I was really very fearful of technology. But even the computer is like ahhhhhh. But I feel a lot more comfortable now with it. I feel like I have some background knowledge, that I can do certain things." When asked how she incorporates technology in the classroom, she responded:

> I also have the Read 180 computers so they do the work on the Read 180 computers, which is that interactive program. It kind of keeps the kids at a certain level as they answer questions and they read books, like that the computer actually adjusts for different levels for them.
>
> To create a lesson, GA stated:
>
> I look into what the kids are doing well and the areas that they need to improve. I look at several pieces of data including their SRI tests, my observations, and FCAT scores, and I create lessons that will help them improve.

As a Read 180 Teacher, GA feels that she can't provide students with authentic activities outside of the normal Read 180 script. She stated "Authentic activities really come into play after FCAT. We are so under the gun that we can't afford to waste a minute from when the kids walk through that door. It is hectic. I teach the lowest of the low." When further questioned about technology and authentic activities, she responded "To like make our own web pages or anything like that. I really don't have the time or anything to do that." She seemed more concerned with having the students motivated prior to starting a project, instead of the project motivating the student. She stated "I think students need to be motivated and then I can work with them. Part of motivation is completing their work and following along with the rest of the class."

GA does not follow the Intel Assessment model at all. She concentrates solely on prepping students for standardized testing. She believes:

> Student assessment is one that I utilize many different assessments. We have the FCAT test what is our most important test of the year. I then have students peer assess when we write. I have group reading and the kids keep track and correct each other. I then walk around and double check they are working.

Teacher 4: SQ.

SQ is also an ESE Read 180 teacher. She works at Northland Middle School. She has been teaching for more than 20 years across a variety of grade levels and schools. She was rated as low across all three measures; lesson plans evaluation, interview/focus group, and Intel Teacher Implementation Survey. Like GA, SQ has rejected many of the items from the Intel Essentials training.

One major reason for the low rating would be that she openly admitted that she does not provide students with authentic activities and the opportunity for inquiry. She stated:

> I would say that my kids get the information from me. I have changed a little over time. I am an old-school teacher and tend to lecture and work out of the book. I am trying to change but it can be a little overwhelming at times.

In addition, when asked how she plans for a lesson, she stated that:

> I follow along with the book. I am a reading teacher and I let the kids work on the computer and do their Read 180 and I conduct small group with the R-Book. We go over each chapter. It is much scripted.

Like GA, SQ explained that the Read 180 program does not allow flexibility in planning. Regarding authentic activities, she described:

> I don't have too much time to create those activities in the classroom. Read 180 is so scripted it is difficult to get in and do all those fun activities. I would like to do all of that but it is just not possible until after FCAT. We are under a lot of pressure at this school and my focus is to teach my kids to read on grade level. That is my primary job.

Read 180 does provide many assessments; however, they do not allow kids to take control of their own learning. She explained that :

> I continually assess. Students take the SRI test quarterly. I have kids reading stories and then take the AR tests. We take quarterly benchmark tests and the FCAT. We really assess these kids to death. I will also do my project that I created in Intel where we use the rubrics and checklist.

Findings: Question 4

What is the relationship, if any, between student engagement and the level of teacher implementation of the Intel Essentials technology course in their classroom?

A Spearman's rank-order correlation coefficient was utilized by the researcher to determine the degree of relationship between the level of engagement as measured by the overall mean of the Beliefs of Classroom Structures Survey taken by the students and the level of implementation by teachers who have been trained in the Intel Essentials course as measured by the Intel Essentials Teacher Survey. The results showed a significant, moderate inverse relationship (Rs = -.53, p =.03) between the level of engagement and the extent in which teachers implement the Intel training in the classroom (Table 31). This suggests that the Intel Trained teachers with the higher level of implementation have lower levels of engagement.

Table 31

Correlation of the Belief of Classroom Structures Survey and the Intel Essentials Teacher Survey

Spearman Rank Correlation	
Rho	-0.539825358
2-sided p-value	0.030898677
S	1047.081243

Note. $p < .05$

The researcher felt that the 3 measures (Document Analysis and Interview/Focus Group Data/Teacher Survey Data) required additional explanation because of their qualitative nature, and the discussion would provide useful information. The overall mean of the combined three subscales for the Beliefs about Classroom Structures Surveys was utilized to provide a ranking for overall classroom engagement. The engagement scores were then ranked by teacher and compared to the level of implementation ranking assigned in question 3 (Tables 28, 29, and 30). The results were mixed. The teachers with a high level of implementation (OD, MW, SA, NI, and CY) had varying levels of engagement as noted on the student survey. For instance, OD and MW each had the highest levels of engagement (ranked #1 and 2) and NI and CY had two of the lowest levels of engagement (ranked #14 and 15). SA ranked 11 out of 16, with a 3.00 out of 4.00 engagement score. From the group with an average level of implementation, LK, HM, and DC ranked 5th -7th in engagement scores respectively. TM, SL, OF, and CL ranked 9th, 10th, 12th, and 13th respectively. The ESE teachers (KF, GA, and SQ) who had low levels of implementation were all ranked in the upper half of the study. KF and GA ranked 3rd and 4th, and SQ ranked 8th overall. BG, who also had a low level of implementation, ranked #16 overall. See Table 32 for a detailed list.

Based on the results, the teachers with the highest levels of implementation do not necessarily have the highest levels of engagement. The teacher with the overall highest level of implementation, SA, had a lower level of engagement based on the survey than 10 other teachers. The level of implementation and level of engagement must have somewhat of a relationship, as OD and MW each were ranked in the high level of implementation and had the highest engagement scores. It is possible that teachers like LK and HM, who were assigned to the average group, may provide the optimal mix of project-based activities.

Table 32

Ranking of Experimental Group Teachers by Level of Implementation and Engagement Score

Teacher Name	Ranking: 3 Measures	Ranking Engagement
1. OD	High	3.55
2. MW	High	3.52
3. KF	Low	3.42
4. GA	Low	3.37
5. LK	Average	3.27
6. HM	Average	3.26
7. DC	Average	3.23
8. SQ	Low	3.18
9. TM	Average	3.16
10. SL	Average	3.14
11. SA	High	3.00
12. OF	Average	2.99
13. CL	Average	2.88
14. NI	High	2.87
15. CY	High	2.79
16. BG	Low	2.48

Conclusions

The researcher addressed a total of four research questions in Chapter 4. The results demonstrated a significant difference between the experimental and the control group based on student FCAT scores. The null hypothesis for research question 1 was rejected. When adjusted for student learning gains, there was no significant difference between the experimental and the control groups. The results from research question 2 indicate that the control group had significantly higher levels of engagement in 2 of the 3 measures based on results from the Beliefs about Classroom Structures Survey. The other measure (Motivating Tasks Subscale) had no significant difference based on the data. Research question 3 provided both a quantitative and qualitative look at teacher implementation based on results from the lesson plan evaluation and the teacher focus group/interviews. Finally, the results of the Intel Teacher Implementation study were compared to the results from the Beliefs in Classroom Structures Survey. A moderate, negative correlation between student engagement and level of teacher implementation was found both quantitatively and qualitatively.

Chapter 5

Discussions, Recommendations, and Conclusions

This chapter discusses the results of the study presented in Chapter 4. This two-phase mixed methods study sought to identify (a) the effectiveness of the Intel Essentials model of project-based learning based on student Florida Comprehensive Assessment Test (FCAT) reading scores; (b) the differences in student engagement between students in classes with teachers trained in the Intel Essentials model of project-based learning and teachers not trained in the model as measured by the Beliefs about Classroom Structures Survey; (c) the level of implementation (high, average, or low) of teachers trained in the Intel Essentials model of project-based learning; and (d) any correlation between the level of implementation and the level of student engagement.

Discussion of the Findings

Question 1: What effect does the implementation of a technology-integrated, project-based learning model have on standardized test scores in language arts and reading classrooms in grades 6-10?

In order to answer this question, a *t* test for independent means was utilized to determine if there was a significant difference of FCAT scores between the experimental group teacher and the control group teachers. In this study, students from the experimental group scored significantly higher than the control group (M = 318.18 Experimental, M = 312.12 Control). These findings support the findings from Gültekin (2005), who concluded that the project-based learning model significantly affected student achievement for students in the social sciences.

However, when looking specifically at learning gains, there was no significant difference between the two groups (M = 80.07 Experimental, M = 80.59 Control). This is consistent with Thomas (2000), who found that project-based learning is equivalent or slightly better than other instructional models when looking at student achievement in reading. The fact that the two groups posted equal gains is worth noting. First, it demonstrates that the Intel Essentials model is just as effective when used to improve test scores as traditional teaching methods. In addition, project-based learning is a relatively new venture for the school district; therefore, with additional training and support, it is quite possible to assume that the impact of the Intel Essentials model may be more significant.

Question 2: To what extent does the implementation of a technology-integrated project-based learning model affect student engagement in language arts and reading classrooms in grades 6-10?

A series of 3 t tests of independent means was utilized for each subscale to determine if there was a significant difference between the experimental and the control group in student engagement. Overall, the control group was statistically significant in two of the three measures (Autonomy and Mastery Evaluation). The third measure, Motivating Tasks, was not statistically significant for either group.

Although the Motivating Tasks measure was not statistically significant, the experimental group did have a higher overall mean in this category than the control group (*M* =2.94 Experimental, *M* = 2.93 Control). The results for this scale appear to align with the findings of other researchers (Liu, 2003; Marx et al., 1994; Stratford & Finkel, 1995; Yarnall & Kafai, 1996). In addition, five of the top seven scores came from the experimental group, suggesting that the outcomes can be attributed to the Intel training.

The significant finding for the control group on the Mastery Evaluation subscale has several key areas worth further discussion. First, the two top highest scoring participants in this measure were from the experimental group. This is a result of the emphasis that the Intel training and project based learning in general places on student assessment. Item 17 on the survey asked students if the teacher in this class uses more than one way to determine grades. The experimental group's mean score was 3.10 in comparison to the control group's mean score of 3.19. This is a focal point of one of the Intel Corporation's (2007) characteristics of project-based learning that calls for on-going and varied assessment. Although the findings are significant for the control group, the researcher feels that students alone may not be the best measure to report how teachers assess.

Likewise, for the autonomy subscale, the two top scoring teachers were also members of the experimental group. Both teachers were also members of the high level of implementation group using project-based learning. This is important because providing students with autonomy is vital to project-based learning. According to various researchers, project-based learning places students in an active role that challenges students to learn through the creation of artifacts (Blumenfeld et al., 1991; Intel Corp, 2007; Van Den Bergh et al., 2006). Although the control group had significantly higher ($p < .05$) overall scores, there were 2 items (#31 and #32) in which the experimental group had a greater mean than the control group. These items specifically addressed topics critical to the implementation of project-based learning (Table 23). The items related to the teacher providing suggestions and guidance for organizing and managing assignments, and students having the ability to choose projects/topics that they want to work with in this class.

One additional finding worth noting was the outlier BG. If she is removed from the study and the *t* tests were recalculated, the experimental group would be significantly higher than the control group in the Motivating Tasks measure. In addition, there would be no statistically significant difference between the groups in the Mastery Evaluation and Autonomy subscales, meaning that both groups provide equal opportunities for student evaluation and autonomy. The researcher would characterize her as an outlier because her overall mean (2.48) on the Beliefs about Classroom Structures survey was .31 lower than the next closest participant, CY (2.79). Furthermore, she was assigned to the low-level of implementation group based on lesson plan evaluation, focus group interview, and the Intel Teacher Implementation Survey results.

Overall, it appears that student engagement does not depend on a teaching methodology alone. Rather, student engagement can be directly attributed to the strengths and qualities of the individual teacher and the students who are working with the teacher. Although it is beyond the scope of this study to know what the control group teachers were doing in their classrooms during the study, each group had students who were relatively engaged, based on mean scores. However, the control group did have eight teachers who taught reading as their assigned subject. The experimental group had only three reading teachers. Reading teachers receive a great deal of specialized training (300 hours) in order to be certified. This training may be one reason that would lead to higher engagement and would be worthy of future study. Finally, reading classes are, by definition, targeted for students reading below grade level. Instruction in those classes, targeted for FCAT improvement, may have precluded active use of the Intel training and more engaging project-based learning approaches.

Student age is another potential area that could have led to significantly higher levels of engagement by the control group. High school teachers accounted for only 6 of the 16 control group teachers, compared to 11 of the 16 experimental group teachers. In general, high school students may not be as engaged as middle school students. This may then account for the difference between the two groups.

Question 3: To what extent are middle and secondary reading and language arts teachers who have voluntarily received professional development training in a technology-integrated, project-based learning model implementing the training in their curriculum?

The Intel Teacher Implementation Survey, focus group/interviews, and lesson plan evaluation were utilized to determine the extent to which the experimental teachers were utilizing the Intel training in their curriculum. The researcher found that the various teachers participating in the study each had their strengths and their weaknesses in implementing project-based learning in their classrooms. Overall, with the exception of SA, who was the only teacher ranked with high level of implementation across all three measures; each teacher was missing a component of program implementation. Guskey &Yoon (2009) found that educators, independent of grade level, require job-based assistance in order to fully implement an instructional strategy learned through professional development. The school district has placed a great deal of effort on training every teacher in the Intel methodology, but has not placed an emphasis on ensuring implementation of the already trained teachers making this consistent with the findings of Guskey and Yoon.

The Intel Corporation (2007) provides the following nine characteristics of projects with full implementation:

1. Varied instructional strategies support multiple learning styles.
2. Thinking skills are integral to project work.
3. Technology supports and enhances student learning.
4. Students demonstrate knowledge and skills through products and performances that are published, presented or displayed.
5. The project has real-world connections.
6. The project involves ongoing and multiple types of assessment.
7. The project is driven by Curriculum-Framing Questions.
8. The project focuses on important learning objectives aligned with standards.
9. Students are at the center of the learning process.

These characteristics are central to understanding the implementation of the Intel Essentials curriculum. Teachers need to incorporate as many of the characteristics into their practice as possible. However, many of the low and average level of implementation teachers did not attempt to implement these components of the training in their classrooms. Only 6 of the 16 experimental group teachers either spoke about or had evidence of Curriculum-Framing Questions in their lesson plans. Many of them stated that they used it only after the FCAT test. For instance, GA stated that “Authentic activities really come into play after FCAT. We are so under the gun that we can’t afford to waste a minute from when the kids walk through that door.” In addition, HM added that “We are somewhat bogged down with the amount of material we have to cover with our pacing guide and all of the benchmarks.” The district has made a concerted effort to overcome this fear by ensuring teachers that the program is a research-based model and that it is acceptable to implement as long as the standards are being covered. However, many teachers are reluctant to implement different approaches because they do not fully understand the relationship between those approaches and meeting the standards. To solve this problem, the researcher suggests further professional development with administrative follow-up.

Another problem in the implementation of the Intel curriculum is that technology, which should be used as a tool by students to fill-in gaps of knowledge, is instead being used by the teacher in ways that perpetuate the old style of teacher directed instruction. We must make a distinction between project-based learning and using technology in the classroom. Some teachers feel that putting items on a projector and having the kids talk about it is project-based learning. Langer (2001) called for teachers to provide students with increased opportunities to use technology to interact with not only the teacher, but with other students. However, several teachers, including MW, stated “I use PowerPoint, I use the LCD projector, I require computer work.” Each teacher brings differing definitions of project-based learning. Therefore, the role of the district in setting a clear definition and purpose is vital to having teachers adopt the training.

Another factor when dealing with technology integration is the utilization of engaging practices with technology. If a teacher turns on a computer and projector to post the homework each day for his or her students, this would not be an engaging example of technology integration. Likewise, the teachers who ask students to complete meaningful tasks with the computers would be considered more engaging.

Table 33 represents a visual display of experimental group teacher activities based on their level of implementation. In a model class, students are actively creating deliverables that are used to answer high-level questions. At the average and low levels of implementation, it is the teacher who tends to provide students with knowledge. The researcher utilized statements and overall themes developed from each of the teachers in each level of implementation to compile the list.

The researcher realizes that project-based learning, like any district level professional development program, takes time to develop and grow into a successful program. The Intel Essentials method of project-based learning has been in place in Kaye County for less than 3 years. One of the things that we can learn from this study is that professional development must provide teachers with regular opportunities to discuss the challenges and barriers to implement an approach that may be different than their methods of teaching. As Porter et al. (2000) asserts:

> Having a coherent, long-term plan would enable districts and schools to provide both the depth of professional development experiences needed for them to be effective and the breadth of coverage of specific content and teaching strategies that teachers should learn over time. (pp. 10-11)

Table 33

Characteristics of High, Average, and Low Level of Implementation Teachers

	Integration of Technology	Student Learning	Implementation	Student Assessment
High	Students create Power Points, web pages, brochures. Teacher allows students to use the internet for meaningful research to answer challenging questions.	Student takes control of learning Utilizes "essential" questions throughout units Students collaborate Students create projects	Teacher regularly has student's complete projects in the classroom. Teacher uses various instructional strategies.	Incorporates both formative and summative assessment in the classroom. A variety of assessments are utilized.
Average	Teacher primarily uses projector, document camera, and other media. Uses internet sparingly for student research.	Teacher provides students with the information necessary to learn. Will utilize higher level questioning techniques when appropriate.	Teacher has student's complete less than 3 projects per year. Teacher sometimes uses various instructional strategies.	May use rubrics, checklists, formative / summative assessment
Low	Uses computer for student drill. Rarely uses technology provided in the classroom.	Teacher provides students with the correct answers. Teacher relies on computer programs to help teach students.	Teacher has students complete less than 1 project per year after FCAT. Teacher primarily lectures to students.	Summative assessment only

Note. *See Page 81 for explanation of High, Medium, and Low Level of Implementation

Question 4: What is the relationship, if any, between student engagement and the level of teacher implementation of the Intel Essentials technology course in their classroom?

The researcher utilized the Spearman Rank-Order Correlation Coefficient to determine if there was a correlation between the Intel Teacher Implementation Survey and the level of engagement as measured by the Beliefs in Classroom Structures instrument. In addition, qualitative analysis was utilized to further explain the results. The data may appear contrary to what one may expect, considering the expectation of training and potential engagement of students in the area investigated. The results may lead one to conclude that training is not the primary variable in increasing student engagement. Rather, the actions and commitment of the teacher most impact student engagement.

The researcher also found it interesting that the results from question 2 were similar to the results from question 4. Both findings suggest that higher overall implementation of project-based learning does not necessarily mean higher levels of student engagement. Rather, the opposite seems to emerge. The inverse relationship between the level of implementation and the level of engagement may be attributed to the overall level of implementation of all teachers. If the teachers who received the training are not implementing the training with fidelity, then it can be expected that engagement scores would decline.

Limitations of the Study

There are several key limitations for this study. First, it is difficult to make assumptions as to the level of implementation in a classroom based on document analysis, self-report survey data, and interview data alone, although this triangulation did prove useful. The lack of direct observation made it difficult to fully assess the implementation efforts of the Intel Trained Teachers. In addition, the study design did not include the assessment of the utilization of similar inquiry-based approaches for the control group. It is possible that the control group teachers employ the methods consistent with the Intel training independent of the program.

This study relied on the Intel Teacher Implementation Survey and the Beliefs about Classroom Structures Survey. Self-report data collection is widely used across many disciplines and is popular because of the ability to collect a great deal of data at a relatively low cost (Pohlmann & Beggs, 1974). When using self-report data it is always important to realize that scores may be artificially inflated and/or depressed, even though it is relevant to collect such information because it represents teachers' perceptions of their own practice. The researcher attempted to use other means to measure teacher implementation; however, it would be impossible to control for all possibilities.

Another limitation of the study would be the method of professional development. Due to time constraints and contractual issues, the school district has focused professional development in the summer months. It is very possible that a teacher would receive the training in June and then be expected to implement the training in August without receiving a refresher course. In addition, the lack of follow-up training is a distinct disadvantage to the experimental group participants. Without continuous reminder, it is easy to revert to prior teaching practice.

Recommendations to Improve Practice

With the above limitations of the current professional development system noted, it is easy to understand that conventional one-time professional development does not adequately prepare teachers to implement wholesale changes in their curriculum and teaching practice. This is supported by Feiman-Nemser's (2001) finding that conventional professional development provides little chance for meaningful interaction or follow-up. Any district effort to increase student achievement and engagement relies on teacher implementation. The data in this study seem to support the fact that the teachers are calling out for additional professional development opportunities. OD, a teacher with a high level of implementation, indirectly called for additional professional development when she stated "I would not say that I am 100% or an expert in project-based learning; one course can't do that." BG, a low level of implementation teacher, also stated:

> I would like to add that I wish for myself personally that I had more time in my schedule to improve my technological abilities. I wish that I had more time for professional development. There is just not enough time in my schedule. It is really hard to find the time to do it, unless; the only time I have is in the summer time. So I wish we had more time for in-service. So I could increase my learning.

The researcher believes that all teachers need additional training focused on teacher implementation and best practices. Administration needs to fully support teacher implementation. This can be accomplished through classroom walk-throughs with direct and adequate feedback on implementation, providing time for teachers to plan projects, and providing release time for teachers so they can view teachers with high levels of implementation who are getting results. Administration needs to have the expectation that teachers will implement the project-based learning model in their classrooms. They need to create a climate of teacher learning and growth in the school.

For successful implementation of the project-based learning model in the county, professional development must focus on the following areas: (a) technology integration; (b) student assessment; and (c) project-based learning implementation. Once a teacher receives the Intel Essentials training and the district technology package, teachers should be required to attend an inservice on best practices in technology integration. Currently, there is no training provided when the materials are installed. This would allow the district to ensure that the materials are being used properly. The district should also include training on properly assessing and grading students in a project-based environment. The Mastery Evaluation scores detail the need for changes in assessment patterns. Finally, the district should provide additional training in project-based learning implementation. There are several free courses built on research-based materials that would be logical to follow up with, such as the Buck Institute for Education's Project-Based Learning Course from Boise State University or the Intel Teaching Thinking with Technology Course that builds on the Intel Essentials Course. Either course would be appropriate for building teacher support in the district for a project-based classroom.

The researcher believes additional research and time need to be provided to ensure complete implementation. A great deal of money and time has been invested in this program; therefore, all resources need to continue in order to support the overall implementation of the program. The district needs to establish a clear vision for all schools to follow and the schools need to embrace it. This is accomplished through setting a clear priority on teacher learning.

Recommendations for Future Research

There are clearly many additional areas necessary to study in order to fully understand project-based learning. The researcher believes that because this is a district-level, professional development initiative, this identical study should be extended to other disciplines and grade levels. The current study focused solely on FCAT reading scores and student engagement at the middle and secondary level in Reading and Language Arts classrooms. Similar studies could look at FCAT Reading, Math, Science, and Writing individually, and the scores at the 3-10 grade levels. In addition, engagement can and should be measured independently at all levels and for all subject areas.

In addition, direct observation of teachers should be conducted when looking at student engagment in a project-based environment. Observation can focus on specific teacher actions that lead to engaged learning. This can be conducted whether the teacher is trained in the Intel coursework or not. Direct observation can also be utilized in an investigation of academic learning time versus engagement. Having engaged students does not necessarily mean that they are learning. Future research should address the concept of academic learning time and whether the students are on task while being engaged in these open-ended projects.

This study hypothesized that students are more engaged in classrooms that provide a project-based curriculum. Overall, this was not found to be the case. Therefore, future research endeavors may focus on identifying teacher behaviors that are most closely centered on student engagement, which may provide a broader context for student learning than the more narrow definition of project-based curriculum. Studies focused on student engagement could contribute to an understanding of best practices that teachers could utilize to engage students, including but not limited to project-based curriculum, and ultimately impact student learning.

Another area of future study should focus on the teacher implementation of project-based learning and how their students fare on standardized tests. The current study relied solely on teacher-provided data to assess level of implementation. Future study should include student input either through survey or interview protocols and direct observation to further assess the level of teacher implementation.

A final recommendation would be to conduct similar studies at different time intervals. It should be assumed that with additional teacher training and continued district support, the teachers will be more comfortable with project-based models. The researcher recommends that a study be completed at the end of the 3rd complete year of implementation and then again at the end of the 5th year of implementation.

Conclusions

In conclusion, this two-phase mixed methods study sought to identify (a) the effectiveness of the Intel Essentials model of project-based learning based on student Florida Comprehensive Assessment test (FCAT) reading scores; (b) the differences in student engagement between students in classes with teachers trained in the Intel Essentials model of project-based learning and teachers not trained in the model as measured by the Beliefs about Classroom Structures Survey; (c) the level of implementation (high, average, or low) of teachers trained in the Intel Essentials model of project-based learning; and (d) any correlation between the level of implementation and the level of student engagement.

The study found that project-based learning may be an effective method of instruction under the right circumstances. The significant finding for the experimental group for the scaled FCAT scores demonstrates that project-based learning may positively impact student standardized test scores. This finding provides further justification to continue the investment and further study into the effects of the training.

Project-based learning also requires a great deal of teacher training as well as the tools to ensure that teachers fully understand how to implement the model in their classroom. In addition, we must also realize that a single 32-hour course is not sufficient to assume that a teacher is an expert in project-based learning. Project-based learning requires teachers to rethink their practice. Teachers must also understand that project-based learning is not appropriate in all classrooms at all times. Good teaching requires the teacher to understand what model is appropriate at the time. Good teaching requires a balance of project-based models as well as class discussion, teacher presentation, and student participation. This is how to properly motivate and engage students.

Appendix A

Beliefs about Classroom Structures Survey

Greene, B. A., Miller, R. B., Crowson, H. M., Duke, B. L. and Akey, K. L. (2004). Predicting high school students' cognitive engagement and achievement: Contributions of classroom perceptions and motivation. *Contemporary Educational Psychology, 29,* 462-482

Constructs & Items

Motivating Tasks

1. Students can work together on assignments in this class.
2. In this class, making mistakes is a part of learning.
3. The teacher explains ideas in this class in ways that make the information meaningful to the students.
4. In this class, the teacher focuses on how to pass tests.
5. Students learn in this class by participating in class activities and discussions.
6. In this class, activities and assignments are interesting.
7. The teacher in this class values creative thinking and original ideas.
8. In this class, the teacher emphasizes learning the material to gain understanding.
9. In this class, the teacher introduces material in ways that are relevant, interesting, and familiar to students.
10. The teacher shows how the activities in this class are related to students' everyday lives or future careers.
11. In this class, students learn mainly by listening to the teacher and taking notes.

12. In this class, the teacher tries to find out what each student wants to learn about.
13. Students are given a chance to correct their mistakes in this class.
14. Students know it is OK to make mistakes in this class.
15. The teacher helps us understand how the activities and assignments in this class will be useful to us.
16. Students are encouraged to use different methods for completing tasks in this class.

Mastery Evaluation

1. The teacher in this class uses more than one way to determine grades (tests, projects, presentations, journals, etc.).
2. In this class, the teacher praises students for genuine effort.
3. The tests in this class match what we learned in class.
4. In this class, assignments and tests are returned in a way that keeps individual student grades private.
5. The teacher grades fairly in this class.
6. Students are given a chance to correct their mistakes in this class.
7. In this class, the teacher pays attention to whether I am improving.
8. Students' responses are treated with respect in this class.
9. Only students with the highest grades can keep up with the pace of this class.
10. When students make mistakes they are treated with respect in this class.
11. Students are provided with guidelines for how they will be tested on quizzes or other assignments in this class.

Appendix A (*Continued)*

Autonomy

1. Due dates for projects/assignments are flexible in this class.
2. In this class, the teacher wants us to take responsibility for our learning.
3. The teacher tells us how we can plan to meet our goals for this class.
4. Students get to choose projects/topics they want to work on in this class.
5. The teacher provides suggestions and guidance for organizing and managing the activities and assignments in this class.
6. Individual thinking and students' ideas are accepted in this class.
7. In this class, the teacher changes the pace of instruction to meet the needs of the students.

Appendix B

Intel Implementation Survey

1. Please describe the extent to which you do the following in your classroom:

5 – To a great extent, 4 – Often, 3 – Somewhat Often, 2 – Not Really, 1 – Rarely, 0 – Not at all

	5	4	3	2	1	0
Focus on integration of technology into your teaching.						
Illustrate effective uses of technology with students.						
Use project-based models in your teaching.						
Use web-based tools in your classroom.						
Promote the development of 21st century skills in your students.						
Provide multiple assessment strategies to grade your students.						
Implement methods of teaching that emphasize independent projects by students.						
Increased the integration of technology into your teaching.						
Support your students in using technology in their schoolwork.						
Implemented some or all of the unit you created.						
Assess technology-based work your students produce.						
Align your teaching and assessments with required standards or curriculum content.						

Appendix B (*Continued)*

Overall, how comfortable are you in using technology in your classroom projects? To what extent are the following incorporated into your classroom?

Please select one response for each row

5 – To a great extent, 4 – Often, 3 – Somewhat Often, 2 – Not Really, 1 – Rarely, 0 – Not at all

	5	4	3	2	1	0
Activities involving wikis						
Activities involving other web-based tools						
Formative assessments						
Rubrics						
Activities that promote accountability and adaptability skills						
Activities that promote communication skills						
Activities that promote creativity and intellectual curiosity						
Activities that promote critical and systems thinking						
Activities that promote information and media literacy skills						
Activities that promote interpersonal and collaborative skills						
Activities that promote problem identification, formulation, and solution						
Activities that promote students' self-direction						
Activities that promote social responsibility						

2. Will the ideas and skills you learned from the Intel Teach training help you successfully integrate technology into your students' activities?
   4 – Definitely Yes, 3 – Probably Yes, 2 – Probably Not, 1 – Definitely Not, 0 – Not Applicable

3. How easy was it for you to fit the course into your existing workload?
   4 – Very Easy, 3 – Moderately Easy, 2 – Somewhat Easy, 1 – Not at all easy

4. Would you recommend this course to other teachers?
   4 – Definitely Yes, 3 – Probably Yes, 2 – Probably Not, 1 – Definitely Not, 0 – Not Applicable

5. Please select the term that best describes your level of experience integrating technology into your teaching.
   1) Never used before with students
   2) New user (for example, you have tried a few times to have your students use technology during your classes)
   3) Intermediate user (for example, you have a few lessons involving technology that you feel comfortable having your students do during your classes)

4) Advanced user (for example, you regularly have your students use technology to engage in school work)
5) Expert user (for example, you are a technology leader in your school, or you train others in the use of technology)

6. How many years of teaching experience do you have?
    1) Less than 3 Years
    2) 3-9 Years
    3) 10-20 Years
    4) Over 20

Appendix C

Teacher Focus Group/Interview Protocol

Hello, my name is Jeremy Wright. I will be discussing with you the Intel Essentials course that you completed last school year.

Question: Would all of the participants state their name and school.

Question: What is the role of the student in the learning process?

Question: How do you create a lesson?

Question: What are your thoughts of assessment? How do you evaluate students in your class?

Question: What role does creating authentic activities play in your classroom?

Question: How do you incorporate authentic activities in your classroom?

Question: How do you know that students learn the material you teach?

Question: How do you incorporate technology in the classroom?

Question: How have you changed as a teacher as a result of the Intel course?

Question: What do you do to support various learning styles?

Question: Is there anything else that you would like to add?

Appendix D

Letter to Assistant Superintendent

Jeremy Wright
Sebastian River High School
9001 Shark Blvd.
Sebastian, FL, 32958

Dr. Fran Adams
Assistant Superintendent – Curriculum
1990 25th St.
Vero Beach, FL, 32960

Dear Dr. Adams,

I am asking your approval to perform a study with teachers and students of Indian River County School District. The purpose of the study is to determine the effects that the Intel Teach Essentials course has on student engagement and FCAT reading scores. I intend to ask approximately 36 teachers to take part in this study (18 who completed the Intel training and 18 who have not). I strongly believe that this study will answer many questions regarding the effectiveness of integrating technology and project-based learning in the classroom. In addition, there will be minimal risk for the participants. I ask that you please approve this proposal.

Thank you for your consideration.

Sincerely,
Jeremy Wright

I have read or had read to me the preceding information describing this study. All my questions have been answered to my satisfaction. I, on behalf of Indian River County Schools, freely consent to participate. I understand that I am free to withdraw from the study at any time. In addition, I have received a copy of this consent form.

Signature of School Official: ________________________ Date: _________________

Signature of Investigator: __________________________ Date: _________________

Appendix E

Adult Consent Form

1) <u>Title of Research Study:</u> The Impact of the Intel Essentials Project-Based Learning Model on Secondary Student Achievement
2) <u>Investigator:</u> Gail Burnaford, Ph.D. and Jeremy Wright, M.Ed. (graduate student)
3) <u>Purpose:</u> The purpose of this research study is to assess the effectiveness of the Intel Essentials Project-Based Learning Model on middle and secondary student achievement and engagement. In addition, the study will also look at the level of teacher implementation of the Intel Essentials Project-Based Learning Model in comparison to student engagement.
4) <u>Procedures:</u> Participating teachers for this study will be separated into two groups: Intel trained and not-trained. For the teachers not trained in Intel the researcher will have students in the not-trained classes complete a survey to measure student engagement. Student FCAT scores will also be used to determine gains in student achievement. For Intel-trained teachers, participation in this study will require the completion of a classroom technology survey which will be administered by computer. Participating teachers will also be asked to submit a total of 2 lesson plans for analysis. In addition, Intel trained teachers will be asked to participate in a focus group or an interview to discuss teacher implementation of the Intel training. The focus group or interview will last approximately 30 minutes.
5) <u>Risks:</u> The risks involved with participation in this study are no more than one would experience in regular daily activities.
6) <u>Benefits:</u> Potential benefits that subjects may attain from participation in this research study include a greater knowledge of reading instruction with technology integration and the satisfaction of knowing that they have contributed to a better understanding of reading instruction and technology integration for students in South Florida.
7) <u>Data Collection & Storage:</u> All of the results will be kept confidential and secure and only the people working with the study will see your data, unless required by law.
8) <u>Contact Information:</u>
For questions or problems regarding your child's rights as a research subject, you can contact the Florida Atlantic University Division of Research at (561) 297-0777. For other questions about the study, you should call the principal investigator(s), Jeremy Wright at (772)564-4201 or Dr. Gail Burnaford at (561)297-2305.
9) <u>Consent Statement:</u>
I have read or had read to me the preceding information describing this study. All my questions have been answered to my satisfaction. I am 18 years of age or older and freely consent to participate. I understand that I am free to withdraw from the study at any time without penalty. I have received a copy of this consent form.

Signature of Subject:______________________________________ Date: _________________

Signature of Investigator: _________________________________ Date: _________________

Appendix F

Permission to Use Beliefs about Classroom Structures Survey

Hello Jeremy, Sure you are welcome to use those items. The cognitive engagement items there were geared toward mathematics, so there were items that might not work in a project-based context. Keep that in mind and you should be fine.
Good luck on your research.
Barbara Greene

From: J. Wright [mailto:jwright74@bellsouth.net]
Sent: Sunday, January 27, 2008 3:09 PM
To: Greene, Barbara A.
Subject: Question

Dear Dr. Greene,

My name is Jeremy Wright and I am a doctoral student at Florida Atlantic University in Boca Raton, FL.

I have started the process of writing my dissertation and have read some of your work. I am interested in studying student engagement at the high school level within a project-based learning environment. I found your article Predicting High School Students' Cognitive Engagement and Achievement: Contributions of Classroom Perceptions and Motivation to be applicable in the areas of engagement that I would like to measure for my study. I would like to formally request permission to use the Student Questionnaires found on your website in my study. Please let me know if you have any further questions.

Sincerely,

Jeremy Wright

Appendix G

Themes from Managing Project-Based Learning

Theme	Sub Theme	Principles
Time Management	Scheduling Projects	1. Avoid bottlenecks within courses: schedule projects and end-of quarter assignments at different times. 2. Avoid bottlenecks between courses: coordinate project schedules with other teachers. 3. Use block scheduling to increase flexibility.
	Holding to Timelines	1. Build in a 20% overrun 2. Be prepared to introduce alternative instruction when the project schedule bogs down 3. Learn how to adjudicate scheduling decisions: when to enforce and when to extend a time line
Getting Started	Orienting Students	1. Get students thinking about the project well before they begin 2. Give students a rubric that communicates what they are responsible for 3. Reach agreement with students on grading criteria before the project
	Promoting Thoughtful Work in the Early Stages of a Project	1. Build in the use of a research plan for recording what, why, how decisions 2. Use negotiation, as needed, to start students on productive tracks 3. Require frequent checkpoints and products to facilitate a sense of mission
Establishing a Culture that Stresses Student Self-Management	Shifting Responsibility from the Teacher to Students	1. Involve students in project design 2. Avoid making decisions for students

Appendix G (*Continued)*

	Establishing a Culture that Stresses Student Self-Management Principles	1. Take advantage of opportunities to foster time management skills 2. Take advantage of opportunities to teach students how to learn
	Working with People from the Community	1. Take sufficient time to work out the feasibility and nature of external partnerships before rushing in. 2. Students need to figure out how they will work with external resource people 3. Experts have the greatest impact at the point when their expertise is needed by students
Getting The Most Out of Technological Resources	Using the Internet	1. Find ways to help students make informed choices about web sites to explore 2. Take advantage of opportunities to teach critical thinking skills for Internet use
	Using Technology	1. Make certain that technology is crucial to the goals of the project before making it a central feature 2. Try out the technology before using it with students 3. Have students master complex technology before including it in projects 4. Contract or partner with an expert
Assessing Students And Evaluating Projects	Grading Students	1. Use a variety of assessment methods 2. Include both individual and group grades 3. Emphasize individual over group performance
	Troubleshooting Projects	1. Monitor project progress with an eye toward glitches and misdirection 2. Look for opportunities to intervene with mid-course instruction 3. Be prepared to intervene with mid-course corrections and renegotiated work plans
	Debriefing Projects	1. Put procedures in place to collect formative evaluation information from students 2. Use models to demonstrate reflection strategies 3. Prompt students to give you information about how the project might be improved
Note. Adapted From "Managing project-based learning: Principles from the field." Mergendoller, J. R., & Thomas, J. W. (2000). The Buck Institute for Education. pp. 1-51.		

Appendix H

Portfolio Rubric

	4	3	2	1
Technology Integration	The technology in my Portfolio deepens my students' understanding of important concepts, supports higher-order thinking skills, and develops their lifelong skills. The technology enhances student learning, increases productivity, and promotes creativity. The technology in my Portfolio is age appropriate and meets the diverse needs of all my students. The use of technology enhances my Portfolio by creatively supporting and developing students' research, publishing, collaboration, and communication skills. The technology used in my Portfolio is reasonable and feasible given the specific circumstances of my teaching situation.	The technology in my Portfolio helps my students understand concepts and develop skills. The technology enhances student learning, increases productivity, or promotes creativity. The technology in my Portfolio is age appropriate and shows that I have considered the diverse needs of my students. The use of technology enhances my Portfolio by supporting and developing students' research, publishing, collaboration, and communication skills. The technology used in my Portfolio is reasonable although somewhat difficult given the specific circumstances of my teaching.	The technology in my Portfolio seems to be added without much thought to how it supports and deepens student skills and understanding. The technology in my Portfolio is not age appropriate at times and I have not adequately considered the diverse needs of my students. The use of technology in my Portfolio is limited to supporting students' research, publishing, collaboration, or communication skills. The technology used in my Portfolio takes a great deal of effort on my part.	My Portfolio could be taught more effectively without this current use of technology. The technology in my Portfolio is not age appropriate and I have not considered the diverse needs of my students. My Portfolio does not take advantage of research, publishing, collaboration, or communication capabilities. Given the specific circumstances of my teaching situation, the technology used in my Portfolio is not feasible.

Appendix H (*Continued*)

	3	2	1	0
Student Learning	The work my students complete in this unit is authentic, meaningful, and resembles the kinds of work people do in real life. My unit clearly addresses standards and requires thorough and deep understanding of important concepts, the proficient exercise of 21st century skills, original thinking, and connecting concepts within or across disciplines. My targeted learning objectives are clearly defined, well articulated, derived from standards, and supported by the Curriculum- Framing Questions. My unit requires students to thoroughly and deeply answer the Curriculum-Framing Questions in meaningful and insightful ways. My unit takes diverse learners into consideration and provides well-defined and thoughtful accommodations.	The work my students complete in this unit is meaningful and has elements that resemble the kinds of work people do in real life. My unit clearly addresses standards and requires deep understanding of concepts and the exercise of lifelong skills. My targeted learning objectives are defined, derived from standards, and supported by the Essential and Unit Questions. My unit requires students to answer the Curriculum-Framing Questions in meaningful ways. My unit provides some accommodations to support a diversity of learners.	The work my students do in this unit has a few elements that resemble the kinds of work people do in real life. My unit addresses some standards, but requires little understanding of concepts or the use of 21st century skills. My targeted learning objectives are not clearly defined, but they relate to standards and are moderately supported by the Essential and Unit Questions. My unit requires students to answer the Curriculum-Framing Questions in superficial ways. My unit supports some learning styles but does little to support any special needs.	The work my students complete in this unit does not resemble authentic work in a discipline in any way. My unit does not address standards in meaningful ways and can be completed with only superficial understanding of concepts and application of skills. My targeted learning objectives are vague, unrelated to standards, and not clearly supported by the Essential and Unit Questions. My unit does not require students to answer the Curriculum-Framing Questions. My unit does not provide any accommodations to support multiple learning

Appendix H (*Continued)*

	3	2	1	0
Assessment	My assessments clearly and thoroughly address all targeted standards and learning objectives. My unit includes a variety of assessments that are student-centered, ongoing, and provide valid and reliable information for both students and me about learning and teaching.	My assessments address all targeted standards and learning objectives. My unit includes a variety of assessments that are student-centered, ongoing, and provide information for both students and me about learning and teaching.	My assessments address some targeted standards and learning objectives. My unit includes some assessments that are student-centered, ongoing, and provide some information for my students or me about learning and teaching.	My assessments are not included or address few targeted standards and learning objectives. The assessments included in my unit are neither student-centered nor ongoing, and they do not provide information for my students or me about learning and teaching.
Implementation	My Unit Plan has well thought-out, detailed instructions and procedures that make the unit easy to implement. My Portfolio components are well-developed models that clearly support project implementation.	My Unit Plan has instructions and procedures that serve as an effective guide for implementation. My Portfolio components are models that support project implementation.	My Unit Plan has instructions and procedures, but some areas are unclear, making implementation difficult. My Portfolio components are complete, but they lack detail and are only moderately effective models that support project implementation.	My Unit Plan lacks clarity and is not an effective guide for implementation. My Portfolio components are incomplete or unclear models that do not support project implementation.

Appendix I

Parental Consent Form

1) <u>Title of Research Study:</u> The Impact of the Intel Essentials Project-Based Learning Model on Secondary Student Achievement

2) <u>Investigator(s):</u> Gail Burnaford, Ph.D. and Jeremy Wright, M.Ed. (graduate student)

3) <u>Purpose:</u> The purpose of this research study is to assess the effectiveness of the Intel Essentials Project-Based Learning Model on middle and secondary student achievement and engagement.

4) <u>Procedures:</u>

Participation in this study will require your child to take one survey which will be administered by computer at your child's school. The survey will take about 20 minutes to complete. In addition, the investigator is requesting permission to use your child's FCAT scores from 2007 and 2008. This information will be used to determine learning gains over time. All student FCAT data will remain anonymous and will be available only to the investigator who is a school district employee.

5) <u>Risks:</u>

The risks involved with participation in this study are no more than your child would experience in regular daily activities. It is unlikely your child will experience any harm or discomfort.

6) <u>Benefits:</u>

Your child may gain a greater knowledge of reading and technology and the satisfaction of knowing that they have contributed to a better understanding of reading instruction for middle and secondary students in South Florida.

7) <u>Data Collection & Storage:</u>

Any information collected about your child will be kept confidential and secure and only the people working with the study will see your child's data, unless required by law. The data will be kept for 7 years and then destroyed.

8) <u>Contact Information:</u>

For questions or problems regarding your child's rights as a research subject, you can contact the Florida Atlantic University Division of Research at (561) 297-0777. For other questions about the study, you should call the principal investigator(s), Jeremy Wright at (772)564-4201 or Dr. Gail Burnaford at (561)297-2305.

9) <u>Consent Statement:</u>

I have read, or had read to me, the information describing this study. All of my questions have been answered to my satisfaction. I allow my child to take part in this study. My child can stop participating at any time without giving any reason and without penalty. I can ask to have the information related to my child returned to me, removed from the research records, or destroyed. I have received a copy of this consent form.

Signature of Parent or Guardian:___________________________________ Date: ___________

Signature of Investigator: ____ Date: ___________

Appendix J

Child Assent Form

The Impact of the Intel Essentials Project-Based Learning Model on Middle and secondary Student Achievement

Researchers from Florida Atlantic University are trying to learn about project-based reading instruction using technology. You have been asked to participate because your teacher has completed a course designed to use technology and projects in the classroom. If you decide to participate in this study, you will be asked to complete a survey about your class. You will be asked about your class and how you feel during instruction. This study will take place in your reading or language arts classroom and should take only 20 minutes of your time.

The researchers hope this study will help to make reading and language arts classes more enjoyable and help you learn more about reading and language arts in general.

You do not have to be in this study if you don't want to and you can quit the study at any time. If you don't like a question, you don't have to answer it and, if you ask, your answers will not be used in the study. No one will get mad at you if you decide you don't want to participate.

Other than the researchers, no one will know your answers, including your teacher, friends, or administration. If you have any questions, just ask Mr. Wright at Sebastian River High School.

This research study has been explained to me and I agree to be in this study.

____________________________________ ____________________

Subject's Signature for Assent Date

Check which applies (to be completed by person conducting assent discussion):

☐ The subject is capable of reading and understanding the assent form and has signed above as documentation of assent to take part in this study.

☐ The subject is not capable of reading the assent form, however, the information was explained verbally to the subject who signed above to acknowledge the verbal explanation and his/her assent to take part in this study.

____

Name of Person Obtaining Assent (Print)

____ ____________________________

Signature of Person Obtaining Assent Date

Appendix K

FCAT Score Information

FCAT Reading Development Scores by Achievement Level

Grade	Level 1	Level 2	Level 3	Level 4	Level 5
6	538 - 1449	1450 - 1621	1622 - 1859	1860 - 2125	2126 - 2758
7	670 - 1541	1542 - 1714	1715 - 1944	1945 - 2180	2181 - 2767
8	885 - 1695	1696 - 1881	1882 - 2072	2073 - 2281	2282 - 2790
9	771 - 1771	1772 - 1971	1972 - 2145	2146 - 2297	2298 - 2943
10 -12	843 - 1851	1852 - 2067	2068 - 2218	2219 - 2310	2311 - 3008

FCAT Developmental Scale Score Points Necessary to Show a Year's Gain

Grade Level Change	Reading	Math
5 to 6	133	95
6 to 7	110	78
7 to 8	92	64
8 to 9	77	54
9 to 10	77	48

Appendix L

Focus Group/Interview Coding Guide

Integration of Technology

Research Question: To what extent are middle and secondary reading and language arts teachers who have voluntarily received professional development training in a technology-integrated, project-based learning model implementing the training in their curriculum?

Targeted Questions

How do you incorporate technology in the classroom?

<u>Code for the following:</u>

1A) Technology is used to support and enhance student learning.

1B) Teacher utilizes the internet and other web-based tools to enhance learning.

1C) Students collaborate on the computer via blogs, IM, or Wikis.

1D) Teacher and student use technology to collect and analyze data and interpret results.

2: Student Learning

Research Question: To what extent are middle and secondary reading and language arts teachers who have voluntarily received professional development training in a technology-integrated, project-based learning model implementing the training in their curriculum?

Targeted Questions

What is the role of the student in the learning process?

What do you do to support the various learning styles?

<u>**Code for the following:**</u>

2A) Students are at the center of the learning process.

2B) Students are placed in an active role creating things to solve problems, make decisions, investigate, or document.

2C) Teacher encourages student self-direction.

2D) Teacher utilizes strategies to differentiate instruction.

2E) Students demonstrate knowledge and skills through products or performances that are published, presented, or displayed.

2F) Teacher incorporates the various 21st century skills into lessons.

Theme 3: Implementation

Research Question: To what extent are middle and secondary reading and language arts teachers who have voluntarily received professional development training in a technology-integrated, project-based learning model implementing the training in their curriculum?

Targeted Questions
How do you create a lesson?
What role do authentic activities play in your classroom?
How do you incorporate authentic activities in your classroom?

<u>Code for the following:</u>
3A) Teacher creates real-world activities.
3B) Teacher incorporates varied instructional strategies
3C) Teacher utilizes curriculum framing questions
3D) Teacher plans using the "Backwards Design" model. (What do the students need to learn?)

Student Assessment and Evaluation

Research Question: To what extent are middle and secondary reading and language arts teachers who have voluntarily received professional development training in a technology-integrated, project-based learning model implementing the training in their curriculum?

Targeted Questions
How do you know that students learn the material that you teach?
What are your thoughts of assessment?

<u>Code for the following:</u>
4A) Teacher utilizes both formative and summative assessments throughout the lesson.
4B) Students are involved in understanding project expectations, learning goals, and criteria before work begins.
4C) Teacher provides students time to reflect on learning.
4D) Students are encouraged to self and peer-assess
4E) Students are provided rubrics and checklists to self-assess

Appendix M

Lesson Plan Analysis by Intel Trained Teacher

Teacher Name	LP1: Int. of Tech	LP1: St. Learn	LP1: Implement	LP1: St Assess	LP2: Int. of Tech	LP2: St. Learn	LP2: Implement	LP2: St Assess	Mean All 4
SQ	2	1.5	2	2	2	2	2	2	1.9375
DC	3	3	3	3	3	3	3	3	3
KF	2	2.5	3	2	2.5	3	3	3	2.625
GA	1.5	2	1.5	2	1	2	1	2	1.625
MW	2.5	3	2.5	3	3	3	2.5	3	2.8125
SL	1	2	2	2	1	1.5	2	2	1.6875
HM	2	3	2	2	3	3	2	2	2.375
LK	1	2	2	2	1	2	2	2	1.75
CL	2	2	2	2	2	2	2	2	2
OF	2	2	2	2	2	2	2	2	2
BG	1	2	3	2	1	2	3	2	2
OD	2	2	2	2	2	2	2	2	2
TM	2	2.5	2	2	2	3	2	2	2.1875
CY	2.5	3	2.5	3	3	2	3	2	2.625
SA	3	2	3	3	3	3	3	3	2.875
NI	3	3	3	3	3	2.5	3	3	2.9375

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