INQUIRY-BASED INSTRUCTION IMPLEMENTATION:

A DISTRICT'S LEARNING EXPERIENCE THROUGH TEACHER INPUT

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The undersigned, appointed by the dean of the Graduate School, have examined the dissertation entitled

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And hereby certify that, in their opinion, it is worthy of acceptance.

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ABSTRACT

Inquiry-Based Instruction is a format of instruction that is reported to provide students opportunities to develop their higher-order thinking skills (analysis, synthesis, and evaluation) as well as experience and training in problem solving situations. The IBI problem solving approach requires students locate and evaluate all sources of information and then produce and present their solution to others.

Eleven teachers from a small, rural Missouri school received extensive professional development in the use of IBI. One year after training, the teachers were interviewed about their experiences and observed in their classrooms using what they had learned. This qualitative study reports the findings on IBI though the experiences and perspectives of the teachers involved. Areas of interest reported by teachers include; teacher perceptions about professional development practices, the impact IBI had on their teaching, benefits of IBI for students, and roles school leaders play in such implementation processes.

The findings of this study may serve to aid school administrators in the implementation process of new instructional practices, provide teachers new knowledge from experiences of other educators in similar situations of organization change, and assist teachers and administrators as they make decisions about new instructional methods such as inquiry-based instruction.

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Chapter 1: INTRODUCTION OF THE STUDY

Every few years, different groups of educational stakeholders offer what they believe to be better solutions for educating the youth of our nation. Calls for more teacher accountability, increased math and science efforts, school voucher systems, magnet schools as well as a wide range of "best practices" have all been suggested as a means to improve the public school system. These groups and individuals profess a need for some type of a change. "Reform in education is usually imposed from the outside, through changes in social consensus about what schools should look like, rather than generated from within, though organizational decision processes" (Seashore Louis, Toole and Hargreaves, 1999, p. 253). Whether these educational changes are really intended to advance student achievement or further some other agenda is questionable (Cuban, 2001), but regardless, schools often feel pressured to change some practice within their system to meet these requests. Now the federal government itself has joined the ranks of educational reformers with its *No Child Left Behind* legislation. One component of this bill holds educators accountable for greater student achievement in math and language. The NCLB requirement of 100% proficiency in these areas has prompted many schools to once again reevaluate their educational programs in an attempt to meet this mandate.

Throughout the country, ideas about how to increase student academic achievement to meet national goals proliferate. One suggestion for meeting these requirements that receives much attention is inquiry-based instruction (IBI) and a greater, more effective use of technology in the classroom. This method of instruction requires the student to take a more active role in his or her learning through a problem solving

approach in instruction. Students are given a task to accomplish or problems to solve, which require them to find their own information about the topic, evaluate different possible solutions through collaboration with their teacher and peers, and then develop their own conclusions based on their individual level of understanding.

While current research shows promise in the use of inquiry-based instruction (IBI), (Rubin, 2005; Baumfield, 2006), this method may encounter a difficult time proving its worth if school leaders, and especially teachers, do not support its implementation in the classroom. In an educational setting that is guided by practices and principles developed over generations, a proposal of this type would require significant changes within the organizational structures, attitudes of teachers and students, and a shift in the concepts about school operations in general. Major organizational changes such as these are never easy (Davis, 2003; Schlechty, 2000; and Hanson, 2001).

Purpose of the Study

The purpose of this study is to better understand the issues and difficulties teachers and administrators in a small, rural Missouri school experience when the district undertakes the implementation of Inquiry Based Instruction as an instructional practice. Ways in which school leaders can assist with educational changes and the identification of problematic structural and operational procedures in such a process may also surface. This knowledge may help other schools make appropriate decisions when attempting similar changes in their futures.

The importance and even necessity of teacher contributions in a study that involves instructional methods cannot be overstated. In fact, a study involving classroom instruction may be of questionable value if it did not rely heavily on teacher input. School

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leaders can learn much from listening to the ideas and concerns of their staff (Yukl, 2002). The views and voice of teachers can help school leaders correct, minimize, or prevent problems they themselves may not have considered with an educational change. The input of the teachers can provide valuable information in helping school administrators set in place a school reform that actually survives.

This study will be guided by the following research questions:

1. How do teachers trained in IBI integrate the new teaching methods into their classroom practices?

2. What factors influenced teachers' ability or willingness to implement IBI practices into their classrooms?

3. How can school leaders assist teachers in the implementation of the IBI methods?

To address these research questions the study will follow a set of eleven teachers through a two year professional development plan that will focus on instruction of inquiry-based methods and the use of technology in the classroom. Listening to what the teachers have to say about the change process may help school leaders learn how to eliminate some of the challenges when undertaking other educational changes. Continued observations of classroom activities will provide data on the extent to which teachers actually use the IBI in their classrooms and thereby give an indication of the success of the implementation process.

Statement of the Problem

The diverse student population and changing social norms have created new challenges for America's schools not seen in previous years. The high national dropout

rate, low national and international test scores, and criticisms from universities and businesses about poorly prepared high school graduates would suggest that there is something wrong with our current education system. A changing world is demanding a different type of education for our young people. Where once general knowledge was all that was required for the factories, fields or industry, now students must acquire a completely different set of skills to be successful in the working world. The ability to work with others to accomplish goals, the knowledge of how and where to find and evaluate information, and the development of higher-order thinking and problem solving skills are what many suggest will be needed from tomorrow's employees or business owners (Ramsay and Sorrell, 2007).

No Child Left Behind legislation requires that all public schools across the country will have all students performing academically at a proficient level by the year 2014 in reading and math. The "proficient" levels are individually and arbitrarily set by each State, meaning that proficient in one state may or may not be proficient in another. While those in education may look at this mandate with a skeptical eye, never the less, efforts are being made toward increasing student academic skills to meet these requirements. Realizing that the traditional methods of instruction are not producing the desired results, school teachers and administrators are working hard to find teaching methods that can accomplish more.

One suggestion that may be able to accomplish this goal is a form of instruction that differs greatly from those used in the traditional classrooms of the past. Schools and other educationally focused organizations have identified IBI as a powerful teaching method that encourages students to become a more active participant in their learning,

develops higher-order thinking skills, and keeps students more highly motivated, which in turn, is tied to improved attendance and more positive classroom behaviors (Rubin, 2005; Kleiman, 2004). While IBI is not seen as the educational "silver bullet," many believe that this method of instruction is worth a thorough investigation.

IBI requires students to identify and locate their own information about the topic being investigated. Often times this entails the use of the internet to find current and relevant information. This component of the IBI creates the need for students and teachers to become proficient in the use of technology, which will enable them to access and navigate the internet resources.

The use of technology in our world is ever increasing. A vast majority of businesses and organizations rely on a wide range of technological devices for record keeping, presentations, communication, information location, and a wide variety of other tasks. Schools themselves have become reliant on technological tools. However, while many schools are spending large sums of resources on computers, interactive white boards, hand-held calculating devices, and others forms of technology, teachers have generally used the devices or programs to put a new face on their old practices (Matzen & Edmonds, 2007; Tomei, 2007; Roberts, Kelley & Medlin 2007). Several school districts across the country have spent large sums of resources on technology only to later greatly reduce or eliminate the program because of the lack of effectiveness when compared to cost (Cuban, 2001). These researchers suggest that schools need to reevaluate and change the way in which they use technology if their goal is truly student achievement and not teacher lesson enhancement. IBI makes extensive use of classroom technology as a means of learning rather than simply learning about technology as many schools have

focused their attention in the past (Juniu, 2006). Using computers to learn is the goal, not learning to use computers.

Changes in organizations are seldom easy. Even with well thought out goals and plans, organizations must take into consideration several components in order to accomplish the desired change (Bolman & Deal, 1997). The structural, political, human resource, and cultural factors must be addressed before such organizational changes can take place. And even with proper consideration of these and other factors, there are no guarantees that the change will be accepted or long lasting (Hanson, 2001; Fullan, 1996; Davis, 2003).

Organizations such as schools are oftentimes deeply entrenched in tradition and culture, which makes change difficult. Teachers who were instructed as students in a particular manner tend to adopt that format and use it in their own classrooms. After years and sometimes decades of using this preferred delivery method, teachers often have a difficult time letting go of an instruction style with which they are comfortable only to change to something else with which they have little confidence, little knowledge, and a great deal of fear (Vannatta & Fordham, 2004; ChanLin, 2005). Even current teaching practices that are not viewed as overly beneficial remain because of tradition, the resistance to change, or both. The lecture is listed as the most predominant form of instruction used in education today, and yet several studies indicate that lecturing is one of the least successful methods for conceptual understanding and retention of information (Butler, 1992; Beers & Bowden, 2005; McKeachie, 1994). These studies suggest that teachers are most comfortable with the type of instruction they received in their own schooling, have difficulty giving up the position of teacher as dispenser of knowledge, or

simply do not believe there is any need to change their practice as their reasons for staying with methods that are not the most beneficial for students.

Changes can face other resistance as well. Parents and other community members often reject new ideas in education that were not in use when they were in school. Physical and operational structures that are in place can also present barriers to adoption of changes (Rosenfeld & Martinez-Pons, 2005; Schlechty, 2000).

Many different instructional methods have been suggested and tried over the years, often at the bequest of the school administration, but few have endured. After a trial period of the newest "best practice," teachers tend to revert back to their own preferred method (Hanson, 2001). Cooperative learning, peer tutoring, outcomes based education, and whole language are but a few examples of practices that did not survive.

Deeply entrenched barriers to change such as tradition and teacher's control must be carefully addressed for progress toward IBI to be successful. Change in school has been tried before, over and over, with limited success. The American school system is not opposed to change. In fact just the opposite seems true. "While it is common to decry the traditionalism of the American school system, it seems more appropriate to emphasize the extraordinary rate at which innovations of various kinds are incorporated into American schools (as well as the rapid rate with which they disappear)" (Meyer, 1992, p. 56). School leaders are painfully aware of this problem of "come and go" change initiatives   and carefully study new proposals before they take on yet another "best practice." If the history of educational change holds true, then getting teachers to try IBI and the more effective use of technology will not be difficult, particularly when it is a

directive from school administration; however, keeping the practice in use may be more of a challenge.

Collaborative leadership is based on the idea of the many members of an organization working together to accomplish goals (Yukl, 2002; Davis, 2003). Hallinger and Heck (1999) stressed the importance of teacher support and empathy from school leadership in their efforts to increase the effectiveness of schools. The voices of both teachers and students should be part of any decisions and discussions about implementation of the change toward IBI. This study focuses on teacher input on an educational change.

Teachers' roles in an inquiry-based classroom are drastically changed. This change in roles is unlikely to take hold if teachers themselves resist. Teacher buy-in is essential. It is the responsibility of school leadership to show teachers the benefits of IBI, help them make the adjustments needed for implementation, and support their efforts. Hallinger & Heck (1999) write, "…research suggests that mission-building is the strongest and most consistent avenue of influence school leaders use to influence student achievement" (p. 179).

Similarly, student acceptance of IBI is vital. One factor listed for the increased drop-out rates across the country is the lack of relevance between today's students and the lessons being presented. Students need to see how they will directly benefit before their best efforts are given. Senge (1990) points out this same fact in his discussion about organizational learning: "Many of the best intentioned efforts to foster new learning disciplines founders because those leading the change forget the first rule of learning: people learn what they need to learn, not what someone else thinks they need to learn"

(Senge, 1990, p. 345). IBI attempts to provide the desired connection between the students and lessons. Teachers and other school stakeholders are required to show students how these types of learning opportunities will be of value to them.

Inquiry-based instruction may be a potential solution for increasing student achievement; however, nothing in education is a sure thing. Without proper implementation, helpful and collaborative leadership, professional development and training, as well as student and teacher buy-in, the success rate of any new educational initiative is questionable (Bolman & Deal, 1997; Schlechty, 2000). Because of the complexity of organizations and the uniqueness of individuals, proposed changes are not always successful.

<div align="center">Organization of the Dissertation</div>

This study consists of five chapters. Chapter one has set the stage for the reader by listing the pertinent information about the need for and value of such a study. A brief discussion about IBI and its goal of academic improvement should help orient the reader in the right direction.

Chapter two will review the current literature required for further study into the topic of adopting new teaching practices. First, research on IBI and related areas will provide the reader with a base knowledge about this form of pedagogy. Next, issues and programs associated with educational technology and the influence it has had in the classroom, particularly the "eMINTS" program, will be discussed. And lastly, an overview of organizational change and the importance of leadership will conclude the literature review. Research on organizational change will help the reader to better understand the requirements needed to increase the chances for such a change to occur.

Chapter three will examine the research design and methods to be used in this study. A discussion on the theory and application of qualitative research, sample size, selection and demographics, and then data collection and analysis will enable the reader to judge the validity and usefulness of this research on IBI.

Chapter four will present the findings of the study through the narrative voices of the participating teachers trained in IBI. This data will then be systematically analyzed to determine the extent to which the research questions were addressed. The fifth and final chapter of this study will present the findings, draw conclusions, suggest implications, give recommendations, and list the limitations of the study.

Definition of Terms

Constructivism   Learning theory that suggests that individuals

                                        construct their own meaning and understanding to

                                        new experiences based on previously held

                                        knowledge and beliefs (Ozmon & Carver, 1992).

Inquiry-Based Instruction (IBI)   Teaching method that uses the concept of

                                        constructivism learning. Students are given realistic

                                        situations or problems to solve and use skills and

                                        knowledge they presently possess to find, assimilate

                                        and evaluate new information to adjust old or form

                                        new concepts. Students develop answers to

                                        presented problems (Christensen, 1995).

Problem-based learning   A form of IBI that uses problems as the impetus for

                                        new learning (Bridges & Hallinger, 1997).

eMINTS   The acronym for "enhancing Missouri Instructional

                                        Networked Technologies" project. State grant

                                        program that furnishes schools with equipment and

                                        teacher training in IBI with the goal of student

                                        academic improvement (Bickford, 2000).

Higher-order thinking skills   The more advanced types of skills from Bloom's

                                        taxonomy of learning. Evaluation, synthesis and

analysis are typically the skills listed as the higher-order skills (Baumfield, 2006).

Classroom technology   Any number of devices that are used within the classroom intended to enhance student learning. The devices include computers, interactive white boards, digital cameras, scanners, "handhelds," audio devices, computer software and others (Sandholtz, Ringstaff, & Dwyer, 1997).

Traditional instruction   A classroom setting that places the teacher in the position of dispenser of knowledge and holds the center position in the learning process (McCombs & Whisler, 1997).

Best practices   Common education jargon that refers to any of the many teaching practices that are touted as beneficial to students. The practices are typically wide spread across a region and generally short lived. Many of these practices have ties to groups or individuals that have something to gain from the use of the practice (Cuban, 2001).

NCLB   *No Child Left Behind* federal legislation enacted in 200l, which mandates that all students meet or exceed state developed academic standards in the area of math and reading by the year 2014. A wide

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array of other educational issues such as teacher

education and qualifications, guidelines for

developing state standards, and funding for

education is also addressed in this bill.

Student-centered classroom   Classrooms in which the student rather than the

teacher becomes the focal point. Based on the

psychological principles of learning, developed by

the American Psychological Association in the early

1990s, the student-centered classroom addresses

several factors of student learning that the

traditional classroom overlooks. Metacognitive and

cognitive, affective, developmental, personal and

social as well as individual differences are factors

that are all considered important in teaching and

assessing learners (McCombs & Whisler, 1997).

Chapter 2: REVIEW OF THE LITERATURE

School reform is a continual driving force in the American education system (Seashore, Louis, Toole and Hargreaves, 1999). A lengthy list of reform ideas has been introduced and presented to educators by outside groups in an attempt to improve the educational system, or at least those initiating the reform claim that there will be an improvement. Sometimes those ideas do actually advance the learning of the children and sometimes they do not. From the introduction of kindergartens in the later part of the nineteenth century to the present day push for greater technology usage, schools are continually being given unsolicited advice by outside groups (Cuban, 2001). IBI has been suggested by educational leaders from many arenas as a method of increasing student academic performance and building higher-order thinking skills such as evaluation and synthesis. Whether or not this method of instruction will find a permanent home in the classroom is yet to be seen; however, without knowledge about IBI as well as the issues associated with educational change initiatives, its chances for success are limited.

The federal government, through the education legislation *No Child Left Behind* (NCLB), has joined other reform groups by requiring school to, among other things, integrate technology into instruction practices to promote learning and increase academic performance. The September 2007 issue of the *American School Board Journal* reports that there is a "common understanding and appreciation among parents that technology will play a key role in improving the way teachers teach and students learn" (p. 7). Since the NCLB federal mandates are now in place, and if these reported opinions of parents are accurate, one might assume that it would be a simple matter to provide and integrate

technology into the schools. However, as Cuban, (2001) and others have alleged, it is not the availability of the technology that is the hurdle for schools but rather using it in such a way that encourages real twenty-first century learning. IBI is an instructional method that attempts to provide students with technology enhanced learning opportunities geared toward the changing needs of our students as well as further development of their higher-order thinking skills.

This chapter will present research that discusses IBI and its related topics. Multiple intelligence theory and constructivism will introduce the reader to the logic behind IBI. Next, the development of this instructional method, its strengths, weaknesses and various forms will be presented, followed by studies on current uses of technology, the e-MINTS program in particular, and teacher issues when encountering change. The chapter will conclude with a discussion of organizational change and the leadership role involved in carrying out these changes.

Multiple Intelligence Theory

Give ten individuals a problem under the same set of circumstances and one could expect to get ten different solutions that solve that problem with equal measures of success. With inquiry-based lessons and in real life situations, there are multiple possible solutions or outcomes to problems. The different life experiences each individual has had throughout their life will determine how each will go about addressing the problem. One of the categories of the learner-centered psychological principles developed by the American Psychological Association in 1997 addresses individual differences among students (APA, 1997). Students within a single grade level classroom vary greatly in their physical, emotional, and cognitive strengths and weaknesses. Add to these physiological

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and psychological differences the social, cultural and life experience differences and it is little wonder why individuals arrive at varied solutions to a single problem (Moran, Kornhaber & Gardner, 2006).

Inquiry-based learning and the student-centered classroom both acknowledge student differences and attempt to accommodate various learning styles as well as the individual strengths of each student. The multiple intelligence theory developed by Howard Gardner in the early 1980's puts forth the idea that intelligence should be viewed from a more broad perspective and take into consideration the different strengths found in children (Gardner & Moran, 2006). Gardner suggested that rather than a single measurement of general intelligence based on a narrowly focused set of cognitive attributes, a truer and more accurate account of one's intelligence should include other areas. Gardner suggested we look also at one's mathematical, spatial, musical, naturalist and personal strengths to determine one's intelligence. Defending his multiple intelligence theory, Gardner states, "we have refashioned the concept of intelligence so that it comprises what the individual brings and what the cultural and social environments contribute to a particular cognitive performance" (Gardner & Moran, 2006, p. 228). Similar theories such as the Mozart Effect (Rauscher, 1997) and Emotional Intelligences (Salovey & Mayer, 1990) also suggest the need for a broader measurement of intelligence. Critics of these theories question the reliability of such ideas due to the lack of empirical data that support such claims (Waterhouse, 2006); however, few if any would question that there are indeed many differences found within individuals' cognitive abilities. These authors use the illustration of individuals with Savant Syndrome and ask if they are extremely intelligent, or extremely challenged?

The student produced product, or solution to a given problem is seen as one of the strengths of inquiry-based lessons (Ramsay & Sorrell, 2007). The open ended format of this type of instruction allows students to use their strengths to produce their end product. Where some may produce an end product that utilizes music or art, another may produce one using words or numbers. Each end product is assessed by how well it addresses the posed question or problem and not on a teacher predetermined single right or wrong answer. Also, the format of the end product is not provided by the teacher as is the case in many of the traditional classroom lessons.

Single measures of intelligence and narrowly defined right or wrong answers limit the types of students that are graduating (Gardner & Moran, 2006). These authors profess that requiring students to follow paths of teachers instead of blazing their own trails will not advance our knowledge base or propel us forward in a world market. The use of IBI and student-centered classrooms take full advantage of student differences.

Constructivism

Educational administrators are recognizing the fact that in order to educate young people with the skills needed for today's world, classroom instructors will be called upon to teach more creatively as well as make adjustments to the curriculum and their own personal pedagogy (Sugar, Crawley & Fine, 2004). The traditional classroom presented students with fragmented, arbitrary and limited bits of knowledge aimed at improving either performance on standardized objective assessments or preparation for the workplace (Trimble, 2003). This type of instruction delivery often results in non-realistic classroom activities that make it difficult for students to find the connections between their lesson and their own lives (Perchman, 1992). The lack of relevance for students in

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their assignments is reported to be a leading cause for the disconnect from school and thus a contributing factor of the increasing dropout rate (Finn & Rock, 1997; Modell & Elder, 2002). Researchers Wenglinsky (2004) and White and Frederiksen (1998), suggest that students can find the missing relevance in their lessons through the use of constructivist teaching methods. Constructivism builds on the theory that all people construct their own understanding and knowledge about their world through their own experiences and reflection on those events (Huitt, 2003). When an individual encounters something new, that new information must be considered based on previous knowledge and understanding. This new incoming data may now cause the learner to think about what they had previously learned and then accept, reject, or alter either the old or the new information (Rubin, 2005).

The constructivism movement as a philosophy of learning can be traced to the work of John Dewey in the early nineteenth century (Huitt, 2003, Ozmon & Carver, 1992). Dewey believed that learning was based on activity, doing not just listening (Ozmon & Carver). He suggested that education should be grounded in more realistic, life-like experiences, and that knowledge would only come from a context in which ideas were developed by the learner based on the child's prior knowledge. Dewey forwarded the idea that the learning context was a social context where students learn from others. In the 1970's, Jean Piaget and Lev Vygotsky further developed the constructivist theory by linking a student's learning to discovery and active involvement with others (Ozmon & Carver, 1992; Wertsch, 1985). Vygotsky's "zone of proximal development" refers to the degree of social interaction that took place within a learning experience episode. For Vygotsky, more interaction equated to more learning. His "social learning" perspective

stated that children learn best when they interact with others, and that much more learning is possible with adult or peer interaction.

Ryan and Powelson (1991) wrote that today's schools attempt to teach students in an "unnatural" setting of allowing students limited interaction with others, making learning a more individual and competitive endeavor, and fragmenting the learning through separate and seemingly unconnected subject matters. This approach would appear to contradict the constructivist theory, which stresses almost the opposite, learning with others, making connections between one's new and past knowledge, as well as learning with a purpose.

The educational philosophy of constructivism is hardly new, but as teachers and educational reforms come and go, so do the ideas about how best to educate children. A resurgence of the constructivist philosophy is being experienced through the use of IBI, increased use of technology in education, and new programs that incorporate the two.

Inquiry-Based Instruction

The term inquiry is frequently used as a synonym for investigation, search for truth, examination, or discovery. The current educational use of the term inquiry is applied to the concept of having students search for the truth about a topic rather than being told by teachers what they should learn. The expansion of the constructivist theory through the use of IBI is reported to develop a richer, fuller understanding of content with greater retention of the material (Cote, 2007). Students seek and discover the new knowledge through a process of gathering information and data by using their prior knowledge and senses. Students then create new meaning as well as develop connections between the new data and their past experiences (Rubin, 2005). The current educational

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system almost discourages this type of natural inquiry process. Students typically ask their teachers questions for clarification of understanding about some point or concept; however, rarely do they have the opportunities to ask questions that may lead to discovery or searching for truth. The natural curiosity in children is diminished by the type of instruction that discourages inquiry and discovery (Christensen, 1995).

Inquiry-based instruction and its many variations and labels calls for a different approach to education and teaching. Inquiry as a teaching format requires that teachers ask questions that encourage dialogue, thought, and reflection to stimulate and development of higher-order thinking skills, not simply rote learning. In short, IBI requires a move away from the teacher-centered classroom and toward a more student-centered classroom (Budnitz, 2000). The student-centered classroom and IBI use constructivist concepts to guide the student toward acquisition of their own learning.

Higher-order Thinking Skills and the Student or Learner-centered Classroom

An educational standard for the classification of learning is the Bloom's Taxonomy. Developed in the mid 1950's, Benjamin Bloom grouped learning found within the cognitive domain into six sections ranging from the simplest form of learning, which is knowledge, and continuing up an ever increasing ladder of difficulty to evaluation. There have been some modifications to this scale since its development; however, it remains for the most part unchanged today (Smythe & Halonen, 2008). IBI attempts to move away from the traditional teaching methods, which focuses on the lower end of Bloom's scale: knowledge, comprehension, and application, and instead strives to move students to the upper end of the scale, the "higher-order" thinking levels of analysis, synthesis, and evaluation.

The student-centered classroom is a classroom that considers the student rather than the teacher as its central component (McCombs & Whisler, 1997). Educators know that students come to them with a wide variety of differences and abilities. The learner-centered classroom looks at the different cognitive and metacognitive, affective, developmental, personal, social, and individual differences found within all students to teach and assess the learner. These classrooms consider the multiple differences present in children and try to accommodate those differences. Many traditional classrooms use only single or limited types of instruction and assessment to teach and evaluate students. Lessons presented in a singular format give students that learn best with that one type of instruction an advantage over those students which may do better with another style of presentation. The learner-centered classroom strives to adjust its teaching to accommodate all students. IBI strives to integrate both the higher-order thinking skills and student-centered classroom concepts to increase student achievement.

Budnitz (2000) and others stress the importance of teachers guiding students by asking the right types of questions. Asking open-ended questions that require students to analyze data, make predictions, or explain their thinking is one of the hallmarks of classrooms that help students develop their higher-order thinking skills (Koufetta-Menicous & Scaife, 2000; McGregor & Gunter, 2001). "By legitimizing higher-order questions in their practices, teachers establish a framework for dialogue in which students are encouraged to probe into the underlying reasons, the 'why' behind the answer, to make judgments and justify their conclusions" (Baumfield, 2006, p. 188). Daniel Flage, in *The Art of Questioning*, (2003) discusses general types of questions that differ significantly from those frequently asked by the traditional classroom instructor. Rather

than asking closed-ended questions requiring a single right answer, Flage suggest asking questions that require students to make inferences or interpretations. He argues that this approach to questions is far stronger in assisting students with mastery of the topic. Questions that require transfer of knowledge to some hypothetical situation and those that call for the development of hypothesis are forms of questions that further develop a student's higher-order thinking skills (Flage, 2003).

The debate over teaching facts or critical thinking skills has continued between educators and policymakers over the last several decades. Which is more beneficial for students? Using data from the National Assessment of Educational Progress (NAEP), Wenglinsky (2004) found that while facts and foundation knowledge are extremely important, teaching the higher-order thinking skills produces greater results in standardized testing. Presenting students with authentic problems and allowing them to work with peers to develop solutions allows them to integrate new information with previously constructed knowledge (Von Glasersfeld, 1981). Knowledge gained in this manner tends to be more deeply grounded because of the many links the student must make between each step of the problem-solving event. "In the learning process, these problems help learners organize their learning and facilitate growth in reasoning and problem solving skills" (Rakes, Field & Cox, 2006, p. 409).

Allowing students more time to think before they answer a question (Ferretti et al., 2001) and eliciting more questions from students (Naisbett, 1997) are additional practices used to develop the higher-order thinking skills; both practices are encouraged with IBI. Ferretti and Naisbett each discuss a need for allowing students more time to respond to the higher-order types of questions suggested by Flage (2003) before they are

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required to come to their conclusion or answer. Many questions asked by the traditional classroom teachers call for less involved processing of materials, such as simple knowledge, and therefore, do not require as much process time. If teachers desire to move toward questions requiring analysis and synthesis types of thinking skills, they must allow students additional time to process before they speak. And yet, Vannatta & Fordham (2004) listed this additional time requirement as one of the major stumbling blocks for teachers when they attempt this method because they (teachers) already feel rushed to cover the curriculum and believe that they simply do not have the time to spare.

The classrooms of the past have typically had teaching instead of learning as the central activity. These classrooms are marked by students that are passive; the diversity of the student learning styles is seldom addressed; and students merely restate, reproduce or regurgitate knowledge presented to them. The work of McCombs and Whisler ((1997) entitled *The Learner-Centered Classroom and School* list several benefits of student-centered learning. Children do not develop mental cognition or physical stature at the same rate. Student-centered instruction allows students to advance academically based on their ability to comprehend and not necessarily at some arbitrary pace chosen by the instructor. Consideration of social and cultural diversity, individual learning style preferences, lesson connection to student's real-life requirements, and fewer discipline issues through higher levels of student engagement are other hallmarks of the student-centered classroom (McCombs & Whisler). A strong constructivist frame may be seen within the learner-centered classroom.

Both ChanLin (2005) and Vannatta and Fordham (2004) reported teacher concerns about the loss of control, both management and academic, and the fear of

change when confronting a move toward a more student-centered, inquiry-based instructional format. The shift toward inquiry-based lessons and student-centered learning does not mean that teachers give up authority or the leadership role in the classroom. Teachers' roles change but do not diminish. Zohar (1999) indicate that teachers in the student-centered classroom face even more challenges than those in the traditional teaching setting. For reasons mentioned (different developmental paces and stages of students, different learning styles of students, varied social and cultural groups of students), teachers are more important than ever. These differences have always been present in the classroom; however, the individual needs and learning styles of the students were often overlooked or ignored. In the traditional setting, the teacher presented a single lesson to all students and expected similar answers on assessments. The predetermined pace, expectations, and objectives were usually geared toward those students of average ability. IBI, which takes into account the different developmental and cognitive ability levels of the students, requires a more thorough knowledge and understanding of each student's ability. Individual learning styles, abilities, and weaknesses of each student are now paramount as teachers attempt to accommodate each child in a manner in which they learn best (Baumfield, 2006). If anything, the responsibilities of teachers using IBI are increased (ChanLin, 2005).

Forms of Inquiry-Based Instruction

While inquiry-based lessons present an approach to teaching rather than a packaged format, there are some types of lessons that have been closely tied to IBI. Web Quests, mind mapping, and the PBL (problem based learning) are three of the more common types of lessons that fall under the category of inquiry. All have been used

successfully in the classroom, all are similar in their approach and requirements, and all have certain characteristics consistent with inquiry lessons.

Web quest. The web quest was originally developed at San Diego State University by B. Dodge and T. March in 1995 (Dodge, 1995; 2007; Watson, 1999). This type of lesson uses the World Wide Web to retrieve information about some given research problem for younger students. Students work together to locate, read, analyze, and synthesize information in their attempt to solve a problem, role play, recreate, or re-invent/discover. Teachers, or others, develop a sort of an internet journey for the students to take to "discover" the subject content. Predetermined websites are linked by the developers to ensure that the students discover the intended objective and avoid accidentally accessing inappropriate or unhelpful sites. This format does limit the possible conclusions the students may make, but at the same time gives students the skills they will later need to navigate the internet, collaborate with their peers, and gain understanding of relationships of material (Merrill, 2007).

Dodge and March (1995) identify two different types of WebQuest™. The "short term" version, which as the name implies, takes fewer classroom periods, focuses more on knowledge, integration, and learning how to navigate through the activity. The "long term" version takes more time and requires a greater use of higher-order skills such as analysis and synthesis. The short term WebQuest™ is typically intended for younger students or those unfamiliar with, or just beginning this type of lesson.

The popularity of the WebQuest™ can be seen by the number of these lessons posted on the internet. Teachers and others by the thousands have posted their quests on the internet for other teachers to use with their students. Lessons for every age group and

a wide range of subject matter are linked to many public and private schools' websites. In his book *Oversold and underused: Computers in the classroom* Cuban (2001) questions whether these lessons are produced in such numbers because of the professed strength of educating or rather as some justification for schools' spending large portions of their budgets on school technology. However, many universities, individuals, and other organizations contend that the types of instruction that connects technology with student learning continues to better prepare students for their futures and work-place settings and should therefore be included in the school's curriculum (Rubin, 2005).

Mind maps. A mind-map is a diagram or drawing intended to represent a task, concept, or idea arranged radially around some central word or key term. It is used to help convey one's thoughts or ideas about the central term, how it relates to other items, or how it would progress through a process (Novak, 1993; Nast, 2006). Through these diagrams students are able to visualize and better understand more complex concepts and how they interact with the other components. In contrast to the traditional practice of giving students a term to define or describe in writing, typically resulting with the student copying down the definition in the textbook's glossary, the mind map allows the student to gain a much more holistic view of the term and how it relates to other components (Nast).

Visual images of these types are not new, but rather simply being reintroduced to students in the lower grade levels to help them grasp higher level thinking skills. Dr. Allen Collins and Mr. R. Quillian worked with visual organizers in the early 1960's as a way to enhance student learning (Novak, 1993). Identified by many different terms: brainstorming, memory pictures, visual thinking, webbing, spidergrams, concept map, all

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use a central word along with other terms, phrases, ideas, or steps branching out to describe more complex concepts and connections. Allen and Collins praised these types of visual aids as a superior alternative to note taking that increased retention of subject matter and provided deeper understanding (Novak).

The resurgence of the mind-map is perhaps influenced in part by the number of computer software programs available as well as the increased number of computers being used in schools (Nast, 2006). Many versions of mind-mapping programs are available to the public in a wide range of complexity and level of sophistication. Several are geared for the elementary grade levels.

Problem-based learning. One of the most popular and widely used forms of an inquiry-based lesson is what is known as problem based learning, or PBL. Problem based learning is exactly what the label suggests, learning by solving a problem. Students are presented with realistic and meaningful problematic situations and allowed to gather their own information, collaborate with others to develop a plan of action to address the problem, and present their solution to others. Because students themselves see personal value in the assignment, they tend to better retain and apply the knowledge gained, put forth more effort in the assignment, find the task more meaningful and enjoyable, and develop stronger decision making skills (Bridges & Hallinger, 1997; Cote, 2007; Kleiman, 2004). These studies also found that during the PBL assignment, students further developed their skills in locating and assessing the value of related information, working with others, communication, and leadership. The PBL assignments are particularly well suited for older students in that these students have a broader base of knowledge from which to make the links and comparisons between the newly discovered

knowledge and their past experiences. Von Glasersfeld (1981) contends that these comparisons and links are critical components of learning.

First used in the late 1960's at McMaster University as an attempt to improve test scores of nursing students, the PBL has since been widely used in a variety of settings around the world (Ramsay & Sorrell, 2007). Now found in a number of medical schools, engineering schools, and other colleges and universities, the PBL is beginning to make its way into the elementary and secondary schools (Merrill, 2007). The use of PBLs at the secondary school level and below requires more guidance and interventions on the part of the instructor, however, the principles and practices are basically the same regardless of the level of education.

The PBL differs from other forms of similar instruction, such as the "case" method or "in-basket" scenarios, in its instructional and implementation practices. The case-study or in-basket formats are teacher centered and driven while the PBL is more student directed. Instructors write up the case, a scenario, and generally have some predetermined criteria in mind for the assessment. Case studies or in-basket exercises are typically used as an ending assessment tool to determine whether or not students can apply what they have learned in the class. The case method and in-basket lessons are often used to simply demonstrate knowledge and application while the PBL is intended to develop and strengthen higher-order thinking skills through the research and develop of a solution (Bridges & Hallinger, 1997). One strength of the PBL when compared with other similar type lessons was the higher level of student satisfaction (Cote, 2007). Properly designed PBL activities are seen by students as being relevant to and important in their futures and, therefore, something in which they are willing to put forth more

effort (Ramsay & Sorrell, 2007). Other forms of inquiry type delivery are bound to be

developed and used as more educators learn of the strengths of IBI.

Critiques of Inquiry-Based Learning

Critics of IBI suggest that students should be provided with a base of core

knowledge, so they may use that knowledge as they progress through their education and

life (Hirsh, 2006). This "core knowledge," as Hirsh labels it, is one of the necessary

requirements needed before students can develop higher-order thinking skills. Hirsh

reasons that without this core knowledge base upon which to build on, all else is futile.

Younger students have less ability to think critically without a base knowledge and

limited life experiences from which to draw in making assumptions, inferences, and

developing a hypothesis (Wenglinsky, 2004).

Hirsh (2006) and Wenglinsky (2004) would appear to have a valid argument for

some types of IBI. Without some point of reference from which to compare, the general

knowledge and skills required to gather information, or the ability to distinguish truths

from untruths, very young students would be questionable candidates for some types of

IBI. However, not all IBI requires these skills. And while some components of the

inquiry instruction method may require some level of prior knowledge and experience,

students of any age and level of ability can improve and develop collaborative skills,

learn to ask meaningful questions, and begin to make the connections between what

knowledge they already possess and the new incoming data.

Current school administrators and other educators voice concerns with IBI in the

way it deviates away from the traditional assessment requirements (Kleiman, 2004).

Currently, state and federal testing practices generally evaluate the lower order thinking

skills of knowledge and sometimes application. These levels of the cognitive domain are relatively easy to measure; either you know something or you don't. While developments of problem-solving and higher-order thinking skills are extremely valuable, probably more so than simple knowledge, they are hard to measure. Making allowances for individual differences and preferences toward a particular teaching method make it difficult for accurate assessment from standardized tests as well as assigning grades and course credits.

Summary

IBI is a method of teaching that has been successful in achieving and advancing student knowledge and higher-order thinking skills (Merrill, 2007). Inquiry-based lessons generally share certain characteristics. Inquiry lessons present authentic and relevant problematic situations for students to solve or address, require students to work with others in a collaborative manner, learn from one another, produce end products that vary from student to student, contain no predetermined single correct answer and change the role of instructor to that of facilitator of the process rather than dispenser of knowledge (Ramsay & Sorrell, 2007; Bridges & Hallinger, 1997; Cote, 2007; Kleiman, 2004).

Technology in the Classroom

There are few areas in the lives of American citizens that have not been affected by technology. The first transistor radios of the 1950's or handheld "calculators" in the 1960's, both modern marvels at the time, seem almost prehistoric when compared to the sophistication of today's cell phones, global positioning systems, and microprocessors. The American classroom is no different from the rest of society. Technological devices, which propose to help students achieve, have also found their way into the classroom.

The mandates of the *No Child Left Behind* legislation require schools to prepare students with 21st century skills, which call for an ever increasing skill level in the use of technology.

The increased demand for educational technology in schools is taking place at such a rapid pace that teachers, administrators, and school boards are being required to adjust the way they conduct the business of education (Rosenfeld & Martinez-Pons, 2005). The technology industries realized early that connecting schools with their products would be beneficial (Cuban, 2001). One of the pioneer large-scale initiatives for more technology in the classroom came from the Apple Company in the 1980's (Sandholtz, Ringstaff, & Dwyer, 1997). The Apple Classrooms of Tomorrow (ACOT) began with a market plan to provide one-to-one access to classroom computers. This project sought to study and promote educational practices through the use of technology in the classroom by providing computers to schools. While administrators jumped at the opportunity to sign up for the program for the free technology, the teachers were not necessarily as eager or optimistic. During this period Sandholtz, Ringstaff and Dwyer found that the implementation of computers in the classroom was a gradual process contingent on the comfort level of the teachers toward technology itself. While some hurdles such as teacher comfort level or varying degrees of teacher usage were discovered, the ACOT study showed a correlation between the use of technology and improved student writing skills, thereby establishing a foothold for the computers in classrooms (Rosenfeld & Martinez-Pons).

As technology continued to advance, Microsoft followed with its own version of a one-to-one access program in the late 1990's. Microsoft's Anytime Anywhere Learning

(AAL) project provided pilot schools with classroom laptops for students. The reported findings from the AAL indicated increased enthusiasm for teaching and learning, improved writing skills, increased skills in usage of technology, and a shift toward constructivist teaching (Donovan, Hartley & Strudler, 2007). Follow up studies in 2005 by both Apple and Microsoft reported similar findings. Cuban (2001) and Penuel (2006) question some of the findings of Apple and Microsoft based on the possible conflict of interest associated between the educational benefits to students versus the profit margins for company stockholders.

A plethora of technological devices and programs continue to be introduced into schools across the country (Vinograd, & Klemick, 2007). Handheld computing devices, interactive white boards, digital cameras and camcorders, digital scanners, fax machines, Web cams, podcasts, wireless networks, and others have all found their way into the classrooms with varied rates of success. The number of programs geared specifically toward elementary and secondary classroom use is staggering. Cuban (2001) suggests that newer, better, and more costly forms of technology are presented to schools in a similar fashion that breakfast cereals are marketed to children during Saturday morning programming; more hype than actual benefits. Cuban cautions school leaders to look to long term empirical studies before adopting the latest forms of technology. Unfortunately, the rapid pace of technological advances limits the availability of such studies due to the fact that before the long term studies can be completed the technology has been replaced with the next generation of devises.

While limited data may exist addressing actual improvements to learning though the use of particular types of technology, that is not to say there is a limited amount of

data available on the amount of technology in schools. Beginning with data collected from the ACOT study in the 1980's, technology data continues to be collected covering a wide range of technological topics. Findings such as the students-to-computer ratio changes over the years, total numbers of computers in the school, access to technology by grade level, number of states offering on-line assessments, hours of the school day students use educational technology, types of technology available, and many other sets of data are compiled yearly (Vinograd, & Klemick, 2007). While a vast array of data on technology and schools has been collected, D'Angelo and Woosley, in their study, *Technology in the Classroom: Friend or Foe* (2007), warn that some of these findings can be misleading. For example, they point out that the student-to-computer ratios are given as an indicator of computer usage in schools when in fact having computers and using computers are two entirely different things. Having a low student-to-computer ratio per se does not assure a high level of usage. Cuban (2001) states that there are a lot of computers in schools that become obsolete without ever being used.

<center>Teacher and Classroom Technology Usage</center>

Having technology available and using it are two different concepts. Many conditions must be met before computers in schools are actually used. At home, one has only to plug in and turn on the device in order to use it. That is not the case for schools. Scheduling usage times, logistics and space, electrical and internet connections, site-licenses for software, state mandated technology user agreements, firewalls and other online safety concerns, and teacher training must all be addressed before students are allowed to use the machines in schools.

Numerous studies have been conducted to determine which factors influence teacher and student usage. One of the factors affecting the usage of technology in the classroom is a teacher's personal disposition toward technology (Vannatta & Fordham, 2004). Regardless of the length of training, directives by administrators, or mandates by the state or federal government, without certain personal characteristics held by the classroom teachers, there will be limited usages of the technology (Dupagne & Krendl, 1992; Marcinkiewicz, 1994; Milbrath & Kinzie, 2000; Sugar, Crawley & Fine, 2004). Teachers' philosophy on classroom structure, teacher-centered versus student-centered, is a major factor in technology usage (Honey & Moeller, 1990). Albion (1999) reports that teachers' beliefs about their own self-efficacy is an important and measurable factor influencing technology integration into the classroom. In the study by Vannatta and Fordham (2004), teachers were evaluated based on the length of technology training time and their actual usage of the different devices within their classroom. The most common factor found in teachers that did or did not use the technology in their classroom, had less to do with the time of formal training and more to do with the time commitment given to lesson preparation, willingness to take risks, openness to change, and self confidence. Technology training is important but not necessarily central.

This is not to day that teachers' professional development or training is not an important factor for classroom usage of technology. Those receiving the greatest amount of training were indeed more likely to use the technology as their self-confidence and knowledge increased (Albion, 1999). Teachers still believed that incorporating new technology into the classroom required a great deal of suitable training, as well as administrative and technical support (ChanLin, 2003).

The opportunity to work with other teachers to collaborate and reflect on the different possibilities for technology in the classroom is another contributing factor for usage. Burns (2002) focused on the importance of allowing teachers to work through their difficulties with technology issues through conversations and interactions with peers experiencing the same problems and having similar questions. The sharing of ideas for technology usage though interdisciplinary team planning and discussion helps teachers work through some of their common problems and issues (Burns). A similar collaboration among peers in addressing problems of any type can be seen in IBI.

In a study conducted by ChanLin (2005), four areas were identified as contributing factors to technology usage in the classroom: social interactions, curriculum, environmental, and interest and experience. The social impact focused on the influences of one's social world which included peers' and authoritarian support, students' attitudes, and local stakeholders' views on technology in general. Curriculum concerns covered a range of items from objectives and skills to be assessed to the basic questions about how well technology lends itself to a particular subject matter. Student access to computers, budget constraints, and time allotted for computer usage by students were some of the listed environmental factors. And lastly, the personal experience, interest, and actual usage level of technology in one's home and workplace were additional factors to successful classroom integration.

Beeson and Strange (2003) and Ingersoll (2004) have indicated that a school's location, rural or urban, should be considered when looking at technology availability and usage in schools. Rural schools, schools in towns with populations of less than 25,000, face an additional burden of limited finances, which can greatly limit the number of

computers available. Ingersoll indicated that smaller schools must dedicate their already limited funds to areas which are not such factors in larger districts of the city or suburban settings. The rural/small district challenges of lower per capita income of residents, competitive teacher pay and recruiting difficulties, administrative costs, and additional transportation needs greatly limit the funds available to spend on computers and technology. Naturally, fewer computers will limit the availability to the students.

While the use of technology is common and popular in the U.S., many parents have serious concerns when it comes to their children's use of technology outside of their homes and their direct control (Ingersoll, 2004). Parents list access to inappropriate materials on the internet as a major concern when addressing technology usage in the schools. Even though many states require schools to install safeguards to prevent such access and physically monitor students when using computers, these parental concerns for on-line safety still prevent some students from acquiring access to some forms of technology in schools.

<center>eMINTS Project</center>

Merging IBI with the increased use of technology in a student-centered classroom was an idea that needed developing. Although NCLB (2001) had not been fully developed at the time, many in education were aware of a growing need for increasing technology literacy skills in school-age children. One of the first such programs developed was the Missouri Instructional Networked Technologies (MINTs) project. This program's initial success was later extended to more schools and further developed into its present "enhanced" version or simply e-MINTS.

In 1997, a joint educational effort between Southwestern Bell, the Missouri Department of Elementary and Secondary Education, the University of Missouri, and the Missouri Research and Educational Network (MOREnet) developed and implemented a plan to place computers and other types of technology into six St. Louis County elementary school districts to begin measuring the effects of technology on education. The technology equipment included personal computers for students, an interactive demonstration board (SmartBoard®) connected to the teacher's computer, a digital camera, and high-speed access to the internet for all computers. Teachers were also provided an extensive training course covering both technology usages and inquiry-based teaching methods.

After being exposed to the technology and inquiry-based lessons during the entire school year, a variety of comparative measures between eMINTS and non-eMINTS students were collected. Early studies by Bickford, Hammer, McGinty, McKinley and Mitchell (2000) reported that the eMINTS students showed better rates of attendance, fewer discipline issues, more engaged students, and some gains in academic test scores than did non-eMINTS students. Tharp (2004, 2007) reported that successive eMINTS classrooms also exhibited a more positive classroom climate, better peer relations, more collaboration, and fewer discipline issues than did non-eMINTS classrooms of similar districts and age groups. Students in eMINTS classes exposed to a higher frequency of lessons that encouraged development of higher level thinking skills such as evaluation, analysis, and synthesis showed more growth in these skills than did non-eMINTS students (Tharp).

The reported success of the eMINTS program has attracted the attention of schools across the country and overseas. Data from the eMINTS National Center (2008) reports usage expansion from the thirteen original classrooms in St. Louis, Missouri, in 1997 to over two thousand classrooms in eleven states. In February of 2008, eMINTS training was provided to teachers from Sydney, Australia, and Dubbo, New South Wales, with plans for immediate implementation.

It was the belief of the teachers in the Bickford study (2000) that the strength and success of the eMINTS program were more a result of the IBI rather than the use of technology. However, it was expressed that neither one was independent of each other but rather intertwined. Teachers and students simply use the tools of technology to accomplish the IBI.

Even when given a sound instructional method, a well trained teacher and a well equipped classroom, there is no guarantee that the desired or expected results will transpire. Schools have many obstacles to overcome when they encounter change. The next section will review research on organizational change and the challenges associated.

School Change

Schools are in the business of change. They strive to change the knowledge content and levels of students. Schools teach new skills, broaden perspectives, introduce new ideas, authors, and concepts and even help change poor nutrition and health habits for their students. Education is change. And yet, when schools themselves attempt to change their structure, philosophy, or practices they often fail.

The research on school change is extensive. Louis, Toole and Hargreaves (1999) state that between 1930 and 1950 over two hundred empirical studies were conducted on

school adaptations and change. Conclusions from studies during this period revealed that change occurring in schools is a very slow process often taking decades to implement, schools vary greatly in their willingness to adopt change, new innovations are frequently brought about by special interest groups within and outside the school, and schools typically bring in new ideas through organizational processes rather than from individual decisions.

School change research of the 1960's and 70's focused on goal-directed strategies, how to accomplish goals and initiatives and how schools differ in their willingness to adopt these new initiatives (Louis, et al., 1999). This period of study on school change looked at those schools that chose to implement change and how they differed from schools that resisted such changes. The 1980's school change researchers directed their efforts on identifying the characteristics of "effective" schools, while the 1990's addressed the issue of why school change continued to be sluggish at best. "Research has taught us that the problem of change is much deeper than the adoptions of new innovations" (Louis, Toole and Hargreaves, 1999, p. 254). The involvement of school leadership is currently the area of interest as related to school change. What is the role of leadership in school change?

Davis (2003) calls upon schools to ask themselves several questions when addressing change. From where is the suggestion coming? Why has this change been initiated? To what extent will the change be taking place? What is the expected outcome? Who will benefit? Many suggestions for change come from outside the schools (Cuban, 2001; Louis, Toole & Hargreaves (1999); Davis). Whether these suggestions for school change are intended to increase student learning or some other purpose is debatable;

however, as these authors indicate, schools should carefully study proposed changes to better understand their true implications.

Like all campaigns of any type, school change is more likely to be successful if there is some plan of action in place (Schlechty, 2000). Asking and attempting to answer some of the questions posed by Davis (2003) and others can help to direct the change initiative. Planning for changes can be further aided with the use of organizational frames. These frames are simple mental pictures used to help planners consider different components of organizations (structure, human resources, finances, etc.) that will be affected by the change. While there is no one perfect frame from which to view and plan a change, the use of frames can help the organization better understand the interrelationships between the components of the organization that must be considered and thus make plans accordingly (Louis, Toole and Hargreaves, 1999).

The use of metaphors has been applied to frames to better understand them. Brain, legislature, organism, fire, and tribe are but some of the metaphors used to attempt to illustrate similarities between complex organizations and easily recognizable objects. Bolman and Deal (1997) summarize these frames into four general areas in need of consideration when attempting organizational change: structures, politics, people, and culture. Failing to consider any one of these major areas can greatly reduce the chances for full, long lasting change to occur (Bolman & Deal; Louis et al; Schlechty).

While frames assist with how one perceives or views a change, change theories and models help to understand, pinpoint the issue, and move the process forward. Change theories focus on the component or components that are most directly involved with the planned change. Some changes are directed by individuals within the organization. The

"teleological" change theory suggests that a leader, change agents, or visionary is vital to the process of change. Sometimes referred to as "planned change," "rational change," "scientific management," and "continuous quality improvement," these theories express the ideas that change is a linear process that is driven by a single leader or small group. This group of theories suggests that a leader can help guide the process of change through a logical step-by-step journey.

Other change theories indicate that change is a natural process that will occur regardless of the actions of individuals within the organization. Described by Davis (2003) as "life-cycle," or "evolutional," these theories indicate that organizations change over time due to somewhat uncontrollable factors such as time and cultural needs or desires. While the teleological theory views change as a linear process, these theories pose the idea of change as a more cyclical event.

Another group of change theories focuses on the interaction among people and ideas. The "dialectic," "social cognition," and "cultural" theories address the relationships between people on opposing sides of change and the social and cultural factors one might encounter when promoting a change. This may be one of the more difficult types of changes to encounter as societal or cultural values are deeply entrenched and frequently resist change (Fullan, 1999; 2002).

Change models suggest how to undertake the process of change (Davis, 2003). As one might expect, the change models somewhat mirror the theories in their attention to a particular driving force of the change. For example, the "developmental phase" model gives suggestions of how to proceed if one were to encounter the "life-cycle" or "evolutional" types of changes; whereas the "right people" model may be of use for the

types of issues found in the "theological" theory. However, since change is rarely single facetted, many models have been developed to help address multiple factors. The "four levers" and "comprehensive" models were developed to consider the power, social, human, and leadership issues that all play a part in change.

There are a myriad of reasons that school change fails to take place. Davis (2003) wrote of the need to address planning and types of change envisioned. Schlechty (2000) and Fullan (2002) spoke of the importance of leadership. Hanson (2001) spoke on institutionalism and Cuban (1990, 2001) on the political and cultural influences of change. These areas and many others are but some of the potential sources of struggle, or even failure, encountered during school change. The extreme complexity of schools makes change much more difficult for them than for many other organizations. The expanded web of control found in schools: state and federal legislation, local school boards, superintendents and building administrators, parents, local and national culture, the business world, teachers, and a hundred years of tradition add up to real hurdles for attempted changes in schools (Fullan, 1996, Hanson, 2001).

In his article, *Institutional Theory and Educational Change*, Hanson (2001) makes a strong argument that schools have become so entrenched in the tradition of school, trying to maintain a public sense of legitimacy and coming under fire from other schools to remain within a narrow band of conformity, that schools struggle with actual change. "Institutional theory represents a body of thought that identifies, emphasizes and explores the forces that constrain organizations from changing" (Hanson, p. 653). Hanson uses the term isomorphism to describe the similarities found in all schools. Individual schools attempting real change act as a single unit and face the criticisms from fellow schools,

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because they dare to try something new. The proposed change is seen as a challenge to the legitimacy of the other schools.

This sense of isomorphism acts in a similar fashion, but in the opposite direction, as new practices are adopted en mass once the change is deemed beneficial. School districts scurry in their attempt to embrace the newest wave of educational innovation. This propensity to remain the same now finds many schools, rather than only a few, with practices or equipment that are soon forgotten. Cubin (2001) points to the influx of new technologies, cooperative learning, and block scheduling as examples of educational innovations that have entered schools at a frantic pace with questionable results.

Moving any organization toward change is a difficult process but particularly so when dealing with schools. Schools are traditionally institutions that strive to maintain a body of knowledge and pass on this knowledge from generation to generation. Any new knowledge or practice is scrutinized with great vigor before it is accepted. This intense scrutiny creates major challenges for those schools desiring change. Promoting change in schools can be assisted by the use of frames, understanding theories on change and avoiding the known pitfalls of change implementation. Knowledgeable leadership can help increase the odds of meaningful, long lasting change taking place in schools.

Organizational change is difficult at best. The change faces many sources of resistance: tradition and institutionalism, personal and group acceptance of the proposed change, structural and resource concerns, and leadership issues. The end result, however, seems untimely seem to be closely tied to the leadership involved. There are many positive aspects reported on the benefits of IBI, however, unless a leader or group of

leaders attends to a myriad of change resistance sources, IBI's chance of survival may be limited.

<center>Educational Leadership</center>

As stated, initiating successful change in school is challenging (Schlechty, 2000; Davis, 2003; Fullan, 2002). The number of considerations to be addressed when attempting such changes creates a great deal of potential turmoil. As Bolman and Deal (1997) indicated, the structural, political, cultural, and human resources components all play a vital role in any organizational change. Failure to address any one of these areas may limit the chances for success. An organizational leader who is knowledgeable about and experienced in leading change improves this chance of success.

Yukl (2002), Leithwood and Duke (1999) among others, have summarized various definitions and forms of leadership into at least six primary categories: instructional, transformative, moral, participative, managerial, and contingent leadership. Each of these types of leadership tends to concentrate on a particular aspect of the leadership role or takes advantage of some structure or process within the organization. The instructional leader is, as the term implies, concerned with the behaviors of instructors as they attempt to educate their students. The participative leader attempts to involve many stakeholders in the decision making process. The managerial leader is seeking the most effective and efficient methods, and the contingent leader responds to situations as they arise using the skills he or she possesses. Other forms of leadership focus on other personal trait or sense of direction but continue to be somewhat narrowly defined. While each of these styles may be well suited to a particular challenge, one might assume that the successful leader, however that may be defined, would be well

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advised to take the skills or traits found within each category and apply them when and where they are needed. Yukl (2002) suggests integration, using the best of each style when required depending on the situation.

The needs, structure, or setting of the organization would appear to be guiding forces in the development of these different leadership categories. Addressing the need of the organization seems particularly applicable with the style Leithwood and Duke label contingent, "…the focus of this approach is on how leaders respond to the unique organizational circumstances or problems that they face" (p. 54). The particular needs found within a transformation of instruction style, as with IBI, will need leaders that are willing to take risks, teachers that are willing to change, students and parents that are willing to try something new, and cooperation between them all. The transformation leader is reported to have the ability to bring others together for a common goal (Yukl, 20020).

Procedural, technological, and market changes are relatively simple to implement. Labeled "simple" not because they are without their own difficulties, but rather because they lack the challenge of the human factor; individual preferences, social or cultural differences, and philosophical variations. Deeper foundational changes to the missions or organizations, on the other hand, are not so simple. Changes involving creating values, restoring meaning or purpose, changing culture, or raising commitment to democratic ideas are assignments better suited to the transformational and moral leader (Leithwood & Duke, 1999) because of their ability to bring together the many groups and individuals needed to accomplish the goals. The goal of instructional change for student academic

improvement would appear to be a philosophical and fundamental change which could certainly be viewed as challenging.

Studies from Copland and Boatright (2006) and Portin, Alejano, Knapp and Marzolf (2006) expand the leadership categories of Yukl (1994) and Leithwood & Duke (1999) with the distributed leadership concept. This concept of leadership, as the title implies, suggests that groups of individuals, rather than a single individual, take on the role of leadership. Different areas and stages of the project may have different individuals in charge of some component. Copland and Boatright suggest that distributive leadership is "a collective activity [which] focuses on collective goals," "spans the task, responsibility and power boundaries between traditional defined organizational roles," and "rests on the base of expertise rather than hierarchical authority" (p. 13-14). The distributive leader attempts to give not only a voice to the many, but also the power to many. Critics have voiced concerns about this type of leadership when considering the rate of progress toward change due to the cumbersome process of leading by committee. While politically indulgent of all, the struggle for the end compromise is time consuming.

Regardless of the title, transformational (Yukl, 2002), contingent (Leithwood & Duke, 1999), or distributive (Copland & Boatright, 2006) a central goal of leadership is mission building and accomplishment of that mission. Hallinger and Heck (1999) reported that "mission-building is the strongest and most consistent avenue of influence school leaders use to influence student achievement" (p 179). Change oriented leaders must be able to develop a goal or mission as well as convince stakeholders that this goal is worthwhile. Articulating the change is just as important as its development. Clearly understood and accepted goals are vital to accomplish any organizational change. "One

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of the greatest barriers to school reform is the lack of a clear and compelling vision"
(Schlechty, 2000, p. 191). Without these clear visions, shared and accepted among others
within the organization, there is much less chance of the change being implemented
(Schlechty).

Even the best ideas encounter alternative viewpoints. Inquiry instruction is not
without its critics. Teachers, parents, and others may well have valid concerns with the
implementation of any new teaching method. These viewpoints should be listened to and
considered. The inclusion of many voices affected by change will inevitably bring some
degree of confrontation. However, Yukl (2002) and Davis (2003) suggest the use of
constructive disagreements as a method of looking at alternative solutions. "Conflict is an
unavoidable part of working together. Instead of seeing conflict as a barrier to learning,
or as a failure to establish relationships, dialogues incorporating different viewpoints
should be viewed as a method that pushes members to question existing premises"
(Preskill & Torres, 1999, p. 34).

The educational leader working to implement a new instructional method into the
system will be more likely to achieve the change working with other stakeholders to
develop a plan that is clearly stated and understood by all. Understanding the challenges
of change in general, as well as those found within a particular situation, should help
guide the school leader in his or her approach to implementing the change. Just as in
inquiry-based learning, not every solution to a single problem will look the same.

<p align="center">Summary</p>

The literature has indicated that IBI does accomplish improvement in student
academic performance on standardized tests, increases higher-order thinking skills, and

positively contributes in a variety of other ways to an individual's education (Budnitz,

2000; Bickford, et al., 2000). Inquiry instruction is based on the constructionist theory of

learning, as well as a consideration for the multiple intelligence concepts of different

abilities found in all people to guide its principles to teaching. A student-centered

approach to education is a hallmark of IBI. Knowledge of and consideration for teachers'

preferences for and against instructional practices, teacher knowledge and comfort levels

in the use of technology, examples of IBI, organizational change, and leadership theory in

organizations have all been discussed in this chapter to help the reader understand IBI

and how it may help meet the needs of educational requirements of the future.

Chapter 3: Research Methodology and Methods

As more schools across the country struggle to reach the goals of *No Child Left Behind* and their own state's testing legislation, educators are looking for alternative methods of instruction that will address the requirements of these mandates. IBI is a pedagogy that is reported to help students take a more active role in their education, develop higher-order thinking skills, and help students see relevance between present lessons and further goals (Rubin, 2005). IBI holds promise for improving student performance; however, without teachers willing to accept and adopt this instructional format, there may be limited success in its implementation. This study was undertaken to provide beneficial information about how schools address a change in instructional methods toward IBI, how school leaders can assist teachers with the undertaking of change in instructional practices, and how teachers themselves handle the change as well as their thoughts about the compatibility of IBI to specific areas of education.

Problem and Purpose Overview

Schools too frequently accept new and promising ideas about how to improve student academic performance, only to see the innovation quickly replaced as the next wave of "best practice" comes along (Cuban, 2001). Pressure from many sources for schools to improve student achievement would seem to influence school leaders to try almost any idea that comes their way. While superintendents, principals, and other school leaders tend to be the individuals making the decisions about which "best practice" to adopt, they are not generally the individuals which will be directly involved or affected. The teachers, and not school administrators, will be those that will be truly responsible

for putting these types of changes into practice, and therefore should have input in such decisions.

Few would argue that those most connected to or affected by a decision should be included in the decision making process (Seashore Louis et al., 1999). Studying the concerns, individual differences, and thoughts of teachers as they move to adopt a change in instructional methods should serve to alert school leaders about pending pitfalls associated with such changes and how to avoid them, increase the likelihood of implementation, and help guide other schools with future changes. Teachers' personal differences, levels of experience, comfort with using technology, school climate, and leadership all play a role in the implementation of new teaching methods. Investigating and learning from teachers, their thoughts, fears, and ideas about the adoption of IBI will be the overall purpose of this study. This study will be guided by the following research questions:

1. How do teachers trained in IBI integrate the new teaching methods into their classroom practices?

2. What factors influenced teachers' ability or willingness to implement IBI practices into their classrooms?

3. How can school leaders assist teachers in the implementation of the IBI methods?

Theory and Design

The type of theoretical framework the researcher brings to the study helps define and guide the type of study he or she will undertake (Merriam, 1998). The qualitative study attempts to determine generalities rather than testing specific theories or

hypothesis. Using the inductive approach to knowledge building, the qualitative projects enable researchers to apply their findings to a wide array of situations.

Understanding how individuals interpret their world is a fundamental philosophical assumption of the qualitative research. As discussed in Chapter 2, the constructivist theory suggests that each of us understands and perceives incoming data differently based on our prior experiences. The singular event of an instructional change will be viewed differently by each teacher. A "key philosophical assumption of qualitative research is based on the view that reality is constructed by individuals interacting with their social worlds. Qualitative researchers are interested in understanding the meaning people have constructed" (Merriam, 1998, p. 6).

Research Design

The phenomenological orientation of this qualitative research is intended to gain understanding about participants' insights to a particular phenomenon (Merriam, 1998). What do the district teachers think about the implementation of IBIs into their classroom practices? The phenomenologist researcher primarily uses in-depth, unstructured interview questions to collect his or her data. It is through these interviews that the researcher attempts to find common, meaningful experiences from the participants and integrates them into a "typical" experience. The lack of structure in the interview questions allows the participant to become involved in the direction of the study and thus arrive at the real heart of the matter and not some predetermined or biased assumptions the researcher may have dictated by guiding questions. Ms. Merriam writes, "The task of the phenomenologist, then, is to depict the essence or basic structure of experience." (p.16). As the district moves to adopt a change in instructional methods, an attempt will

be made by the researcher to better understand and report how those teachers involved react to the experience.

While the phenomenological study looks at some event, program, or action and attempts to interpret meaning from the participants' perspectives, a case study focuses on a specific set of individuals within a particular program or event and it attempts to find commonalities as discovered by the researcher. A broader source of data collection is used in the case study than in the phenomenological study. Researcher observations, related documents, and other artifacts are added to the interviews to gain a more "intensive, holistic description and analysis of a single unit or bonded system" (Merriam, p. 12). Case studies record and consider additional details about the context surrounding the case that may also play a factor in the findings. The historical, physical, social, and economic environments are hard to ignore and are important contributing factors in all experiences. The case study includes these factors in its findings.

This study on IBI implementation will use components of both the phenomenological and case study formats. The perspectives of the participants involved are extremely important and play a major role in the findings; however, the study's listed research questions focus on what factors affect teacher implementation, how administrators can help in the process, to what extent was IBI used after training, and compatibility of inquiry to general grade levels and academic disciplines. To address these questions, more data will be required other than simply the thoughts and reflections of the participants.

Methods of Data Collection

Qualitative methods are the predominant techniques used to collect data in this study. Existing demographic data will be used to provide contextual information about participants, the school, and district. Data will be collected through observations, district and participant developed artifacts, and in-depth interviews. Bogdan and Biklen (1998) and Creswell (1994) both wrote about the importance of the interview in gathering a wealth of "rich and descriptive" data from the participants to better understand a complex issue and gain a more holistic picture of what is really taking place. However, the final "design of a qualitative study is emergent and flexible, responsive to changing conditions of the study in progress" (Merriam, 1998 p. 8), and as such, adjustments in the path forward may be made during the project.

Selection of Teachers

A purposive sample was selected for this study as all teachers in the district will not initially work to implement IBI. Participant selection leaned heavily toward core subject teachers: math, science, language arts and social studies, as those subjects are required for all students. State academic achievement testing in these four areas was seen as an additional source of future data collections. An initial interest survey of teachers was used by the school administration, curriculum director, and technology coordinator to identify those teachers interested in participation in the IBI initiative. The final selection of eleven participants was made based on willingness to participate, discipline taught and grade level. The specific makeup of these teachers included; seven female and four male; three elementary, four middle school and four high school; experience

range from three to nineteen years with a 8.4 year average; and nine teachers from core academic areas one foreign language and one library media specialist.

All participating teachers received the fundamental philosophical components of IBI as well as knowledge about inquiry-lesson types, structure of lessons, evaluation, implementation, and use of the technology. Two different training models were offered to accommodate teachers' schedules and time commitments. One group of seven teachers received 250 hours of training over a two year period in both IBI and educational technology usage while the other group of four received only ninety hours. The longer training model included additional components such as web site construction, more elaborate multi-discipline curriculum development, and advanced instructions in a wider array of technology devices used in education. The shortened model offered less time on web page and web quest construction and less depth in the development of lesson plans and evaluation rubrics. While the extended hour teachers were required to construct their own web quests and web pages and more involved lessons, the other group only needed to be familiar with their usage. It was expected that teachers receiving the extended training would be able to instruct other teachers in these areas should the need arise, thus helping defray expenses of professional development for the district and accommodating the time commitment of all participants.

Teachers were each interviewed twice after they had completed their training using a set of open-ended questions designed to gain their perspective of the move toward IBI. The initial interviews consisted of asking teachers nine probing questions intending to help them organize their thoughts and focus on aspects of IBI. Each second interview was intended only for any follow up statements or comments the teachers wished to make

and for any clarification purposes. Sets of interviews were also conducted with the two district administrators and curriculum director to gain their insights into the implementation of IBI. These taped interviews were transcribed and coded both for identifying data and developing interpretative constructs.

Researcher's journaling and notes recorded observations of participants as they worked to implement IBI into their classrooms. These observations were used to corroborate the teachers' statements from the interviews. At least ten observation periods for each participating teacher were conducted to determine levels of implementation and apparent comfort level of teachers in the use of inquiry methods. The drop-in type observations varied in length from a few minutes to up to thirty minutes in duration, depending on the activity in which the class was engaged. Various days and times of the day were observed to gain a more true indication of implementation. Collection of teacher and district produced artifacts related to the study also helped to analyze the implementation process and determine levels of usage.

Selection of District

The Kit Carson School District was selected for this study for a variety of reasons. Kit Carson has a history of being involved with many innovative educational endeavors. This district was one of the original twenty-seven public high schools in Missouri designated as an "A+" school (State funding assistance for post secondary education), is a charter member in a central Missouri multi-school consortium (eighteen districts at present) for interactive television instruction between schools, one of the first schools in the country to implement the eMINTS and its inquiry-based instructional program district wide (K-12), and an original member of the MU Partnership for Educational Renewal

(collaboration between fourteen Missouri school districts and the University of Missouri for educational studies). The Kit Carson District is not afraid to try new and "out-of-the-box" teaching initiatives.

Along with a willingness to try new educational ideas, this district was also selected because of the connection with the researcher. As principal of the district for nine years, the researcher has access to a wide variety of documents and in-depth knowledge of the community, students, and staff. A weakness in such a relationship is that participants may be hesitant or evasive with their true thoughts and comments for fear of some type of reprisal for their honesty. Care was taken to limit bias in reporting as well as possible unreliable responses from teacher participants. Katz (1987) refers to this separation, or at least acknowledgment of possible prejudices, from the researcher and the study as *epoche*. Removing the "researcher's personal viewpoint in order to see the experience for itself" (Merriam, 1998, p. 158) will be required for there to be much validity in the finding.

The Kit Carson School District is located approximately twenty-five miles west of a major university town in central Missouri. The 2008-09 school year enrollment was 431 students in grades K-12. There are fewer than two percent ethnic minority students in the district, and a significant number of students receiving free or reduced food services, 66.9% school wide during the 2008-09 school year. Average daily attendance has remained consistent at around 94% (+/- 0.6) over the last five years. Approximately one-half of the students in the district reside inside the town of Carson or small nearby subdivisions, with the remaining students coming from small farm households nearby. Agriculture and a small number of local businesses account for a portion of the local tax

contributions with the larger percentage coming from families employed in surrounding communities.

The community of Carson has a rich history in its educational endeavors. Its first educational facility was constructed in 1832 where for "$1.00 per month a student would be instructed in Latin, philosophy, religion, mathematics, history and rhetoric" (Howard County Historical Society) . Student enrollment in this building grew to reach one hundred by 1848. Over the next forty-eight years, this building served the children of Carson until its closing in 1881.

The second school building opened its doors in 1882 with an enrollment of sixty-four students. By 1891, one hundred white students and seventy-six black students filled the rooms of the new Carson school. This second school building still stands and serves the present community as a small, church-affiliated education alternative to the public school. This building remained the pride of the town until 1938, at which time work was begun on the present day school building, which officially opened its doors in 1942. This massive native stone building was a product of the WPA (Works Progress Administration) work programs.

Over the years the district has continued to grow and expand its facilities for its students. An elementary building was added in 1964, a high school building renovation in 1984, addition of a middle school wing in 1999, addition of fine arts and vocational classrooms in 2003, and the latest renovation of the high school building in 2008 to modernize the heating/cooling systems and update electrical service to support the additional requirements of educational technology. Citizens of Carson have long believed

in the importance of educating all of its children, and the community still strongly supports education with their time and funding.

The Kit Carson district has a certified staff of fifty-one and an educational support staff of eight. Of the certified staff, twenty-seven hold advanced degrees. Years of district teaching experience range from one to twenty-eight years with an average of 7.3 years. The administrative staff consists of a superintendent, an elementary principal, grades K-5, and a middle/high school principal, grades 6-12.

Summary of Method

Data for this study were gathered using a variety of instruments, including pre-training demographic and technology skill level survey, in-depth open ended questions, and multiple classroom observations of teacher practices. Eleven teachers selected for participation and three school leaders each gave responses to nine questions (see Appendix A and B for initial questions) during their ninety minute interview. The teacher interviews were followed by similar questions asked of the three school leaders; superintendent, building principal, and curriculum director. A second set of short interview sessions asked any contextual or clarification questions about the first interviews after the transcription process was underway. No common questions were asked during the follow up interviews, but rather only specific questions asked of specific teachers about any gaps in the researcher's understanding of the participant's intent.

Merriam (1998) and Bogdan and Biklen (1998) suggest that qualitative research is a flowing and emerging process rather than a mechanical, step-by-step endeavor. Part of the qualitative process is the development of interpersonal relationships between researcher and participant. Without some degree of understanding and trust between the

interview partners, misunderstandings or lack of openness may produce less valid responses. While the researcher must ask their questions in a manner designed to lead the general direction of investigation, a participant's responses often moves to an area of more personally important and pressing concerns. It is the careful probing into these finer points of concerns of the participant that often reveals the most significant findings. Identifying and analyzing these crucial points help the researcher pull the underlying themes to the surface (Creswell, 1998). This insight into the personal experiences of the research participant places a great responsibility on the researcher to correctly identify and record their responses. Because of the narrative nature of the qualitative study it becomes absolutely essential for the one partner to accurately record the true experiences and thoughts of the other.

The brief demographic survey allowed the research to gather baseline information about the participants' levels of teaching experience, technology familiarity, and a self-reflection about their willingness to try new things. These data were used to help identify any personality traits that might influence the implementation process of IBI. Each teacher taking part in the study was visited a minimum of ten times over the course of a school semester to observe their use of the teaching method under review. The observation data collected helped to substantiate or refute what was relayed during the interviews or from the survey. Coding categories were developed and continually refined from all data sources to help identify commonalities and to guide follow-up questions.

<div align="center">Data Analysis</div>

The process of data analysis is nothing more than one's attempt to make sense of the information gathered based on logical and inductive reasoning. The vast collection of

data produced in qualitative studies must be arranged in a manner so that the researcher may easily locate needed components as well as identify emerging patterns. The initial level of analysis is that of a descriptive account of the event followed by the development of categories or themes found within the material. Analysis of such a large accumulation of data requires the researcher to combine the acts of collection and analysis at the same time. Waiting until after all data are collected before analysis begins will likely create holes in the study.

The triangulation component for this study was accomplished though the use of frequent classroom observations, demographic surveys, in-depth interviews, and district and classroom artifacts to help establish validity and reliability. The researcher was able to confirm or deny the statements from the teacher interviews about their reported used of IBI though classroom observations. Data from these observations were then subjected to researcher analysis, coded and included into the study. Teachers were also able to question and interact with the researcher during the entire study for questions, comments, and clarification from either party. Open coding of the data developed during the study was used to help break down, compare, and categorize the information (Bogdan & Biklen, 1998). The listed research questions guided the analysis process.

Strengths and Limitations

There are strengths and weaknesses within all studies. Their identification and acknowledgment are importation to give the study more credibility. The trustworthiness and the theoretical sensitivity are considered strong points of the study while researcher bias and the inability to generalize the findings were the identified weaknesses.

Trustworthiness. The validity of a study is the extent to which it measures what is really supposed to be measured. The trustworthiness of a qualitative study can be measured using several methods (Johnson, 2001). This study has used extended fieldwork, low inference descriptors, triangulation and participant feedback to obtain its trustworthiness.

The extended fieldwork was accomplished though the connected relationship between the researcher and the school district. An employee of the district, the researcher was continually interacting with participants. Ample time for interviewing and observation was never a factor. The ability to conduct observations frequently and at will allowed for a truer picture of what was actually happening in the classrooms of the participants. Easy access for both researcher to participants, and participants to researcher provided interaction time that may not have been possible with an outside researcher.

Low inference descriptors are accomplished through the use of verbatim, direct quotations from the participants from the interview periods. The findings in Chapter four are substantiated by the quotes from participants. Using direct quotes in this manner helps the interpretative validity (Johnson, 2001), by decreasing the occurrence of researcher opinions about what he or she thought was being conveyed. Through the collection of 'thick and rich' interview responses (Bogdan & Biklen, 1998), more accurate interpretations of data can be achieved.

Theoretical sensitivity. A researcher's ability to approach a study with few preconceived assumptions and remain open to the knowledge gained from collected data was discussed by Glaser as early as 1967 in his work on grounded theory of qualitative research. Because the qualitative study depends on data that is less concrete than one

might find in a quantitative study, the research is subject to the possibility of his or her interpretations of data which may be biased. Although it is only natural for researchers to come into a study with a certain point of view, conscious efforts toward objectivity and openness must be ongoing and monumental. In this particular case, any knowledge gained by the researcher and others should be gained from the teachers' perspectives and not that of the experiences of the researcher.

Researcher bias and subjectivity. Two areas of researcher bias are identified. The researcher's employment within the school district and his past teaching experience as a teacher could be seen as influential or even corruptive to the data collection. Even though the awareness of the theoretical sensitivity factor, it is unrealistic to assume that some degree of bias would not be possible, particularly in the qualitative study where so much of the data analysis is subjective. Because the researcher's use of a particular method of instruction in his teaching experience, the use of IBI could be viewed as either very beneficial and effective or frivolous and faddish. While continuous efforts were made to eliminate all researcher bias, some may questions the reality of ever accomplishing the task in any form of research.

<center>Summary</center>

Eleven teachers from a small, mid-Missouri school district participated in a phenomenological and case study qualitative research in an attempt to better understand the process of school change toward IBI. The purposeful school and teacher samples were chosen based on prior interest in alternative instruction methods, association with the e-MINTS program, and distribution of teaching experience, technology usage, grade level, and discipline area. Sources of data collection were demographic surveys, in depth

open-ended interviews with each participant, researcher observations, and artifact

collection. Analysis of collected data helped form generalized statements about teacher

perspectives of classroom instructional method changes.

Chapter 4: PRESENTATION OF DATA

Findings

Findings are presented based on the responses to the in-depth interviews, classroom observations, and demographic and pre-training technology usage survey. Findings are presented both chronologically and thematically to help the reader follow the process and identify commonalities and differences within the data. Three general findings in this study that will be discussed focus on the preparation and implementation process, the impact of IBI for students and teachers, and leadership interventions. This chapter will frame the data to prepare the reader for the discussion, conclusions, and implications to follow in chapter five.

Laying the Groundwork for Successful Change

The move toward IBI at the district level was a slow and emergent process. Identifying the specific problems associated with the district's educational issues, exploring alternatives options and then implementation was a challenge that would take careful planning and collaborative leadership. Without such planning and leadership, the chance for lasting change would be limited.

While the district had been meeting and exceeding state student academic testing requirements over the last several years, there were still concerns from teachers and parents about the overall increasing lack of effort on the part of some students. Additionally, the expectations and requirements associated with NCLB, as well as an increase in the district's recent dropout rate, was cause for concern. Increasing numbers of student classroom behaviors observed by teachers led them to believe that there was a

need for changing the approach educators should be taking to attract and hold the

attention and interest of their present students. These observations were particularly

noticeable with students at the high school level.

> I guess we were seeing more and more students not really engaged, not completing what they were doing, dropping out, not appearing interested, failing to see the relevance in what they were doing. Part of it I think, is just the difference in today's students. The whole cultural change. Not doing what authority figures say just because they say to do it. Now it's, "I need to know a good reason, or I'm not interested in doing what someone tells me just because." And that is just kind of the change in how students really are. And something we have to address, figure out how to deal with them. We can't pick who comes to school; we have to deal with the kids that show up. And what we have today, are people that question everything, and they want a good reason to do their work. They're not going to do it just because someone says to. (High school foreign language teacher)

For the most part, the lesson format of the majority of teachers in the district

followed the traditional lecture style of presentation. While the lecture and individualized

basic reinforcement activities were viewed as successful in their classrooms at one time,

teachers were questioning these types of instructional methods with their current students.

Conversations with teachers, parents, and students about the need to take action turned

into discussions about what was really needed in the elementary and secondary classroom

to help prepare the students for their futures in today's world. Several evening meetings

with stakeholders helped identify specific areas of concern and offered a wide range of

suggestions about how best to address the growing need for some kind of change.

> And then we met with the student councils in the middle school and high school. We listened to what the kids had to say. And it came down to, "we know what the work-world needs, we know what colleges are saying they need, we know what 21st century skills they need, we know what we are doing now and what our limitations are, and if we could just throw out everything being used now and recreate what we want the school environment to really look like." (Superintendent)

Using these stakeholder's sounding-board conversations and meetings, the district administrators started looking for remedies for these issues.

Diagnosis - Pinpointing the Area of Focus

The necessity of pinpointing a focus in an organizational change process seems only logical. However, many organizational change researchers have indicated that change initiatives often fail from lack of a clear direction (Schlechty, 2000; Davis, 2003). The perceived problems voiced by the stakeholders during the discussion period covered a wide variety of areas of potential solutions. Without a clearly understood and defined starting point, the search for the desired change in educational programs could have taken a great deal of time and effort, which may or may not have produced the desired results. In an area such as education, there are often many variables that contribute to the success, or lack, of student academic achievement. After considering and studying many of the possible options for school improvement, the leadership team considered bringing technology into the classroom in some fashion to be a step in the right direction. Making an informed decision about which path to take for instructional change helped the district to move ahead much faster and more efficiently. Once the focus on technology-enhanced instruction was agreed upon, far less time was spent discussing hypothetical problems and an endless list of possible solutions. Even though the final instructional method selected was different than what was initially chosen, the district believed that selecting a starting focus was extremely beneficial in the process. If nothing else, it allowed the district to investigate the many options available to educators as they strive to improve student achievement. The district looked at educational change as a journey, not a destination.

Two of the recurring points of these many stakeholder discussions were the need for increased usage of technology in the classroom and making lessons more relevant to what students needed and wanted to learn in today's world. Investigation into the use of classroom technology by the students being used throughout the state and country became the initial focus for the district. After a thorough internet and journal search into the many possibilities, the leadership team narrowed the choices to a couple of viable options. In part, these options were selected by considering factors of finance, timeframe, present personnel and building mechanical and electrical capabilities of the district.

The two programs identified by the leadership team as possible solutions for increasing technology-enhanced classroom instruction were the use of "hand-helds" and eMINTS. Both of these methods claim to provide increased student usage of classroom technology as well as improvements in classroom behaviors and academic achievements. The small "hand-held" computer-like devices are used by individual students for a variety of educational activities. These "hand-held" activities tend to be supplemental or enrichment in nature. The eMINTS program is a much more systemic program that uses the technology to implement a particular instructional methodology. Much more technology is required for the eMINTS program. Student computers, internet access, and interactive whiteboards were used with the eMINTS program to assist in the instruction. Both of these potential programs were investigated to determine the feasibility of such an introduction into the school.

While the more in-depth eMINTS program appeared potentially more beneficial overall, the initial capital outlay and extensive professional development required for such a large scale program in the small district appeared unattainable in the time frame

the district had given itself. The decision was made to introduce "hand-helds" into the 5th and 6th grade classrooms and to attempt a much scaled-down version of the eMINTS concept, with limited amounts of technology, in the two 4th grade classrooms. The 4th grade classrooms would be equipped with interactive white boards for teacher use, but would not be provided the more costly component suggested by eMINTS, the multiple student classroom computers and student access to the internet. Teachers were sent to various workshops for rudimentary instructions in the usage of both of the devices.

The interactive white-boards were predominately used by the teachers to attract the attention of their students with more appealing lesson presentation. The teachers were able to pull up material from the World Wide Web in the form of video clips, graphs, pictures, and informative material to display for the students on the interactive whiteboard. The hand-held devices were used by the students to read, write papers, practice math and spelling skills through games, and to some extent begin to use electronic computer files to store their work.

Technology Alone Was Not Enough

After one year in the classrooms, two major assessments were made about these two trial implementations. The first important finding of the classroom technology introduction was that the students were indeed more engaged in the lessons in a positive manner when using the various devices. Teachers reported fewer student discipline issues and more on-task behaviors when students were engaged with the technology. The other more important and glaring finding the district identified was that technology alone was not enough. There were no noticeable academic improvements reported by teachers through the use of the technology. Teachers, not the students, were using the interactive

whiteboards and were still the centers of the classroom giving information to students in much the same way that they always had. "Putting a new face on the old methods" (Middle school language arts). The "hand-helds" were also rather cumbersome in their usage because of their small size which made writing a challenge, were difficult to keep powered/charged, and limited in their applications because of the lack of programming available in "hand-held" format. Still believing that technology was at least a part of the solution, the district continued looking for other ideas which used classroom technology to keep students engaged while developing a more student centered learning environment and increasing student academic achievement.

Instruction with - not through technology. The leadership team took a step back to evaluate their progress. They were confident that they were at least moving in the right direction by incorporating technology into the classroom but also knew that they were missing a vital piece for addressing their educational goals. Suggestions coming from a statewide organization for educational renewal, a collaborative effort between the state university and several public schools in Missouri, led the district to further investigate the eMINTS concept as well as another new instructional method being used by a local university's medical school.

Both eMINTS and the university were using an instructional method called inquiry-based instruction (IBI) with reports of significant positive results. Visits to the university's medical school were sought for district teachers to observe IBI taking place. Not really knowing what to expect, a member of the leadership team contacted the university, explained their interest and was subsequently invited to come and observe IBI in action. An initial team of six district teachers spent several days observing and

recording the process of IBI at the university. Later, a group of four additional teachers

visited the university to witness the instructional method for themselves. Called Problem

Based Learning (PBL) by the university, a form of IBI, the district teachers were

impressed with the degree of motivation and self-driven efforts the medical students were

putting forth toward solving their problems. Rather than listening to lectures from doctors

or professors, the students were given "problems" to investigate and solve. Solving these

problems began by students locating relevant materials via the internet, textbooks, and

clinical diagnostic resources. Team members then took turns sharing their findings with

one another so that all would be able to gain knowledge located by any group member.

All of the medical students' actions were overseen by an instructor who acted more as a

monitor than a teacher, in that these instructors did not give resources or make many

comments beyond posing the occasional leading question. The district teachers became

very excited about what might be possible for their own students using this pedagogy and

were anxious to try it. They were almost immediately sold on the power of this pedagogy.

> I think it was really good for us to get to go watch the MU students do it.
> Because you had, I had a concept at first of just some kind of group work
> type activity. But when we got there and actually saw in person, how in-
> depth it was and just the knowledge those kids [university students] had
> gained in a matter of two or three days, it was really amazing. … The kids
> would be talking about it after class and things like that. To me, it seemed
> like a really good way to motivate kids and keep them involved even on
> some type of boring topic. They seemed to get more involved. (High
> school history)

Teachers' increased interest into this teaching method directed district leadership

to further investigate the concept of IBI at all grade levels. Further investigative visits to

other schools using IBI through the eMINTS program were arranged. These visits were

made to elementary schools, the primary target group of the eMINTS program, to witness

how IBI was being used at those grade levels. The reported success of the eMINTS program in the late 1990's in St. Louis, Missouri, was encouraging. The eMINTS program uses classroom technology, such as student computers, interactive whiteboards, the internet, and more, to help upper elementary students become more involved with their lessons. The reports of increased student engagement, decreased student discipline issues, as well as some academic advantages indicated by state test results helped draw attention to eMINTS and its use of IBI. Unfortunately, the significant start-up cost associated with the technology component of eMINTS makes it difficult for many districts to attempt this teaching strategy. Funding for such a program was an issue that would need to be addressed.

The district was interested in teaching methods that would improve student achievement and motivation across all grade levels and not simply in the primary grades where eMINTS had been used previously. If a district wide implementation of IBI was to take place, teachers at all grade levels would need to accept and work toward the goal. This requirement created an additional challenge. Convincing teachers of older students that this type of more active learning was not only possible, but beneficial to their students would also take some leadership intervention.

> I think that traditionally, because of age appropriateness of that type of learning and just the makeup of elementary programs in general, that they tend to lend themselves more towards a hands-on, actively engaged learning environment. In middle school, some of those hands-on concepts are also incorporated, but at the high school, it's just not so. One of the hardest things we had to do was to try to lead the content specialist, high school teacher, to see that even though their students were older, that active learning, when it occurs, is much more meaningful to their students and helps give them the ability to apply that knowledge later on. (Superintendent)

eMINTS and its concept of IBI uses a very hands-on active learning approach, which is something that school leadership believed was key to increase student involvement. Was the hands-on type of activities also applicable to older high school students as well? The district leadership thought it was.

Getting high school teachers to accept and even praise IBI was easily addressed through two interventions. First, the school leadership team arranged for peer-teacher interaction sessions so that teachers that had visited the university could share what they had seen with others that had not attended, and then by arranging additional visits to the university medical school so that more teachers could see firsthand that grade level was not a factor in the use or success of the IBI. No teacher that visited the different schools displaying their versions of IBI reacted negatively towards the concept of IBI, but instead indicated their interest in working with the distinct toward its implementation into their own classrooms.

The school leadership believed that teacher acceptance of IBI was a major and very important undertaking and were willing to spend the time and effort to obtain the support. Widespread stakeholder buy-in for any organizational change is vital. While the administration and leadership team was anxious to try this pedagogy, they were not the ones that would insure its use in the classrooms, the teachers were. Getting teacher acceptance for IBI acted as a signal for moving ahead with the next step in the process. The leadership team now moved on to teacher selection.

Choosing the Right People for Successful Implementation

As with any successful new change initiative, having the right people in the right positions is an essential component. Without these key people, even the best ideas can

fall by the wayside. The district leadership team recognized the importance of personnel and spent significant amounts of meeting time making sure that the right people would be included. Several key factors were considered when choosing their candidates for the IBI training: willingness to try new things, broad range of grade and discipline areas, high levels of self-confidence, and willing to accept the commitment.

The selection of teachers for the IBI training and initial implementation process was made predominately by a school leadership team comprised of the superintendent, building principals, technology coordinator, and curriculum director. This team met frequently to develop criteria that would be used for considering teachers for participation. Developing the criteria list prior to selection helped keep the focus on the implementation and use of IBI rather on other factors such as convenience or interpersonal relationships.

Acceptance of new ideas. One of the first, and perhaps the most important factor the team considered in their selection of teachers for the IBI implementation effort, was the teacher's willingness to accept change.

> Looking at people that were prepared to try doing new things. Not doing things simply because that was the way we always have done it. I think that is really important. Because I think when we really got started, going full force with inquiry based, we had a group of teachers who were really ready to take on the challenge. We didn't have to combat a lot of apathy on the part of the teachers, or teachers that were set in their ways, saying, "No, I've always done it this way, and I'm not going to do this". So I think that was the big thing. Putting together a staff that was prepared to change, was interested in change. (Curriculum director)

Teachers' length of experience sometime affects their willingness to try something new. While this may be true in some instances, the team did not give this stereotypic classification much credibility. Rather, administrator's knowledge of

teacher's performance and review and staff evaluation reports were used to help locate

individuals who were reported to frequently try new ideas or methods in their classroom.

The entire leadership team believed that teacher willingness to try new methods was the

foremost teacher characteristic needed for this project.

School-wide plans for implementation of IBI. Since implementation of IBI was

intended to be used district wide, teacher selection needed to provide broad coverage of

both grade level and subject matter. This wider range of teacher expertise could provide

an additional data collection source to gauge success or failure of the IBI project. Some

selection preference was given to teachers in the basic core subject areas (math, language

arts, science, and social studies) because of the added academic achievement

measurement that might be provided through the results of state testing scores. The final

elementary teacher selection was assisted by previous experience of some of the teachers

with the district's earlier efforts with classroom technology.

> We started with fourth grade at the elementary level because those
> teachers had already had quite a bit of technology experience because of
> the interactive white boards they already were trying out in their rooms.
> So we went with those two for sure. And then we thought the grade under
> them, third, would be good too because it would give the kids a little bit of
> knowledge about technology and the teaching method before they went
> full bore into it the following year. We wanted to kind of prepare them a
> little. (Elementary principal)

Teacher self-confidence. Being a strong, independent teacher was also a

requirement for selection. The leadership team did not want individuals that were afraid

to speak out, say "no", if they did not truly believe that something was working with the

process or with IBI in general. Again, since the teachers were the individuals that were

truly responsible for the IBI usage in their classroom, it was vital that their voices be

heard loud and clear. The district wanted true and accurate input from teachers and not

simply agreement because they thought that is what the administration wanted to hear. Additionally, the need for assisting successive groups of future trainees with their problems and questions would require teachers that were comfortable and confident at sharing with and teaching their peers. It was hoped that the initial set of teachers trained in IBI would also become important verbal advocates for the methodology.

Personal commitment to the cause. After lengthy informative sessions between the leadership team and perspective teachers, explaining the commitment required for training and later implementation into their classrooms, volunteers were requested. From a group of approximately fifteen volunteers, eleven teachers were selected. Because of the increased effort and commitment that would be required of teachers involved in this project, no selection was made without their expressed desire to become part of the process.

> And so the teachers sort of self-selected based on the inquiry mindset idea. And we let them decide if they wanted to make the commitment to the concept of inquiry and for the training ahead". (Superintendent)

Again, the importance of widespread buy-in for any new initiative is required for organizational change to take place (Davis, 2003; Fullan, 2002; Bolman & Deal, 1997). For the IBI implementation to be successful teachers needed to be willing to participate. If teachers were required, rather than asked, to take on additional duties and extended time commitments, there would be greater possibilities of disgruntled teachers which could translate into poor efforts on their part and thus questionable results with the IBI implementation process. The leadership team wanted to eliminate that variable, and therefore only accepted the volunteers. Final teacher selection for the initial training sessions included four males and seven females; three elementary, four middle school,

and four high school teachers. At the beginning of the IBI training period, participating

teacher classroom experience ranged from 3 to 19 years, with an average of 8.4 years.

IBI Training and Teacher Perception

The training in IBI consisted of two different models; one which required ninety

hours of instruction and the other, two hundred fifty hours. The two models were made

available in an attempt to allow for teacher's schedules and time commitment. These

professional development hours took place during summer, school, and after school

hours. The both models received the same lessons in IBI and differed only in the

extended training in technology, web-page construction, and lesson planning. Teachers

were paid a stipend for their training hours. Participating teachers were instructed by both

on-staff and outside instructors, each having undergone extensive IBI training

themselves. Teachers were able to quickly see how the instructional methods of IBI could

be used to increase the participation levels of students by making the lessons more

relevant to the needs of today's students.

Teachers were expected to gain the knowledge and begin using the IBI methods

as quickly as possible. The training lessons were presented in such a manner that allowed

teachers to develop and try lessons in their classrooms several times before their next

training period. This allowed teachers to learn IBI in small, incremental steps. The

opportunity to take what they had recently learned and apply it in their classrooms helped

teachers make any needed adjustments to their new lesson attempts, gave them a sense of

time requirement for those types of lesson, and helped them plan accordingly for future

lessons. After the long period of IBI professional development was completed, the

teachers were asked to reflect on their training experiences. It was hoped that information

gained from these questions could help refine the IBI training or other professional

development endeavors that may occur in the future.

Teacher responses about the overall training sessions were generally favorable.

I thought the e-MINTS and inquiry lessons did a really nice job of showing us how we could use technology to help kids learn better and not to just type papers or use excel or whatever. We can use it (technology) better in this internet age that we're in right now, and that our students are so attuned to and so excited about, that we can use that to help them learn the curriculum or lessons we want covered. (High school science)

I thought the training was useful because as a teacher you kind of get into a comfort zone of the way you like to teach. And if you can bring in new and fresh ideas to the lessons on a constant basis, you're going to see a better teacher. In that respect it was great. (High school social studies)

Yes, it was a lot of training, but good. And I felt that the training was good. The trainer would meet with us and we would learn something new about inquiry lessons or something about technology. And then within two weeks she (the trainer) would come back into the classroom to observe and I found that was a good opportunity to actually try and implement what we had learned. (Middle school language arts)

Teacher Training Pitfalls to Avoid

Once the school district had selected IBI as its base for student academic

improvement, they had hoped to produce a program that would fully encompass the

entire district. They believed that the concepts of IBI were beneficial and sound enough

educationally to be implemented at all grade levels and teachers. This implementation

would require that eventually all teachers be trained in the methodologies of IBI.

Knowing this, the leadership team hoped to continually improve the training process to

ensure it met the needs of teachers. Therefore, suggestions for training improvements

were continually solicited from current trainees. While the following suggestions for

training improvements were connected with the training for IBI, because of the

generalities in the nature of the suggestions for improvement, an argument could be made

that the suggestions could be applied to many teacher professional development situations, and particularly when any new instructional method was being introduced.

The majority of the training participants indicated that overall, the instruction they received in IBI was both beneficial and a good experience. However teachers were also able to come up with aspects of the training that they would prefer to see changed were they to begin anew. This section will report on the areas of training that were identified by the teachers as areas for improvement. The most frequent of these responses had to do with time periods for reflection and trying lessons out in their own classrooms, similarities in teaching assignments, and redundant time spent on basic-level technology instruction.

Time provided for teacher self-reflection. Teachers reported that they believed there was a need for more time in which to engage in group discussions or interactions and more personal reflection time. Being unfamiliar with a new concept such as IBI seemed to stress teachers with concerns about doing something "wrong." Opportunities to observe, try out lessons, and share thoughts with others going through similar experiences were not provided in their training schedules, at least not to the extent teachers would have liked.

Those responding to the time issues remarked:

I think it (training) was very useful but I felt it was also very rushed. I wish I had had more time. It was, "Here it is. This is what it can do." And then on the next training session we would be on to something else. I wished…I mean I had all of this information in front of me…a 3 ringed binder…full of all of this good useful information, but I didn't feel like I had time to implement it as much as I would have liked into my classroom. (High school language arts)

A little bit more time after instruction to be able to interact together would have been nice. After a lesson we didn't have time for any kind of a

debriefing period or time to share. Because we just didn't have time to talk to each other after the lesson, among ourselves. And maybe time for somebody else to show us a model or lesson they had used. We didn't really get much time to visit each other's classrooms or see the each other's work. That would have taken time out of our classes, would require getting a sub, so that was hard to do.
 (Middle school exploratory)

I would have liked to have seen more reflective time after the lesson was taught, maybe even with the whole group. If I could have watched some of my colleagues teach their lesson then maybe I could have gotten some ideas from them. But I never got to watch any of my colleagues. My trainer came in and watched me, but I didn't get to see any of the other teachers teaching their lessens of a similar type. (Middle school reading)

Peer collaboration opportunities. Several teachers suggested the need for some

type of participant group sessions outside of the instruction periods to help each other

with ideas, gain perspectives from other grade levels and subject matters, or just share

experiences about issues with the training or implementation process. They wanted

sessions interjected into the training where teachers did not actually move forward with

additional lessons but rather were given time where they could come together and discuss

and share what each one of them was doing in their classrooms with IBI.

I think having a support group would have helped, which we have implemented now, but at the beginning we did not have. We were just kind of doing things on our own. If we had had a group of teachers, a small group of teachers, we could bounce ideas off each other and help each other develop those lessons, and it would really help when you integrate different subjects. Because the viewpoints of the social studies or the math departments are so different from mine in science, and yet very valuable because you can pull ideas from other classes and make the lessons even more interesting, realistic, and valuable to the student by making them true life-like problems. I would think that having that support group at the very beginning would have been a big help. (High school science)

The inquiry based stuff, I think…I would have personally preferred, if somebody here knew what was going on before we started it all. But that would have been pretty hard, because I think we are one of the only high schools in the state that was doing it at that time. We were all sort of

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learning together at the time, which worked out really well for us, but we really weren't sure what we were doing. So we sort of learned together which was fine. (High school history)

We needed more collaborative, organized collaborative time. We had discussions sometimes, but I think it needed to be more organized with an agenda… so more organized collaborative time. (High school language arts)

Lack of common grade level training groups. A desire to have training group participation arranged by grade level was a predominate comment that came from the elementary teachers. These participants stated that they felt somewhat left out of discussions because of the grade level content examples that were most often used during the training sessions. The elementary teachers also had the perception that the instructor lacked understanding of their particular needs when dealing with the younger students.

I think it is kind of hard, because the trainer has high school students; she is a high school teacher. And while she helped a lot and worked well with us, I don't think she really understood what we needed, what our kids were like. So I think it was hard for her to really adapt the lessons for some of our lower age students. (Elementary 4th)

We were the only elementary, my grade partner and I; most of it was middle school and high school. So I kind of felt like we were on the outside, because they were dealing with other issues and needs. It's just different when you have such big differences in the age levels. (Elementary 3rd)

Well, I think it would have been nice to have it [training] more grade pr at least school level. Make it more appropriate for the different grade levels. I liked the collaborative times when we could all get together and share, because sometimes there were things some might be having trouble with that someone else in the group could help with. (Elementary 3rd)

Accounting for variations in technology skill levels. Another training issue had to do with varying levels of technology expertise. Some of the teachers with more technology experience were disappointed that so much of their time was spent on lessons with which they were already proficient. Better use of their time was desired. The other

side of the spectrum showed teachers with very limited skills and knowledge of technology and became frustrated when they could not keep up during the instruction time. As with all class make-ups there is always the challenge of meeting the needs of all students or teachers.

> The older teachers seemed to have trouble with the computers. I think we could have done a lot more had we…not necessarily skipped over some of that…but we could have reviewed it very quickly. (Middle school history)

> I know there was a session we did over digital cameras, and I know I got lost at the beginning of the training, and I know I didn't really get much out of that session. That is kind of just my fault. But I'm not sure how to correct that other than me saying, "Help" a little louder. (Middle school language arts)

> I think there were maybe some things I didn't need. But then looking at it from their perspectives, I can see where they needed to spend time on those areas. There is no one thing that you can teach everybody. We're all different. Part of it is maybe just an age factor. I am young enough that I grew up with computers for the most part. But you had some older teachers that were learning how to save documents. So we had a day on like saving, and files, and stuff like that and to me it was not beneficial at all. Kind of a waste of time. But other people in the same session were learning all kinds of stuff, because they needed the things we were being taught. But then again, I don't know how you solve that problem.
> (High school history)

> For some teachers a lot of the lessons were spent on learning the technology, which helps the kids learn of course, but some of the teachers had to be taught a lot of the things I learned in college or just because I was pretty good with computers already. We sent time on things I already knew. (Elementary)

The grouping of individuals of similar abilities or experiences would appear to be logical criteria for selecting participants for any professional development opportunities. The team leadership admitted that they did not consider this an overly critical factor when they selected the initial IBI training group. The team leadership now believes like grouping an important consideration and will be included in future training sessions.

Other suggestions made about components of the training the participants felt could have been done differently covered issues of timing of training (as in summer-time, after school, etc.), the pace of the lessons, too few specific examples of inquiry instruction, and more opportunity to visit other schools using IBI during the training period to see if the lessons the participants were constructing and using were on target with what others were doing.

When asked about their likes and dislikes of the training period in general, every one of the participants gave the training positive overall remarks. However, the number of constructive criticisms recorded would also indicate that not all of their time spent in training was positive. The overall tone of the responses to the question about changes in training were not strong or overly negative in nature but rather sincere suggestions about how the teachers thought the training would be more helpful for the next group of fellow teachers going through the training. All current participants knew that others on the school staff would be receiving the IBI training within the next few years and truly wanted to make their experiences more valuable.

<center>Impact of IBI on Instruction and Learning</center>

The purpose for the district's IBI efforts were not intended to simply inform teachers about classroom technology and IBI, but to actually implement the use of both into classrooms to improve student academic achievement. As should be the case with any educational initiative or change, the purpose should always be geared toward student improvement and development. Changing teacher practices to improve student performance is frequently a necessary step in accomplishing that goal. The impact of IBI on both teachers and students will be reviewed to help determine the degree of success of

the IBI implementation process. The most significant impacts of IBI on teachers and students are many and are listed below.

Changes in Teacher Practices with IBI

Once the IBI professional development was completed, teachers started implementing the newly gained knowledge into their classrooms and the district leadership team and study researcher began to monitor its use and effect. Part of the teachers' informal evaluation included looking how, and the degree to which teachers inserted what they had learned in the IBI training into their lessons. (Informal because only the eleven trained teachers were expected to know IBI methods and was used only in data collection.)

Impact assessment data were gathered through self-reported teacher responses during interview sessions as well as multiple classroom observations by the researcher. The relationship between the district and the researcher allowed for easy monitoring and evaluation of the implementation process. Both interviews and observations were conducted the fall semester following the completion of IBI professional development training. It was believed that an extended time period between training completion and classroom observations--about six months--would help give a truer picture of actual implementation. Would the teachers lose interest in the IBI methods shortly after training, or did they truly accept and work toward making them part of their teaching practices?

Increased and more in-depth technology use. Based on the pre-training surveys and interview responses, most of the teachers were limited in their knowledge and usage of classroom technology before the IBI training. All were familiar with and frequently used word processing, e-mail, and the internet. Many had limited experience with

PowerPoint presentations and data collection programs such as Excel or Numbers. Some teachers had been exposed to a few inquiry type instructional formats such as WebQuests and graphic organizers. Previous teacher use of classroom technology was limited. The two elementary teachers who had been working with the interactive whiteboards and two middle school teachers who had been involved with the "hand-held" devices did have some experience with classroom technology. Most others however, had very little or no experience using any student-centered and student-operated technology beyond the occasional visit to the school's computer lab. Up to this point, other than the "hand-helds," most technology was used by teachers as lesson presentation enhancement.

> I think before, it [technology] was mostly just to assist for myself. Like I might go home and look up lesson plans or create a PowerPoint for them to go through or even a Smart-notebook for them to follow in order to help the kids get going. So it was just more of me using it as a guide for myself versus them using it in class. So yeah, it was more for me than it was for the students. (Elementary)

> Well, I didn't use technology a whole lot in the classroom. I was one of those teachers that perhaps was ready to use technology a little more so than others, however, we didn't have a lot available, nor did we have training in how best to incorporate it. And at home I just had dial up so I had limited access to information for research, doing research on my own in order to get the things I needed for class. (Middle school social studies)

After the IBI professional development experiences, the teachers reported a significant change in the frequency and manner in which they used the classroom technology. Teachers indicated that they felt more willing to use the technology because they felt more confident with their own skills and knowledge level because of the extensive training. All teachers reported an increase in the usage of several forms of technology in class. The technology was now more often being used as a tool for student learning rather than to enhance or supplement the instructors' lessons.

Oh, Oh, yeah. I know a lot more than I did before. In some ways, I guess, when I went through the training I kind of felt like there was quite a bit I was familiar with in terms of technology. Like I already knew about PowerPoint, but there was a lot I didn't know about it. Like I didn't know you could do so much with it. That you could make it more interactive. I just thought of it as, you know, just a presentation format. (Elementary)

Yes they [students] use it [technology] a lot more and so do I. I'm a lot more comfortable with using it now. I think part of that is also just how long we have been using it as well as how much more we are using it. And I think a lot of the increased use now is because of us doing a lot more of the inquiry based lessons, because I think we have found out how easy it is to do. (Elementary)

Changes in instructional practices. Perhaps more important than the increased and types of classroom technology usage was the change in the instructional practices of the teachers toward IBI. Responses were overwhelmingly favorable about the use of IBI in their classes. All teachers indicated that the use of IBI in their classes was a major change after the training.

Prior to the IBI professional development, most teachers indicated that they conducted the traditional type of a teacher-centered class. The teachers were responsible for covering a large number of objectives in the curriculum and believed that the best way to accomplish this task was to give the students the information in the fastest, most straightforward method. In the traditional classroom setting, the lecture was seen to be the most efficient method of instruction delivery. These classrooms were much more teacher led and controlled. Students tended to be the more passive member of the didactic pairing.

Well, before the training, we would have gone over our objectives and that would have been teacher directed. You have a discussion of the concept, and then they would have had some sort of independent work that would give them some independent review of that concept. And probably, in the next day or two, I would have given them some sort of a quiz to see how they did, but for the most part it would have been independent seat

work after the lecture type lesson…. worksheets, something like that. (Middle school reading)

This type of response was consistent among most of the teachers participating in the IBI training. High school teachers tended to use teacher centered, lecture-based instruction to a much higher degree than the middle school teachers. Elementary teachers reported much less of the lecture method. They noted that with the younger students, lectures or conversations of more than a few minutes were not very productive, and they seldom used the lecture type of instruction. Shorter question and answer sessions were more commonly used by the elementary teachers.

After the IBI training period, teachers indicated a major shift toward increased use of IBI methods. As the teachers became more cognizant of their teaching methods, they were able to acknowledge their teacher-centered focus and worked to make adjustments toward the more student-centered one. When asked how often, and specifically how, teachers used the IBI methods in their classes, responses were consistently favorable toward its utilization. Teachers reported using inquiry-based lessons almost daily with a wide variety of activities.

> Oh, I mean, I'm very conscience of it. More than I ever was before the training. Well, I kind of think it is how I teach now. Now you're talking about inquiry? … I try not to stand up there and give them the…I mean lecture to them. I don't do that now very often at all. So, I mean is it some fancy big inquiry project? No. But some leading questions? I don't know, daily hopefully. (Elementary)

> Well, I think it is something you develop over time. I am trying it more and more as I go along, over time. Right now other than using the "big question" type of thing, I might use it once or twice a quarter. I think it is more the way you approach teaching, because I know I ask questions like that all the time now. So I think it is everyday or every lesson - questioning them and not just giving them answers. Continually posing that "big question" so that they are always thinking, looking for different

answers, coming up with their own solutions, things like that. (Elementary)

I would say at least three days a week. I mean they may be doing one inquiry-based problem, but it may take three or four days to finish. Yeah, I would say at least three days a week. (Middle school language arts)

Like I said, I probably use the whole philosophy of inquiry-based quite a bit. I like to use it in discussion and things like that as well, because I think you learn more from that style because you take ownership of the argument. (Middle school history)

Classroom observations after the training indicated that inquiry-based lessons were occurring in high numbers. No study related data of instructional methods were collected prior to the implementation process so an actual quantitative comparison is difficult. Only teacher self-reporting, district teacher evaluation reports, and observations could suggest any changes in instructional practices.

Elementary teachers appeared to have a different concept and took a different approach in the application of IBI. Their concept of IBI focused more on the use of probing questions with their students in all subject matters rather than the more activity-based concept of the upper grade teachers. The term "big question" was used by each of the elementary teachers during the interview periods, and the process of posing questions to the class was recorded many times by the researcher during the observation period. The teachers of older students, however, appear to look at IBI as more of a problem solving exercise where students investigate, compile, rationalize and scrutinize their findings, and then try to develop a new schema from the knowledge. The older students are then expected to produce an end-product or solution that represents their final position on the subject.

The high school and middle school teachers seemed to have a preference for the longer, multi-part exercises that required a great deal of independent work on the part of the student or groups, while the elementary teachers generally viewed IBI as the much shorter, less involved activities, commonly only requiring the students to think about and answer open-ended questions. The central process of asking key questions are strong starting points in both perceptions, only the degree of involvement seems to be the major differing factor. This difference in the perception of IBI raises the question of grade level compatibility and preference in the use of IBI and will be discussed in the final chapter.

The first set of classroom observations occurred during the last weeks of September, shortly after the start of the school year, with the second round of observations taking place in November and early December, toward the end of the semester. Observations were all made unannounced; however, teachers were informed that the classroom visits would be made during this general period. Different days and hours during the day were selected for each teacher observation to gain a more accurate picture of the use of IBI by the teacher.

Early during the observation period it was clear that the philosophy of IBI was well practiced in the teaching activities of each of the participants, particularly so in the elementary classrooms through the use of extensive questioning. While questioning of students for understanding and comprehension has always been used at all levels of education, the frequency and required justification for student answers was noticeably different in the teachers using IBI. Elementary classroom lessons in reading, math, and writing all contained frequent use of open-ended questioning. Students were asked the question, time was given by the teacher for all students to formulate their answer, and

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then the teacher would call on a student to share their thoughts. After the student's answer was conveyed to the rest of the class, the teacher would either ask the student to justify his or her answer or ask others whether they agreed or disagreed with the statement. This more in-depth questioning appeared to require the students to really think about their answer before they raised their hands, because they knew they would need to defend their answers. Higher order thinking skills, such as evaluation and analysis, are reported to be strengthened through the use of altered questioning techniques (Budnitz, 2000; Koufetta-Menicous & Scaife, 2000; McGregor & Gunter, 2001). The teachers expressed their belief that students were indeed improving their higher-order thinking skills though this more in-depth questioning format.

A wide range of classroom activities was simultaneously taking place during a large number of elementary observations. A strong reliance on a variety of classroom technology usage was noted. The interactive whiteboard was used during the vast majority of the observations for giving students written instructions, helping students keep track of their time, assignment of groups, as well as direct usage in the lesson. These multiple activities taking place simultaneously gave the appearance of a much more independent classroom. Individual or small groups of students were frequently working independently on computers with a variety of tasks: reading, listening to stories with headphones, looking up information about the topic, and other enrichment activities.

During the September observations at the high and middle school levels, a mixture of inquiry type activities was viewed but with less frequency than was being observed in the elementary classes. There were fewer open-ended questions being asked in the high school classes, and when questions were posed, they seemed to require a

simple, more straightforward answer. Early observations of fewer IBI lessons being used at the high school level raised the question of teachers who were comfortable with the traditional lecture method of instruction having more difficulty moving toward IBI. Later observations and conversations with the high school teachers, however, dispelled that concern. High school teachers indicated that early in the year they tended to be more structured in order to establish the tone and expectations of the class. Observations in November and December noted that high school teachers used more IBI than any other form.

The middle school social studies teacher used many of the shorter, open-ended, multi-requirement lessons. Students were assigned to small groups, given a list of requirements needed for their activity as well as the related scoring guide, but few or no outcome expectations of what the final product should look like. Students were allowed a great deal of freedom in developing their own products. Technology usage in this classroom was frequent, but its use tended to be more teacher-centered. Strong and creative use of the interactive smart board was observed by the teacher. This classroom did not have a set of student computers in the room, but rather shared a set with the language arts classroom next door. The middle school language arts instructor was observed during September to use less inquiry-type lessons but more frequent usage of the computers for writing assignments.

High school classes during this period showed a similar type usage of both IBI and technology as was observed in the middle school classes; the open-ended inquiry-type assignments in social studies and fewer inquiry-type activities in the language arts classes. A notable difference between the middle and high school social studies classes

was the more frequent use of student computers at the upper grades. The high school social studies classrooms as well as the language arts classes each have a set of student computers located in the classrooms. The ready availability of computers for the upper levels may contribute to the more frequent usage.

Assessment. One of the more common challenges faced by teachers at all grade levels was the adjustment required with assessing and assigning grades for inquiry-based assignments. Traditional instructional practices generally look for a single specific response from all students. All students work independently, and the assessment of each student's work is then determined by some relationship to an expected answer. The closer the student's answer to the predetermined outcome, the better the assessment score. All students are expected to arrive at a single "correct" answer. This type of instruction may help perpetuate the concept of a single acceptable answer but does little to increase a student's ability to solve problems, be creative, or face challenges yet unknown. Inquiry-based instructional practices use a very different approach to learning and consequently a different approach to assessment. These different approaches to assessment of IBI lessons have created some difficulties in assigning student grades.

Challenges teachers faced assessing inquiry-based lessons dealt primarily with assigning individual grades for activities completed in pairs or groups and adjusting to the possibility of more than one acceptable outcome.

> Yeah, that is hard because a lot of that is subjective because you're working with a scoring guide. In a group, if someone doesn't do their job, I don't want to punish the others. So I would have to give grades for group work… Did they work together? Did they stay on task? And individual work grades, too. That is very tough. That is hard, yes. (Elementary)

> In the projects that I have had them do together, they all get a group grade for parts of it and I also assign individual grades. I looked to see if they

were participating when everyone else was working, too. In the discussions, how well did they understand it at the very end? Because most of the projects that I was involved in, I was looking for a basic concept being covered. (Middle school exploratory)

Developing grading rubrics for an assignment that required creativity, critical analysis of data, and teamwork differs greatly from grading lessons that require the reproduction of a commonly accepted answer or regurgitation of simple knowledge. Of all challenges teachers reported about using IBI, their most common concern was with assessment. Several of the professional development training hours for IBI concentrated on the assessment component but did not eliminate all of the teacher's questions or problems. Even after completing the implementation process, there are still difficulties with this component.

> I think one of the biggest challenges was how do we deal with grades. The whole idea of assessment, I know there is still a lot of transition in that area. We are not where I would like to see us with that. When you have "worksheets" or the more traditional type of lessons, answering questions from the book it was different, simpler. Now when you start assessing inquiry, cooperative, or group projects types you have to figure out, how I am going to assess this? Is there also going to be a test or not? And how that all works together and how do you create the scoring instruments for creativity and outside the box thinking? And assessing group work, it's always a problem with parents and students. I think that is probably the hardest part. If we didn't have to assess, it would all be a piece of cake. Yes, I think that is by far the hardest part, and we have had some encounters with parents over that issue. What does that mean, and this looks different from what I am use to seeing. And there is only one score in here for weeks and weeks instead of lots of small scores. (High school foreign language)

Lesson planning. High school teachers commented on an additional time requirement for lesson planning. These teachers reported spending larger periods of time preparing for IBI lessons than they normally would have needed using their traditional lecture-based method of instruction. The additional time requirement for lesson planning

was not reported by any elementary or middle school teachers. This difference may be accounted for by the methods of instruction commonly accepted at the different grade levels. Teachers of the middle and elementary grades already more often use activity type lessons than do the high school teachers. Since IBI requires more active participation by the students, for the elementary and middle school teachers it was often simply a matter of making minor adjustments to the previous lessons to make them more inquiry-based, while the teachers at the high school level, more lecture-based in their approach, had to frequently start completely over to develop inquiry-based lessons.

> I think developing the lessons and making sure the lessons were worth the time that it was going to take. Inquiry-based lessons, a lot of times, take a week or two to develop, they all don't have to take that long, but some do. We have some that may only take a day or a couple of days, but developing those lessons takes a long time to make sure they are worth spending your class time to do and to integrate different subject matter together in an interesting way, and where the students are going to get something out of it. And that they are going to be engaged in that particular assignment. (High school science)

> Learning how to write a good lesson is for me the most challenging. The University of Missouri told us that it took a long time to write a good lesson plan, and they were certainly right about that. A good lesson may take, I mean it might take two or three weeks to do in class for the student, but there is a lot of prep time to get to those two or three weeks, because for one, you don't really know where those kids are going to go with it. So you sort of have to work at keeping them on track. But then they may sort of branch out and find things that you had not expected, that you had not planned or explored, so it does take a little time to learn how to write the lesson to account for these things. But once you learn that, it's really beneficial; it just takes a lot of time. (High school social studies)

The amount of time high school teachers reported spending on lesson preparations for inquiry-based assignments seemed to them to be excessive. However, once these teachers were asked to compare the amount of time required to plan for a week's worth of IBI as compared to a week's worth of lecture-type lessons, teachers acknowledged that the

planning time requirements were actually quite similar. The difference being, that with inquiry-based lesson planning, all of the planning is developed at one time at the beginning of the lesson, whereas the traditional lecture method can spread the preparation out over several days as progress is made.

> It does seem to take a huge amount of time to put one together. It is a lot of work on the front end getting ready for it. But once you actually put it into play in the classroom….for several weeks, I'm more like sort of a fixture in the classroom. It is very, very student centered. And it was hard for me to sit or walk around there and not feel needed. (High school language arts)

> I have two lessons that are each a month long. Those took every bit of forty hours to prepare. But now as a teacher, I can pull that out, and I have my whole next month planned. But at the time it took a long time. But then you know, that's a really long lesson. You can do a one day lesson with inquiry-based in probably 20 to 30 minutes. (High school social studies)

> *Classroom character and control issues.* The transformation to IBI has caused

classrooms to become more student-centered, but not without some challenging adjustments by teachers. Teachers reported that "letting go" of classroom control and letting the students accept more responsibility has caused them great anxiety. Interestingly, there were distinct differences with this "control" issue at the different grade levels. The concern over classroom control was much more predominant at the elementary level and almost nonexistent at the high school level. Elementary teachers more often mentioned problems with keeping students focused on the objective when giving an open-ended assignment. Without very specific guidelines and close monitoring, the students sometimes ended up in totally different and unexpected areas. The students seemed to be unsure of what exactly was expected of them.

> Well, I would say with the little kids, I would say, it was knowing when to direct them, not letting them get very far off task before you have to

redirect them. They tend to get pretty frustrated if they get lost, and so they need to be guided a lot. Turning them loose and having them go on their own, some of them would go completely off task and some of them would maybe over time figure it out, that sort of thing. That was probably the hardest for me. (Elementary)

Observations of the lower grade levels did notice a great deal of teacher guidance taking place and answering many "how to" questions from the students when working on the inquiry lesson. One of the adjustments required with moving toward IBI was that teachers accept the role as facilitators of the learning process and not simple dispensers of knowledge. This was very difficult at the elementary level because the students lack of experience and maturity level. The younger students needed a great deal more teacher guidance and intervention than did the older students.

Middle school teachers expressed some concern over the connection between classroom control and covering their curriculum when using inquiry-based lessons. The more open-ended activities did not always accomplish what the teachers had intended. Because of the annual state testing requirements, teachers worried about making sure their students were prepared and did not always believe that they were accomplishing the curriculum objectives when students were involved with IBI. All of the core area middle school teachers remained focused on their curriculum objectives and struggled with relinquishing that total classroom control.

Letting go of some of the classroom control. I think as teachers, we often are very controlling. We have to come in, we have 50 minutes, we have to cover this, and we are very rigid. So letting go of that, seeing them drift off from where you want them to be. And giving them leading questions instead of giving them the answer has sometimes been…I have to bite my tongue…sit back and let them do that on their own. (Middle school language arts)

Impact of IBI on students

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No achievement data on student academic growth or improvement were gathered or analyzed. The underlying purpose of the IBI implementation process was, in part, to improve student academic performance, but this was not its only or initial focus. The district believed that if students would become more engaged with their leaning, then academic growth would naturally follow. True academic growth could be better assessed through more longitudinal studies that could and would be conducted later. Instead, increasing student engagement, stemming the dropout tends, and making lessons more relevant for the present students was what the leadership team hoped and expected to see.

Through their interview responses, there is little doubt that the teachers perceive IBI as beneficial to students. Every teacher easily listed several benefits gained by their students when using IBI. Increased positive peer interaction, more engaged students, development of problem solving skills, and more satisfied students through the use of IBIs are findings heard over and over from teachers at all grade levels.

> I think it is good for them to understand that they have to solve a problem by themselves sometimes. That it is not always going to be done for them. I think inquiry is good to use because it lets them see that there are resources out there to help solve problems by themselves sometimes, because you're not always going to have a teacher there telling you the answer. And that answer we give them today may not be the same in the future. (Elementary)

> Students are thinking. They're not bored. They're interacting; they're discovering things on their own. They're developing ideas and opinions of their own based on information that they have found or discovered, not what someone has told them. They are learning to use their brain. (Middle school reading)

> Students are more excited about their learning. I am not standing up in front telling them the answers. They are coming up with answers on their own, and I think it is more meaningful to them. (Elementary)

Student centered classrooms. The requirement for students to develop some type of solution product to address their lesson problem provided the opportunity for students to assume the central role in the classroom. Once the teacher had presented the students with the lesson problem, given the assessment requirements, and asked for any clarification questions, the teacher's role was dramatically limited.

> I often felt like a fly on the wall. Just there to watch the students as they went about their business of working on their assignment; asking each other questions, sharing ideas, bickering about which idea was better. It is at these times I worried about Mr. X [principal] coming in and might wonder what I was doing just walking around when the students were doing all of the work. But all in all, they really took to it. I felt somewhat unneeded. (Middle school social studies)

Students in classes that were involved in an inquiry-based lesson were commonly working independently or together in groups. While this did create the appearance of less order and a great deal more volume, teachers did not seem to object to the new class orientation once they adjusted to their new role of observer and keeping students on task.

> Over all I think they enjoy this arrangement. It really gives them a chance to work together on the project as well as learning how to get along with each other. There are some pretty strong-willed or opinionated students at this age and learning how to appropriately convince others that your idea is better than theirs is not easy, or always quiet. But at the same time those lessons are invaluable. I can tell you that although it may appear that I am less involved, it still takes all of my focus and efforts to make sure that they are all moving in the right directions. There are a lot of seemingly unrelated conversations at times, but I figure as long as they are getting their assignments done and done well, I can live with it. (High school language arts)

There were far fewer observations of elementary students taking on the central role in the classroom. The younger students were given some degree of choice and decisions about their lesson product, but it was much more limited than was observed with the older students. Teachers did not find success giving the elementary students too

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much say in the classroom activities. Their lack of knowledge and maturity were listed as being problematic when teachers tried to allow them more of the leadership role.

Lesson retention. While no specific achievement data were compiled on this question, the teacher participants used anecdotal observations for support of their claim of increased retention of the lesson when using inquiry-based methods. Teachers made the assumption that when students spent more time and put forth more effort on assignments that had meaning to them, the levels of retention of materials would increase. In their 2005 study of problem based learning and its affect on retention, Beers and Bowden did find a positive significant difference in the levels of retention when students were more involved with their lessons. The teachers' opinions about lesson retention would seem then to have some credence.

> Can I see more on-task behavior and more enthusiasm about doing the work? Yes, most definitely. And then, when you have more on-task behaviors and enthusiasm, then it's kind of a given that you're going to retain more. (Middle school language arts)

> But now they seem to remember, retain the knowledge, because they have to actually go find that information. And when they have to do it on their own, they have to put some kind of meaning to it, which is how they always told us how kids remember things anyway. So they assign meaning to this knowledge they're gaining because it's helping to solve the problem instead of just writing it down from the overhead or whatever I was doing, notes or read a section and answer some questions over that, because they're going to forget all of that after the test anyway. (High school social studies)

> So the things you spend more time with, and inquiry-based takes more time, and more effort, than you're going to tend to remember those things more. (MS Social Studies)

Increased student self-confidence. One of the unexpected benefits reported by teachers was the increased self-confidence students gained by using IBI. One middle school teacher thought that by giving students experiences with unfamiliar situations or

problems such as those used with IBI, they became more comfortable with new

experiences as well as developed skills which helped them to address unfamiliar

problems.

> You know one of the benefits is on the MAP (annual state) testing, where you cannot help them, can't answer their questions at all. By using inquiry all year long they have already kind of gotten used to that. They've already been given these big questions, these challenges that they have had to tackle on their own. So when they have to take the MAP test, and there is a question they don't understand or they don't know how to answer it, they have already been faced with that situation. And while they can't get on the internet and look up the question, they still have some expertise, some comfort level in dealing with things they don't know, problems they encounter. Knowing they can do it, they've done it throughout the year. Someone doesn't have to hold their hand… they have confidence. (Middle school language arts)

A similar response was given by a third grade teacher about the connection between IBI

and raising the confidence level of students. She replied;

> Yes, I think it does, especially even the little ones. Like when they get in there and they realize that they have the capability to solve a problem without an adult. I think that is huge for them, because they soon see that they don't always have to have someone looking over their shoulder to help them do something. You know, their thinking, "I can sit here and work this computer and I look around and find this answer by myself. And now I can stand up in front of the room and tell others what the answer is." You know I think it is a good for them to take ownership for their learning. And in that way, I think inquiry does help. I think it helps a lot. (Elementary)

> *Expression of individual skills and strengths.* One of the reported benefits of IBI

in general is that it advances the notion that no one single answer is a requirement.

Believing that there are alternative possible solutions to many problems, inquiry

assignments are structured so that they can be assessed on criteria that provide students

with opportunities for self-expression. Allowing students to use the skills and interests

they possess when working in a group to solve problems was seen as a major positive

from middle school teachers.

> I think in this type of situation everybody gets to show their own expertise or show what they are good at without that intimidation of, "Well, I don't have to read in class because I'm not good at that," or they don't have to do a math problem in front of others when they know they can't complete it. But if they are really good at art then they would naturally gravitate toward an art component of some project. Whatever they are good at, they get to do. (Middle school exploratory)

> Sure. Different kids learn different ways. Some children are more auditory, some are more tactile, more kinesthetic; they need to be up and moving, whatever. I think with inquiry you can have those different kinds of kids working together and then you get a better balanced final outcome. You get everyone's perspective. And they may all be a little different based on how you learn; if you're the auditory, or kinesthetic, creative or artistic person. (Middle school reading)

This aspect of IBI was reported to a much lesser degree from high school teachers and

not at all from elementary teachers. Observations in the high school classes did notice

much more artistic expression with drawings or writings than in the middle school but

little mention was made of this fact in the teacher interviews. It was noted during the

observations that those students creating the art work were quiet skilled and proud of

their contribution for the project. The high school teachers did remark that when group

lessons were assigned that required a creative or artistic component as part of the grading

rubric, those students with the artistic abilities were sought out by the less capable artists

in the room for their group assignments. One could perhaps make the argument that this

fact could also add to the growth in self-confidence for those students being recruited into

groups.

IBI Compatibility

Without question, the most common finding in this study dealt with teacher opinions and perceptions about the compatibility, or fit, of IBI to a particular grade level or discipline. The initial national introduction of eMINTS and its use of IBI were conducted at the third and fourth grade levels. Data collected during this time was focused on academic improvement and related components of student involvement and motivation. There was no stated indication found in the Bickford et.al. study (2000) of why the program was introduced at this grade level. An assumption could be made that a more self-contained, isolated test group, as one would commonly find in elementary classrooms, would provide more reliable data. Elementary students remain with a single teacher during most of the day for their instruction and would, therefore, limit the number of teacher variables one might encounter were they to conduct a similar study in a typical high school setting where many teachers are involved in the student's day. In the Bickford (2000) study, comparisons were made between classrooms of similar size and settings which did and did not use the eMINTS and IBI methods for comparisons. No data on the compatibility of IBI to grade level or discipline area was found in the Bickford or any other studies.

During the Kit Carson District's investigation phase into IBI, the majority of the fact-finding visits to other schools to view the use of this instructional method were to elementary classrooms. While the participant teachers were impressed with how the younger students were using the classroom technology, they were less impressed with the use of IBI being demonstrated. The only site visits made by district teachers where IBI was observed to any significant degree by older students, were the visits to the university's medical school. The visit to the medical school left a more positive

impression on middle and high school teachers about the use of IBI. "Yes, but I thought the university visit was probably more beneficial, because they actually did it with students that are at least a little more like our own [similar in age]. So they knew what to tell us." (High school social studies) "I thought that they [visits to the university] were very, very useful. Just to be able to talk to the professors and medical students, pick their brains." (High school science) Viewing IBI from two extremes, third graders and college students, gave the participating teachers wide perspectives of the instruction method and how they might best incorporate IBI into their individual classrooms but little insight into the issue of compatibility of the method.

Because of the district's complete coverage (K-12 grade levels) implementation plans for IBI, the teacher interviews produced many comments about their thoughts on the compatibility of this kind of instruction. While there were no specific questions posed to the teachers about the topic of compatibility, the majority of interviews did contain discussions about this matter. The later administrative interviews did ask a specific question concerning discipline or grade level application of IBI. Three general areas of compatibility were identified: grade level, subject matter, and characteristics of students.

Grade level. The grade level compatibility issue was common from each of the three grade divisions of teachers: elementary, middle school and high school. The comments and opinions of teachers about compatibility were typically directed toward the grade levels with which they taught, but the comments were generally consistent: IBI worked better at the upper levels. No teacher stated that they believed that IBI could not be used at any grade levels, only that the experienced-based, open-ended nature of IBI seemed to be better suited to older students.

The elementary teachers cited several reasons for their thoughts about the appropriateness, or inappropriateness, of IBI with the younger students. The lack of skills and knowledge about technology found in the younger students was noted as an issue. This specific concern was not viewed as an unachievable task for the younger students or even a waste of time, but rather the concern was with the requirement for additional time teaching students how to use the technology at the cost of decreasing time with curriculum objectives. An example previously cited indicated the spelling and other writing activities on the computers found students spending more time "hunting and pecking" for the correct keys than actually learning to spell the words or write. While the teacher did not view spelling as an inquiry-based lesson, she indicated that the issue of teaching the technology first and then the subject matter afterwards was always present and extended itself into other activities that were inquiry-based. Initial work with PowerPoint, internet searches, and graphic organizers all required a great deal of students' time learning to use the technology first before they could progress onto the actual curriculum objective.

Another frequently mentioned teacher concern with the use of IBI with younger students was the issue of their limited general knowledge base. The inquiry-based constructivist philosophy requires students to use their previously gained knowledge to search for and develop their own solutions to new situations. The limited experiences of younger students would naturally tend to narrow their perspectives when searching for and analyzing new data. This fact was a challenge for the teachers trying to implement IBI.

> I think it is the age group. Coming up with lessons using inquiry that they [elementary students] are able to do. But leading them to the answer

because they are not to that point. It's really cool that high school kids can do, like, "Here is your question, now come up with an answer." I mean you can't do that with my kids, it's just not… It would be neat if we could, but we can't, because they don't yet have the tools or knowledge to do it, to do a real search, and be safe, or even really to know if something is right or wrong. I think that is the biggest challenge, is the skill, academic level of the little ones. We have to lead and create a lot more. I do think it probably lends itself a little more to the higher grades…middle, high school area. (Elementary)

Middle school teachers also expressed some concern with the grade level compatibility issues but to a much lesser degree. Their comments were focused much more on the knowledge base issue rather than the technology skill level. Typically the middle school students were well versed and confident about their technology usage.

…and it sounds like, when you hear Mr. A and Mr. B [high school teachers] talking, it sounds really exciting, but in the middle school, I think it seems kind of limited in some ways. Because you can't do all the things that they [high school students] do. I wish you could. Because….just to try them even in the middle school you're somewhat limited as to what you can talk about. And like we talked about, the knowledge base. Like talking about somewhere in the world or even in the United States. They have trouble sometime understanding where or what you're talking about. And to go further into a discussion??…It's not like you're having an adult conversation. And I think that is probably the biggest disconnect between the groups [older and younger students]. Like when we talked to the med. school people…I mean that's all well and good, but when you have a bunch of thirteen year-olds in the classroom, it's not going to work as well. (Middle school social studies)

I would like to see it [IBI] used more, even in the primary grades. I know that there are a lot of basic skills they need to deal with, but I also feel that there are some inquiry types of lessons that they can use, and be encouraged to use more. (Middle school reading)

Even high school teachers could understand and perceive the issues with using the concept of IBI with younger students that they had not encountered themselves.

Some of those [WebQuest] I think work better for younger kids. As you get older, I really like just giving them a problem, and making them, giving them some sort of a timeline, and telling them, "you have to solve the problem," because then you're giving them some real world pressure

experiences because of the deadlines and things like that and not so much of a specific answer. (High school social studies)

Other grade level related comments about IBI included the extended time needed for these lessons with younger students and the maturity level when dealing with group assignments. The extended time factor for this type of instruction tended to increase as the grade level decreased. The additional time component when using IBI with the younger students was required because of the additional instructions and guidance needed for assignment completion. Keeping the students moving forward on their assignment was a significant challenge for some teachers, because the younger students were easily distracted when working in cooperative groups and sometimes became frustrated while hunting for web-based resources.

> And I think the other thing is the time that it takes to do all of this. If we didn't have the time frame to worry about it would be great, but we do… I have to get this done, and I have to get this done. I have a lot to cover, objectives and GLE's [Grade Level Expectations]. And if I spend too much time focused on this one WebQuest or something else, then I'm going to get behind. You know you have to set some short-term goals to get the students through them in a certain amount of time. Those are the two things I see, accountability and time. (Elementary)

> And then with middle school students, you put them in those groups and expect them not to talk. It's not going to happen. Keeping them on task and focused is a challenge at times. (Middle school language arts)

> Classroom management. If you are used to having them set in rows and having them working independently, then allowing them some freedom to talk and explore and maybe diverge from the task…that was a real challenge for me. (Middle school social studies)

> And it is harder for the teachers to make sure that everything is covered with the PBL, and that it ends up going in the right direction. Because if you're not careful, because it is pretty much student directed, it could end up going in a totally different direction than you planned. (Middle school exploratory)

Content area. Another question about suitability of IBI addressed its use within various disciplines. In general, teachers believed that IBIs could be utilized in any subject area; however, some disciplines appeared to work better than others. Teachers with classes or topics that allowed more flexibility in the solutions or answers reported using more inquiry-based lessons. Topics that were unfamiliar to students, which required them to search various resources to find answers or information, also seemed to work well with IBI. Science and social studies classes frequently use this form of instruction. The disciplines that required more fixed outcomes or answers, such as math or spelling or vocabulary building were reported to be more difficult with IBI.

> You know, spelling, sorry you just have to memorize the words, or at least the rules for the words. And yeah, we can teach you tricks for it, but you know you can't really get your hands in it [as in hands-on]. And with reading, sometimes it is just very hard to use technology and inquiry-based lessons for some things, but then in other areas it really works well and helps the kids learn better. (Elementary)

> Yes, some are a little more conducive to inquiry and some are a little less. Math would be much more of a challenge, but it is possible to do it in there with maybe some of your section projects and things of that nature where there is a little more application based. But I think science and communication arts are great. And of course social studies is a great avenue for IBI. And there are already a lot of resources out there in these areas. (Middle school social studies)

> Government, to me, works pretty well, because my course standards [curriculum requirements] just tell me what topics are supposed to be covered. I like politics well enough that I just sort of write the scenarios where we put the kids in these certain situations, and they're learning about government, democracy and all of those types of things. World history seems more difficult because it's a more factual type class. So you almost have to write those as a mystery type thing. And I haven't done a whole lot of those types yet. And I think math… it seems it would be probably the hardest one to do in the inquiry format. I mean, you can only write so many word problems, so basically you're still doing the same thing. (High school social studies)

It is interesting to note that while teachers did believe that some subjects were easier to apply the methods of IBI, there does not seem to be a consensus on which classes those may be. Some teachers felt it was not so much the subject matter that was incompatible with IBI but rather how the material was presented. Grabbing the attention of the students so that they wanted to become involved was the key rather than the topic. "The how, not what" as one high school teacher put it.

> I'm not sure it is so much the subject, but how you put them together. I find that the mystery and intrigue kind of approach is appealing to students. And that is the way I try to write mine, make it a mystery for the students to try and figure out. I think it kind of captures their attention. (High school science)

> Well, it is sort of like a mystery. It is more like a game for them. It's like a puzzle. You know I want to get on there and find out what this is all about, instead of someone just giving it to them. (Middle school language arts)

> I think that if you can relate it [the lesson] to a real world application or a real world activity, it's going to hit home with them a lot more. You know, we may get some kids that perhaps go into my particular subject area once they leave here, that are going to become scientific people, but most of them are not. So if you can relate that topic to how science is going to affect their daily lives, I think that they appreciate that a lot more, and they kind of understand things better later in their lives. (High school science)

Academic ability - student characteristic. During these discussions on compatibility of IBI with grade or subject matter, several teachers volunteered their views on groups of students that seemed to like or perform better using the inquiry method of instruction. There was a mixture of responses. Two teachers did indicate that they saw more production from lower achieving students when using inquiry methods, however, the majority of teachers indicated that they observed more aggravations or frustrations, at least initially, from the higher achieving students when using IBI.

> I always give my students a chance after a lesson is over to tell me what they think about it. For the most part, students really like them. I've done

them [IB lesson] for some time now, and I think I have had less than five kids complain about them. Generally, your really intelligent kids, the ones with good grades, don't initially like the idea of working in a group because they think they are going to be the one doing all the work. And they are also the ones that have grown up with the "right or wrong" answer style; they really care about their grades a lot. And when they don't see a right or wrong answer right off, they tend to get frustrated. Once again, that is real life training they need… sometimes there aren't right or wrong answers and things just happen. So I think that is really good for them, even though they don't like it at first. Some lesser achieving kids seem to get into this type of stuff because it is more "hands-on", they have a part in a group. And it's just surprising some of these kids have really done a good job with it. (High school social studies)

I think it is safe to say that it forces those gifted students to work outside of their safety zone. And I think that is difficult for them sometimes. But I think that it is good for them because most of them are going to go to college. And when they get to college, they are not….I'm not sure if pampered is quite the right word for it, but they are not going to have as much attention. They are not going to have a teacher where they can run to for every little this and that. So if we can get them to become even a little more critical thinkers and problem solvers now, I think they are going to be more successful, not only in college, but in the real world outside of the four walls of education. (High school foreign language)

For your middle of the road, or the lower level students, especially your lower level students, it gives them the opportunity to shine sometimes. To get in there and show their abilities. Now you're always going to have those students that don't do anything in the regular classroom, and they are not going to do anything with this, but those tend to be few and far between. I have found, on occasion, that a student has amazed me. Once a student has been given a task, and they feel important and validated, then they are all over it. (Middle school social studies)

The elementary teachers tended to see the opposite with their students. The higher achieving younger students were reported to be some of the more outgoing and confident students and enjoyed the IBI more than some others. Teachers believed it gave those students more opportunities to explore their leadership abilities.

Honestly… probably your higher level students like the inquiry more. Yeah, I think so. I don't know why exactly. I think maybe they are more excited about formulating their own ideas. The lower ones still want to be

told more. They seem to be scared of that "on your own" thing, but it does help them. (Elementary)

At first they are a little scared, because it is new and for so long they have been just told what to do by the time they get to us. I think at first they are a little afraid; they don't want to step away from the teacher always telling them what to do. And I think it is a little more work on our part to get them to build that confidence about doing things on their own. (Elementary)

Administration team viewpoints on compatibility. While the teachers were not directly asked about compatibility issues associated with inquiry-based instructional methods, after the topic was so frequently discussed during teacher interviews, the question seems pertinent. The school leaders were asked directly if they believed that IBI was better suited for a particular grade level or academic discipline. These comments, too, reflected the view that some use of inquiry instruction was applicable for most any grade level and subject matter, but did perceive a strong connection between this methodology and higher order thinking skills and, therefore, its application with the more mature students. Additional connections between IBI and the students' maturity levels, cognitive and social abilities, and relevance to post-secondary experiences were also noted by the school leadership.

…with the younger kids in the elementary, you can only do so much. I can see middle school and high school building more and more on inquiry. Especially with the problem based learning, PBLs. I think as the children get older they get to where they can do more of that kind of educational based activity. They have some foundation knowledge to work with, to be able to work on their own, figure things out on their own and they don't need to be spoon fed so much. And so it is easier to use inquiry I think with an older group. (Elementary principal)

In the middle school, I think it takes out some of that silly stuff they naturally get into, the social and adolescence stuff, and I think inquiry helps them focus better because they are oftentimes working in groups and so it gives them an opportunity to work on social stuff, but in a controlled, structured learning environment. And at high school I think what it does is

that it lets kids that may not be strong in the "book smart" type of lesson, and in the traditional methods of teaching, we make them feel like that are failures, where with inquiry, I think it gives them the means to use their creativity, their applications, their knowledge, and any time you can include an individual's skills into the structure of the lesson you're really helping those kids. (Superintendent)

The district curriculum director, which is more directly connected to students at all three grade levels, gave a more comprehensive expression of the suitability of inquiry to different groups.

I think it [IBI] probably is really geared for the higher order thinking skills, and with the additional level of responsibility I think it really is more geared for the high school, which is interesting because the whole idea of eMINTS and inquiry started in 3rd and 4th grade. And while I think there are some valuable inquiry things you can do at those levels, I still think … that they [younger students] are still doing a lot of skill building that they really need to be prepared to do the more inquiry-based types of lessons.

In the middle school they are beginning to learn about responsibility, and how they are responsible for their own learning. But they still have to be faceted with deadlines and models, and they have to be fed the project in much smaller chunks. They can't handle everything like in a three week project all at once. They can't make that leap. For them it has to be, "Today we want to accomplish this, tomorrow it is this." And then later start to stretch it out with, this week we need to get done to here or wherever. But as far as with, "Here is your problem, and go with it, figure out your own method, and everything to solve it," we certainly have not evolved to the point where middle school and elementary students are ready to do that.

Certainly there are higher-order thinking things that can be done with elementary students, to ask deeper questions. You know, asking questions that required students to do more than just give knowledge-based answers. But really taking on that whole inquiry type project, and once again, the teacher can easily do those cross disciplinary lessons in elementary, sometimes more easily than middle or high school because they teach all of the subjects, so there is no difficulty issues with collaboration with other teachers. But the teacher really has to scaffold the steps to it so the students can put the pieces together. (Curriculum director)

Teacher preference and the compatibility issue. One might raise a question about a connection between the teacher's personal preference with IBIs and comments they

made about its compatibility, stating they did not think the teaching method was

compatible simply because they did not personally care for IBI. This connection did not

seem likely based on the comments teachers made about both the benefits to students

when using this methodology as well as how much the teachers themselves enjoyed the

format.

> As a teacher, it's a lot more enjoyable than me just lecturing and spouting out information to them and hoping they are learning and memorizing. (High school science)

> Yes, but not only that I was more excited about it as a teacher. And I think when teacher is more excited about something, and the kids see that, and they too get more excited about it. Because it is a new way of teaching. It was exciting for me because I was no longer just sitting, standing in front of them and lecturing, giving them information all the time. (Elementary)

> I think, well as anyone that is a teacher knows, when you see students grasp the information that you're wanting them to attain, it is a major plus. It is also a much more enjoyable form of teaching from my viewpoint. You see the students "get it" a lot more often. (High school social studies)

Comments from administrators also indicated that they too noticed positive

attitudes from teachers, which would tend to support teacher enjoyment of the IBI.

> Yes, I saw the same thing in the high school as well. One of the things that I was most impressed with was our guys [male teachers], and coaches sitting around talking about lesson plans and projects they were trying instead of the ball scores or sports topics. It was really a little scary. (Curriculum coordinator)

> Yeah, and not only that but I have even seen middle school teachers over in the elementary building a lot more sharing with different grades about writing and reading that they were doing. Sharing ideas. (Superintendent)

> *Researcher's observations of compatibility.* Observations of compatibility issues

were difficult to assess because of the timing of the visits. Not all subjects were being

covered during the classroom visits in the elementary. Most of the observations of the

elementary class visits found the use of IBI in science and social studies projects.

Researching for relevant information, producing products using the classroom technology that illustrated their mastery of concept, and writing assignments were the most commonly observed inquiry-based activities for the younger students. A WebQuest activity was conducted with both 3rd grade classes in history. The most obvious and frequent used form of IBI at the elementary level was the continual open-ended questioning of the students in just about every lesson. Even while the students were being read to, the teachers were asking questions about the story and having students explain their thoughts and justifying their answers.

Since the middle school and high school are structured by subject matter, it was more obvious which classes were using inquiry lessons. The social studies teachers at both the middle and high schools were observed using IBI more frequently than other disciplines. These classes were observed using a variety of project-based activities where teachers gave students choices about their end products. The middle school activities were less tied to the use of technology and relied instead on student created artwork or craft-type products. High school students were highly dependent on the use of technology to find information and produce their product.

It was easy to witness the degree of assistance provided to students by their teachers. The middle school instructor was constantly interacting with students, guiding, keeping students on task, and giving suggestions when students asked. High school students were typically more self-directed and self-motivated. There were more off-task conversations with high school students; however, the older students seemed to be able to carry on these tangential conversations and still complete their lessons. Both age levels of

students were highly focused on their assignments and few incidents of non-cooperative students were observed.

Language arts and science classes incorporating IBI methods entailed the use of open-ended writing assignments, projects requiring the investigation of authors, scientists, genres or periods of literature, diseases or biological topics, productions of products associated with readings, mock interviews of authors/scientists or book characters in video or brochure formats, and reenactments of events with skits or storytelling. The language arts activities tended to be longer in duration than in science. This observation seemed to be related to the lengthier writing component required by the teacher. Some language arts activities lasted several days and weeks. These activities were not the sole activity for the period, but rather the students were given some time each day to advance their progress on that particular assignment. The longer assignments did appear to produce more off-task behaviors from the high school students. Foreign language, reading, and exploratory teachers were observed using the inquiry-type lessons less frequently.

In the views of the participating teachers, the use of IBI has some very beneficial attributes for students and teachers; however there would appear to also be some issues of compatibility between IBI to certain grades levels, discipline areas, and different types of students. No expectations were voiced at anytime by the leadership team or teachers that IBI should become the only method of instruction for the district. The intent expressed by both of these groups was to enhance the education of their students though more current and relevant lessons and technologies. If teachers learn the methods of IBI and include

this methodology as part of their teaching repertoire, then the leadership team would consider the change initiative toward IBI a success.

Dependence between Technology and IBI

One of the early questions raised by the district during the investigation period into IBI was the connection to technology. What types of technology, if any, were deemed necessary for this type of instruction and just how vital was it? Are IBI and technology mutually inclusive? The answers to these types of questions could be used by the Kit Carson District to help make decisions about technology needs and purchases. Other districts could also use the information when considering whether or not IBI was a methodology they might consider for their schools. Because of the financial challenge schools face in the acquisition of large amounts of technology, cost is always a factor. Could schools use IBI without large portions of their budgets going to technology? Grants available for eMINTS and other programs that supply schools with large amounts of classroom technology are limited. They are also highly competitive because of the significant boost this money gives districts trying to implement large scale technology programs. Grant awards of half a million dollars are relatively common for even the smallest of schools. While a large portion of some awards is restricted for use on inquiry or other professional development components, significant amounts are still left for acquiring technology. If the district was to eventually fully implement IBI into all classrooms, it was important to know which and how much technology was really required.

Teachers in the study were therefore asked for their perceptions on the connection between IBI methods and the need for technology. Was this type of instruction possible without technology?

> Yes, because you could use the books or other types of resources. Or even going to community leaders, experts in their fields, having them come in to talk about it. So yes you could do it [inquiry] without the technology, but it is a lot more enhanced and easier with the technology. I think you can get more resources easier and quicker. (Middle school exploratory)

> So much of the IBI is tied to the technology in that you're using a lot of that technology to gather information and then processing that information. And if you don't have access to that technology, being able to gather that information would be more difficult. But it can be done with textbooks and encyclopedias. (High school social studies)

> Why, I think both [technology and IBI] are great, but I think that the inquiry instruction is more important than the technology. I think you can do the IBI without the technology, although the technology does help the inquiry-based stuff. I think also, from my viewpoint in science, in a small school with a limited budget, being able to develop inquiry based lessons allowed us to have a lot better discussion and maybe learn things in a lot more in-depth way on a small budget than if we were doing things traditionally. (High school science)

While responses indicated that the technology did make IBI more practical and easier, no one stated that they felt the two were absolutely dependent upon one another. Teachers believed that there were other ways to utilize the concept of IBI without the use of technology. This fact was especially obvious in the middle school social studies room that used IBI principles frequently without the use of any technology.

Other classroom observations indicated similar findings. Although the elementary teachers were using their interactive whiteboard almost continually in some manner, the student's usage of the technology was limited, and when it was used it was generally individualized. The elementary teachers approach to lesson presentation, however, still exhibited many of the hallmarks of the IBI; students were led to answers through

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continual questioning, no one "right" answer was deemed absolute in most situations, and students were relying on sources other than their teacher for their solutions.

The use of technology was generally believed to be very beneficial for students overall, but in some situations the use of technology actually seemed to hinder the learning process. The additional time younger students spent on letter/key location, excessive graphics and animation in PowerPoints by middle school students, and even off task web-surfing by some high school students are examples of the ways the technology became troublesome. Close student monitoring by teachers, dependable content filters, and strong technology policies are needed for schools with these devices to help eliminate, or at least reduce, some of this counterproductive use.

Two of the middle school teachers pointed out a necessary consideration they sometimes struggled with when using an inquiry-based lesson tied to technology usage. How do they deal with students that have lost their technology use privileges? Students that no longer have access to the technology are not excused from the assignment and are required to use other sources during the information collecting phase and must hand write their products. This situation becomes even more problematic when the assignment is a group activity.

> And that is something else too, having a backup plan for that student that loses their computer privileges for doing something against the rules. You have to have the textbooks or encyclopedias there or library resources so that student can still complete the assignment after they get kicked off the computers. They don't like doing it that way, for sure. But that is a good thing to help keep them from getting in that situation. They like to use the computers, so they are pretty careful most times. (Middle school social studies)

Other examples of the relationship between IBI and technology were easy to observe. The middle school teacher using the most inquiry-based lessons was also the

teacher using the least amount of classroom technology. Access to the student computers was available for this class, but not a simple matter of walking across the room to pull one out of the cabinet, as was the case in most other classrooms. The computers assigned to this classroom were stored in another room and thus more burdensome to use. This particular class demonstrated a high reliance on the interactive whiteboard by the teacher, however, infrequent use of computers by students. Students were frequently involved in group effort, multi-faceted projects that allowed students a great deal of freedom in developing their end products. Their textbook and other resource books located in the room were their major sources of information.

The middle school language arts classroom, where a shared set of student computers was housed, showed a greater reliance on, and usage of, technology in conjunction with its IBI lessons. It was not clear whether the ease of availability or teacher preference to use the technology was the reason behind the increased use for the language arts class. Language arts students typically used the computers for writing assignments.

While some types of IBI lessons were not necessarily tied to technology, others most certainly were. Many teachers throughout the school occasionally used a video assignment in their classes. Students used the computers or digital cameras to produce video stories, commercials, instructional films and even community service messages. These video assignments did however, create some problems and require additional teacher planning. Logistical considerations and challenges needed to be addressed when assigning these types of lessons. Individuals or groups of students needed additional space to complete the video assignment to assure their speaking and "acting" was not

interfering with other groups. Teachers needing to monitor several students or groups

widely spaced also created a supervision issue.

> When students are doing the multimedia things in their classes, recording, or using cameras, whether it is a video camera or digital, or some audio recording for podcasting or something like that, they have to have a somewhat isolated place to do that, and when there are several groups in a classroom, they kind of need to be away from each other when they are working on it. Or even on some kinds of cooperative grouping work, it works better if you're not in the same close proximity to each other. So as a teacher, you have to figure out places for the groups. So they may be in a foyer, or in the hallways spread out. All around, little groups of students doing things that usually are on task doing their class work, but it may be strange to see them all over the school instead of just sitting in rows and seats. (High school science)

High levels of student enthusiasm and participation were observed with these

assignments.

The high school observations indicated a much higher rate of student use of

technology and less use by the teachers. There was little difference noticed in the way the

computers were being used regardless of the subject being taught. Students generally

used the computers for any writing components of the assignment and for locating

information relevant to the subject. These two activities could, of course, be

accomplished without the use of technology.

Administration was also asked their thoughts on the dependence between IBI and

technology. Generally the impression given was that the technology was a tool to assist

IBI.

> I do think it can be done without technology; however, it becomes more burdensome for the teacher. Technology is the tool in the background, not the driver. And with kids there is an excitement about learning with technology. Almost as if they are saying, "This is my generation of learning, using what I have now." I think it is the connection into how their real world is. So I think it can be done, without technology, but I would think you would really have to be a fantastic teacher, a very

knowledgeable and dedicated teacher to keep that level of student engagement going all the time. And in reality that is very hard. (Superintendent)

The researcher's classroom observations for considering the dependency between technology and IBI noticed similar findings as the teachers' responses; useful but not a requirement. While some types of inquiry-based lessons are most assuredly tied to technology, MapQuests, video assignments, to some extent concept mapping, and others, the majority of observations did not reveal an absolute requirement of technology in the use of IBI. Some significant differences were observed in the use of technology at the different grade levels and in the different subject areas which would add to the questions about the dependency issue. The fact that the students who had lost their technology privileges and were still able to complete the assignment using alternative resources would also support the claim of 'beneficial but not required'.

Administrative Assistance with the IBI Implementation Process

Research question three asked teachers for their reflections about the importance and actual assistance received from school administration during the IBI training and implementation process. As stated previously, school administration was heavily involved in the process of investigating and selecting the new teaching strategy intended to improve student achievement and involvement. A school leadership team: administrators, curriculum, and technology staff were also involved with the selection of the eleven teachers for initial training session. Once the training started, however, the administration accepted a more peripheral role, providing funding, scheduling, public relations, and record keeping while letting the teachers take center stage. The

administration believed it was important to have teachers and staff take ownership of the implementation process if there was to be successful and long lasting change.

The most common teacher comment heard on the importance of administration during the IBI implementation process was the need for administration's trust in teachers' abilities and decisions, and to allow teachers to take risks with untested lessons. Teachers indicated they were initially concerned about how their direct supervisors would view teaching methods that were so different than what they thought the administration expected. Since the principals evaluated each teacher periodically on their teaching skills and outcomes, participating teachers worried about how they would be scored while using the inquiry-based instructional practices. Teachers indicated that this concern would be particularly worrisome if the evaluator knew little or nothing about the method of instruction. Knowing that the Kit Carson school administration was knowledgeable about IBI, was supportive of the initiative, and willing to allow teachers the freedom to try new instruction methods was important and comforting to them.

> They were very supportive. They got us the resources that we needed, and they gave us the safety to try things. Knowing that they were not going to walk up and watch us every minute or mark us down on our evaluations because we maybe tried a lesson that didn't go as well as we expected it to. You have to be ready for a little trial and error if you want to try something different. (Middle school reading)

> And I've never run into a time where I wanted to try something where they have said "No, I don't think you better do that." There may have been a "Well, how about if we start here." Sometimes my ideas get a little big, and I want to jump in with both feet, and need someone to bring me back down to reality occasionally. But saying, "No, I don't think that is a good idea," I've never encountered that, and in talking to other peers, other teachers, I have never heard that from them either. (High school science)

> I don't think we could probably be at the level we are at now, well, I know we could not be at our level with inquiry based instruction, without the support we have had from our administration. If you're going to really

delve into inquiry- based instruction, …everybody has to be on board and the administration is obviously key to that. (High school language arts)

The majority of participant teachers noted the importance of allowing teachers the freedom to try things that they had not done before without fear of negative administration intervention. One of the teachers stated that the philosophy of IBI had to be tested on the implementation process itself: the teachers were given a problem and asked to solve it based on their own skills and knowledge, there was no perceived single right answer about inquiry, and teachers were not sure what the product should look like. "An inquiry project on inquiry-based instruction" (Middle school exploratory).

Based on their own comments, the school leadership seemed to understand and accept the importance of being able to trust their teachers and trial-and-error instruction.

> ….so I think setting the framework for the mindset, and giving the teachers the freedom to think and try things outside of what we have traditionally accepted. Trying things to drag us out of the mindset that we have used in schools for the last century or so. So we had to empower the teachers with knowledge, resources and the freedom to rethink how they should teach. I think teachers know what kids need; they know how they learn best, so I think giving them that freedom to try some of those things was huge. (Superintendent)

> I think good administrators have to step back but also look, check to make sure things are getting done. And if they see things heading in the wrong directions, they have to step in and help them regroup. Freedom to try things doesn't mean freedom from oversight. (Elementary principal)

Since the administrative team had reported selecting the teacher participants partly based on their willingness to try new instructional strategies, "Putting together a staff that was prepared to change, was interested in change" (Curriculum director), it would only follow that allowing teachers to try new instructional methods would be accepted and even encouraged by the administration team.

One of the follow-up questions addressed the use of IBI by individual teachers in buildings where others were not using IBI practices. A distinct difference between the teaching levels was noted. Middle and high school teachers questioned whether or not IBI would be as effective on an individual basis. The greater frequency of interdisciplinary assignments used at the high school level required more interaction between teachers. The middle and high school students each have several interdisciplinary inquiry-type activities throughout the year. These grade-level or school-wide activities require students to use their knowledge and skills across the entire spectrum of classes to complete their assignments or projects. Teachers develop the interdisciplinary activities to illustrate to students that what is learned in one particular class is applicable in many other areas. Having all, or at least several, teachers involved with such an assignment versed in the instructional method being used would seem logical. Currently, the district does provide collaborative time for middle and high school teachers to develop multi-discipline inquiry-based activities. This team planning time is typically scheduled on early release days with half of the staff guiding the entire student body in a grade-level half-day PBL while the other half of the staff prepares the next half-day PBL, or the more involved school-wide PBL that takes place at the end of the school year. Teachers report that these collaborative planning sessions are both productive and enjoyable for themselves but also very valuable lessons for the students.

The elementary teachers did not think incorporating IBI into one's classroom, even if they were the only teacher in the school using such a method, would be much of a problem. Their statements indicated that increased questioning and more open-ended presentation of materials were relatively simple to accomplish on one's own. However,

when asked if they thought an individual teacher could implement IBI into his or her classroom without the support of the school leadership they were skeptical.

The elementary teachers as a whole are not given the collaborative planning time to collectively work on inquiry-based projects as are the middle and high school teachers. However, grade level partners are given some common planning times where they can work together to develop inquiry lessons. The different approach and use of IBI, intensive questioning rather than open-ended problem solving, was seen to be one of the reasons other elementary teachers did not collaborate as much as the middle and high school teachers. They also indicated that since they taught all subjects to their students, it was not a problem to integrate many subjects into an inquiry lesson.

Generally, teachers responded to the question about individual teacher implementation possibilities in much the same manner as when questioned about the requirement of technology to IBI, which was, "Possible, but more difficult."

Teacher participants also placed the need for assistance and support from others on the school leadership team high on their list of requirements for inquiry-based implementation. The interrelationship between inquiry instruction and technology necessitates the need for strong technological support for teachers.

> The school district has to pay a tech person to be available at all times. This is very big for us. It's not like a teacher standing in as the "tech" person but right now she can't come help because she is in a class. I mean there is always someone here that can help us with any problem. Some warm body, a "techie" to help you. Always. And they have always been good with helping if you have a problem, they will be right down. So that is first and foremost with me. That we have people here to help with the programs and with the hardware. (Middle school Reading)

Additional support sources for advice and assistance were also requested by teachers going through the process.

As far as Mrs. [curriculum director] is concerned, she had done an outstanding job of giving us resources, being someone we could talk to about a lesson. I always feel comfortable about walking into her office and asking her questions, because I know she will help me. (High school social studies)

Other areas listed by teachers where administrators could assist with the IBI implementation project included release-time and financial compensation for investigation and training, and more direct involvement and interaction between teachers and administration during the entire process.

Be in our classrooms more. Be in there when we try something new and give us the feedback. Maybe come in with some ideas about what we should try. Because sometimes teachers are scared, or they haven't seen it, or they don't know about it, or they don't have time to research it. And if administrators come in and say I saw this happening in the other classroom or this other school, you know, maybe you teachers could work together. (Middle school social studies)

Give suggestions and just be an extra pair of hands in the room when we are starting something new like that. With the little kids they sometimes get going every which way and it is nice to have others in there. And she can see what we are doing and make suggestions to help change it to something better, or you might try this next time. (Elementary)

And even having the administrators telling us more of what they want to see and maybe help us to be able to implement what they are looking for. (Elementary)

School leadership involvement in the IBI implementation process was appreciated by the participating teachers. Knowledge about the instructional format by the administration gave teachers a degree of comfort when trying new and untested lessons. Including teachers in the decision making process and listening to their thoughts for making adjustments and corrections helped teachers accept and become partners in the IBI initiative.

Chapter Summary

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Eleven teachers from the Kit Carson School District were trained in and later introduced IBI into their classrooms. These teachers were frequently observed over a period of one semester to determine the level of use of the instructional method. In-depth interviews were conducted with each teacher to gain their perspectives of both the training process and the implementation of IBI. During these interviews and observations the general finding areas that surfaced included an increase in the frequency and depth of use of technology, several factors which influence the use of IMI in the classrooms, administrations role in IMI implementation, and the benefits to students of this teaching method.

The fifth and final chapter of this study will discuss these findings to determine whether or not the district was successful in its IBI implementation endeavor, to assess the impact of IBI on both students and teachers, and to help administrators in making decisions toward moving education forward to meet the needs of the twenty-first century student.

Chapter 5: Discussion, Conclusions and Implication of the Study

Discussion

Chapter five will contain sections on discussion of findings as well as conclusions and implications. The discussion section will begin by reviewing the problems the district encountered which initiated the study, the methods used for the study as well as a detailed discussion of the findings. The final section will address the conclusions reached by the researcher about the implementation process, give implications for classroom practices, recommendations for further study, and personal thoughts about IBI.

Summary of Problem

There is little doubt that the educational requirements for today's students are changing. Instructional methods that were once common and widely accepted are not producing the types of employees that businesses require or students that post secondary schools accept. Now businesses and universities are demanding more highly skilled employees and students that can make sound decisions and solve problems. Additionally, the ever increasing national student drop-out rate, increasing public school competition from charter and voucher schools claiming they can do a better job of educating, and demanding requirements of the *No Child Left Behind* mandate, have put public schools in a position of improving or stepping aside.

These pressures and increasing demands on public schools have not gone unnoticed or ignored by educators. Many schools are moving to include more cutting edge classroom practices into their every day teaching (Seashore-Lewis, Toole, & Hargreaves, 1999). Attempting to make school more relevant to students as well as

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providing the requirements requested by universities and the business world are seen as important steps to keeping children in school and better preparing them for their futures. With these 21st Century skills in mind, problem solving and higher order thinking skills, the Kit Carson School District moved to implement a classroom instructional program which claims to increase student use of educational technology and develop problem solving and higher order thinking skills in its students. IBI is reported to accomplish just that (Rubin, 2005; Rosenfeld & Martinez-Pons, 2005).

The primary purpose of this study was to gain an understanding of how teachers implemented IBI into their teaching; what was desired or needed by teachers from school administrators during the process; and what factors influenced teacher's use of IBI once they were trained. Many researchers have stressed the importance of stakeholder buy-in with educational initiatives if there is to be any chance of real and sustainable change (Fullan, 2002; Hanson, 2001; Bolman & Deal, 1997). Listening to the individuals that would be directly responsible for this change would not only identify strengths and weaknesses in this particular educational change initiative but would also help foster a positive school environment through the value given to teacher's input. Teacher input during the process was the main source of the study findings.

Summary and Discussion of the Finding

The educational philosophy of constructivism, of which inquiry-based teaching strongly adheres, indicates that each of us learns and perceives stimuli differently because of the differences in our life experiences. And while differences in participant perceptions were of course present in the study, common themes were identified in the responses and observations of both teacher and the school leadership groups. The areas identified as

common threads in the study by both group were: professional development experiences, impact of IBI on classroom practices, the connection between IBI and technology, and how administrators can assist with pedagogy implementation processes.

It is important to state that while several common thoughts and patterns were identified in this study with the eleven teachers of the District, this is not to imply that their viewpoints would be consistent with another set of teachers from another location or period. These finding only report the beliefs and thoughts of this small group of teachers. Further study and sampling would be required to make such categorical statements more conclusive.

Professional development experiences. The range and quality found in today's teacher professional development opportunities is extremely broad. Birman and Yoon, (2001) report that effective training requires a focus on content, opportunities for active learning, and collective participation of teachers from similar settings - schools, grade levels, or subjects. Similar findings surfaced in this study. While all teachers indicated that their experience during the professional development period was valuable, they were also able to identify some components that they believed were in need of improvement.

It is interesting to note that no distinction between the two different training models was observed by the researcher during in-class visits or reported by the teachers in the interviews. While some of the additional training in technology use, lesson planning, and web-site construction included in the longer training model may be extremely valuable, no obvious differences were noted in the teacher instruction. Both groups of trainees seemed to experience the same challenges and report the same type of

benefits. This finding may help guide the District and others to rethink or restructure the two training models.

All teacher participants commented on the strength of the content found throughout the training. The professional development placed strong emphasis on getting the IBI methods embedded into the teacher's classroom instructional practices. Training in the use of technology associated with IBI was only a companion part of the professional development. The general assessment by teachers about the training overall was very positive and teachers believed their time was well spent on this learning opportunity.

One of the more positive findings connected with the professional development aspect of the study addressed the increase in teacher collaboration when using the IBI. Teachers frequently worked together to construct lessons that required elements from several disciplines. These collaborative efforts crossed both content and grade level divisions. Most of the collaborative lessons were developed between those teachers trained in IBI but others not yet trained were also occasionally included. Teachers indicated that since real problem solving takes many different approaches and is more often than not multifaceted, it seemed only logical to develop lessons that involved many different disciplines. Participant teachers suggested that the extended periods of training together helped them feel more comfortable conversing with each other about ideas or problems with IBI lessons and thus helped increase the levels of collaboration. They also stated that the time together helped them get to know each other better and built stronger school climate.

As is often the case when given an opportunity to evaluate an event, individuals tend to focus on the issues that created more stress for themselves rather than expanding on the more general points that were not issues for them. One of the areas participants wished to see improved for future trainees was allowing for more time for peer interaction during and after their professional development. Providing opportunities for teachers to share experiences and ideas was a common desire heard from all teachers. When facing unknown or unfamiliar teaching situations, teachers stated that they felt fearful of making mistakes. They suggested that conversing with others in similar situations would help to alleviate some of those uncomfortable feeling. Additionally, they believed that they would gain more ideas from each other if allowed to meet as a group and share experiences.

In conjunction with peer interaction time, teachers believed there was a need for individual reflection time to evaluate the successes and missteps they encountered when implementing a new inquiry-based lesson. A need for some type of formal criteria or check list teachers could use to help evaluate a lesson was also suggested. These forms or check-lists could then later be taken to the group sessions for discussion and sharing. The self-evaluation and peer interaction time component during the professional development period was the most common suggestion for improving the training process.

Teachers also suggested that more progress toward the training objectives would be possible if participant groups were more similar in makeup. Teachers within smaller spans of, or similar grade levels; teachers on similar technology skill levels; teachers within the same or related discipline areas were suggested as possible adjustments to training team makeup. Professional development tends to become more interactive

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among those being trained when they have similar strengths and knowledge base (Birman & Yoon, 2001). Grouping elementary and high school teachers together for professional development may work adequately when discussing such topics as school law or insurance plans, but in more specific areas of classroom pedagogy, one would be well advised to group trainees by grade levels and, or subject matter. Multiple difficulties frequently arise when trying to serve groups from different areas at the same time. Because of the vast difference in the needs and, or experiences between a seven and seventeen year old student, illustrations or examples used for one seldom work for the other. This concern was a particular challenge with the elementary teachers. They reported feeling out of place when being instructed with the larger number of high school teachers and with an instructor more familiar with the older high school students.

An additional category that might be taken into consideration when grouping trainees in this particular situation was that of common skill levels in the use of technology. Since technology usage is such a connected part of IBI, grouping individuals of similar skill levels may serve to save the time of some of the more experienced people or limit the frustration levels of the complete novice as the instructor move forward to quickly.

Impact of IBI on instruction. A second important finding centered on how IBI changed the learning and teaching in the classrooms. Five areas of impact were noted; a more student centered classroom, changes in teacher practices, benefits to students, connection to technology, and issues of compatibility. Teacher comments about the impact of IBI tended to list benefits for students and challenges for teachers. Increased lesson involvement and retention, increased self-confidence, and freedom of choice in

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lesson product or solution were reported and observed as student benefits. The teacher challenges listed were; assessment issues, increased time for lesson planning and lesson completion, and changing to a student-centered arrangement for the classroom.

The use of IBI vastly increases the opportunity for students to take on the central role in the classroom. After receiving their problem and instructions from their teachers, the students are required to then assume the responsibility of locating sources of information, analyzing their findings, making the cognitive connections between the old and new information, and produce and present their solution. Teacher roles are changed but not demised. Diligence is required of teachers to keep students on task and arriving at reasonable solutions. The student-centered classroom that was commonly observed with IBI allows students to develop more of their personal interest as well as cognitive and social skills.

Teachers believed that their students became more involved in the lessons when using IBI methods. The increased student engagement was assumed to be tied to the requirement of student produced products or solutions often associated with IBI. This increased involvement was in turn believed to lead to longer lesson retention by the students. When students become more engaged with the learning objective through additional efforts required in producing a product, teachers reasoned that they would naturally increase their retention levels. Additionally, giving students the opportunity to choose their mode of presentation gave them a sense of empowerment which also helped connect them to the assignment.

One could logically argue that giving students more decision making opportunity about the design of their product would lead them to choose a format that more fully

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utilizes their talents. And the showcasing of talents could lead to increased lesson involvement and self-confidence, which finally, in turn, could lead to better retention of the lesson objectives as well as better attitudes about learning in general. The connections between these factors all seem logical and deeply intertwined.

While the impact of IBI for student learning tended to be reported as benefits, the impact for teachers tended to be listed as challenges. The areas of concern about using this teaching method were identified by teachers as; additional time requirements, changing classroom focus from teacher to students, completing the current curriculum, and assessment issues.

Teachers commented on the need for additional time for both lesson preparation and student assignment completion when using IBI. There was however a distinct difference in these findings between elementary and high school instructors. The high school teachers stated that many of their longer, more involved inquiry-based lessons required a great deal more time for preparation but did not indicate that their students took significantly longer periods to complete. The elementary teacher did not find inquiry-based lesson preparation much more time consuming but did comment on the extended completion time needed by their students. Elementary teachers attributed the increase in completion time to the younger students' lack of self-direction which required a great deal of teacher guidance and intervention and thus more time needed to cover the objective. The younger students also needed additional time learning to use and manipulate the technology.

When asked about the difference in lesson-plan time requirements between high school and elementary or middle school teachers, it was believed that the lower grade

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lessons were already in a format similar to those found in IBI, more hands-on or activity based, and thus easier to adjust. The high school teachers, on the other hand, frequently developed lessons using a more lecture-based approach which is significantly different than what is called for with IBI and therefore requiring more than a simple modification.

Other challenges in the use of IBI were seen as less problematic and more about acceptance of change. The changes in the teacher-student dynamics when using IBI are vastly different than what many teachers had previously experienced. Inquiry-based lessons place more emphasis on a student-centered classroom and less reliance on the teacher as simply a dispenser of knowledge. Several teachers indicated that they initially struggled with this student-centered focus. When using IBI, after initial giving instructions about the assignment and guidelines for completion, teachers often spent much of their time in an advisory capacity. Teachers did not feel that they were as needed, or as important as they once believed they were and had difficulty with this. The change in classroom directional focus was again much more predominate in the upper grades were teachers have traditionally delivered lecture type lessons. The lesser degrees of self-discipline, self-motivation and limited knowledge base typically found in younger students precluded their teachers from giving over as much classroom authority.

The elementary teachers were worried about covering their curriculum when using IBI. Additional time needed by younger students in the form or leaning to use the technology, learning group cooperation and collaboration skills, and more individual student needs cause these teachers to worry and make decisions about what and what not to cover in their already tight schedule of objective completion.

The challenge of assessing inquiry-based assignments was identified by all teachers and at all grade levels. Teachers also identified this issue as most problematic. The open-ended subjective nature of inquiry-based assignments places greater pressures on the teacher to assess a student's, or even more difficult a group of students, on their work. The assessment component made the teachers extremely aware of the need for, and importance of, a well thought out scoring rubric. Because there is often a range of accepted solutions or answers with the inquiry-based assignment, there should also be a range of scoring criteria. The use of a scoring rubric allows teachers more flexibility when assigning grades. Common criteria found in teachers' scoring guides included such areas as; time management, creativity, presentation, logically followed solution, and peer interaction and collaboration. Teachers, students, and parents often point out that many of these criteria are quite subjective and thus open for debate. The assessment issues is compounded when the teacher attempts to determine if all of the criteria areas are to be given equal value or whether one or another should carry more importance. How to assess group work is also problematic. Regardless of which grade level or subject matter, teachers all struggled with the assessment aspects of IBI.

Findings from this study identified teacher opinions about the compatibility of IBI to different grade levels and subject matter areas. One year after the district implementation process, teachers were in agreement that IBI was more beneficial and effective when used at certain grade levels, in certain subject matter, and to some degree with certain types of students. Teachers agreed that the planning for IBI was very similar to the types of lessons currently developed by elementary and middle school teachers, hands-on and more activity based, but the lack of knowledge gained through more

education and life experiences hindered the younger students from receiving the same benefits as the older students.

Two of the groupings, subject matter and student type, were identified by teachers less often. Subjects that tend to accept alternative solutions were more easily adapted to methods used with inquiry-based lessons. Social studies, some areas of science, and language arts classes seemed to be better suited to IBI because they accept opinions or interpretations of events or writings as plausible answers to their questions. Areas, such as math and other more concrete disciplines, seem to be harder to adapt into the open-ended world of IBI. Several teachers did indicate however, that they felt it was really more about how, rather than what was taught.

There were mixed opinions about whether there was a particular type of student that preferred IBI. Elementary teachers suggested that they thought the higher ability students enjoyed these types of lessons more because it allowed them to make decisions, and increase their leadership qualities, traits that the teachers associated with the stronger students. High school level teachers however reported more negative comments coming from stronger academic students when given IBI assignments. They saw students that had not learned how to play the listen, study and regurgitate game, those typically less concerned about grades, as being the students that showed the greatest levels of improvement when using IBI. These students appeared to enjoy the freedom of choice, using their personal skills and interest, and having their thoughts and opinions valued.

All teachers were in consensus when it came to grade level compatibility. Inquiry instruction relies heavily on the constructivism concept of learning and as such seems to favor the older, more knowledgeable students. All teachers did state that there were many

practical uses for IBI at all grade levels for developing the students' higher-order thinking skills, but many more applications of IBI were possible with older students.

   Connection between IBI and technology. Larry Cuban (2001), D'Angelo & Woosley (2007) and Vinograd & Klemick (2007) all suggest that the use of much of the classroom technology, including interactive whiteboards, detract from the concept of student-centered classrooms and are simply a method of enhancing teachers' presentations. Where these sentiments shared by the IBI teachers? As stated several times, the lessons and methods of today's schools are changing. So too are the students. Pencils and paper have been replaced by computers and electronic writhing tablets. Libraries are being replaced by the internet. Most would therefore agree then, that students wishing, or required to use these tools and resources should be somewhat proficient in their use. It would be naive to think that IBI was the only instruction practice being used in schools that made use of technology. However, it is not the use of technology that is the key component of IBI but rather the instructional practices of the teachers…the methods, not the machines.

   As this study showed, teachers and school administrators tended to agree that inquiry-based assignments were more effective and easier with the use of technology, but the technology was not absolutely necessary. Students used many sources including peers, textbooks, library or classroom resources, maps, and others to gather information not requiring technology. Additionally, they were able to produce their end product solutions without the use of technology as well. Students did however prefer to use the technology for both. The preference for the use of technology in school by the students is consistent to what we see in their everyday lives outside of school. It would therefore

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seem logical to use whatever tools that are available to attract and keep their attention to further advance their education.

School leadership assistance with an implementation processes. When teachers were asked about what they wanted and needed most from school leadership during an instruction implementation process, the most common request dealt with issues of trust, knowledge, and general leadership. All teachers believed that it was the responsibility of the leadership team to make decisions and guide other organization members toward goals. Teachers wanted leadership making the final decision and assist with getting others on board.

Administration knowledge about the methodology was viewed as essential by each participant teacher. Because IBI is such a radically different form of teaching, administrators lacking a clear understanding of the methods may well question a teacher's ability or effectiveness. If a principal was expecting to see a teacher in front of the classroom, delivering a traditional lesson, watching a teacher conduct an inquiry-based lesson may cause him or her to question that teacher's ability. Teachers commonly use the term 'trust' when speaking about their needs from administration when trying something new. Knowledge of administrators about IBI would be a vital component in building this trust.

A common finding from teachers indicted their desire to have more administration interaction and observations during the implementation period. Teachers wanted input from the leadership team. They requested ideas, suggestions, and critiques for their teaching. It is also the opinion of this research that the teachers were also

looking for acknowledgment and praise for successful lesson they had worked so hard and long planning.

In summary, the implementation of any new educational change is challenging (Louis, Toole & Hargreaves, (1999), Davis (2003), Bolman & Deal (1997). The change in instructional practices at the Kit Carson School District created challenges and apprehensions for administrators and teachers alike. However this endeavor also created a stronger group of teachers that were willing to take chances in their search for something better for their students and an administration team that was willing to trust their teachers to accomplish that better something. It is hard to attempt change, but the rewards are often worth the effort.

<div align="center">Implications for Practice</div>

As our society moves into the 21st Century, we have become increasingly aware that the methods of the past are quickly becoming obsolete. Education is no exception. In every facet of education we encounter a need, request, or demand for change. The type of information needed, how and where we find it and even the method of delivery seem to change at an ever increasing pace. State and federal requirements for improvements in student achievements, higher than ever student drop-out rates, and shifts in employment requirements have caused schools to reevaluate their practices. These changes however do not come quickly, easily or without some degree of stress. This study has hopefully served to demonstrate the challenges that teachers encounter when they are asked to make adjustments in their teaching methods. The findings from this study suggest several implementations for today's educational practices in general as well as steps the district should take to support the current IBI initiative.

Efforts should continue to include others in the decision making processes involving school changes. All decisions dealing with changes in educational practices should be undertaken by a wide array of stakeholders. When there are few individuals in the position of decision making for the many, the likelihood of that suggested change being long lasting or widely accepted is limited. Those most directly affected by an implementation processes involving instructional practices should have additional emphasis placed on their input.

Future district professional development training should be conducted with individuals of similar make-up whenever possible. Grade level, subject matter, degrees of expertise and experience should be considered when assigning training sessions. It is believed by teachers that groups of similar grade levels or subject matter would make the professional development sessions more productive, although sharing thoughts and ideas among the different groups after training sessions is also valuable. Additionally, extended periods of professional development among individuals may increase the occurrence of collaboration among participants as well as increase positive school climate. Individuals experiencing common training appear to better understand and work with each other more than those without those common experiences.

Expectations and requirements for participation in any school change initiative should be explicitly stated and understood before the implementation process is begun. Failing to fully explain either of these may increase the frustration levels of those involved and help derail the proposed change. The teachers involved in this IBI implementation project were given full knowledge of the amount of work and time

commitment that would be required of them before they began the process and were appreciative of this knowledge.

In-depth knowledge about any proposed implementations is critical of all members involved. The teachers in this study emphasized the need for administrators and others in leadership positions to be very knowledgeable about IBI. In order to successful lead others; the administration must be knowledgeable about both the process of organizational changes and the specifics about the initiative itself. School leaders must always be just as informed as teachers, if not more. Their leadership skills are needed to educate, convince, support and provide for a successful implementation process. Without vast content knowledge of the proposed change, their leadership role becomes diminished. And, school leaders should continue to stay abreast of any and all new developments in IBI and other teaching strategies being used in their building or district.

When attempting something new and different, teachers often become doubtful of their own skills and abilities and appreciate frequent encouragement and suggestions from their direct supervisors on how to improve their teaching. Building and district administrators should provide time in their schedules to make sure they continue to stay involved with classroom interaction with both students and teachers. This is particularly true when introducing something new into the school. Developing mutual trust between school leadership and teachers through ongoing two-way dialogue helps teachers develop their teaching abilities and builds healthy school climates.

The district has provided a great deal of time, effort and funding into this educational initiative. While these efforts have been impressive, this project has also created some additional challenges that will require district long-term planning. Plans

should be made to provide; ongoing IBI training for other current and future teachers within the district, specific funding schedules to address both teacher training and maintenance and replacement of classroom technology, and development of an instructional oversight committee that monitors the progress of IBI instruction as well as keeping the district abreast of changing trends in classroom technology and other related instructional practices.

Based on teacher comments and observations of this study, IBI has the potential to provide many benefits to students. Greater levels of lesson retention and self motivation, development of higher-order thinking and problem solving skills, and students taking a more active role in their own learning have all been reported by teachers using IBI in their classrooms. The district should now begin longitudinal studies to collect data on these, and other reported benefits of IBI to help guide them in future decisions about classroom practices.

Teachers in this study reported limited success with IBI with the elementary students and a great deal more at the high school level. The strong connection of IBI to the constructivist philosophy of learning would suggest that this observation by teachers was credible. Older students with a greater source of knowledge and skills from which to draw would obviously seem more suited to an educational teaching method that requires the use of present knowledge to expand future knowledge. If this is so, should the district continue IBI at all levels? Teachers also believed that some types of classes were also better suited to IBI practices. IBI appears to be more applicable to classes which require less concrete answers. Social sciences, language arts, and some disciplines of the natural

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sciences seem to provide a better stage for this instructional method. Further monitoring of both of these teacher suggestions would be prudent.

As cautioned previously, it is important to note that the perceptions of this small sample of teachers about the suitability of IBI to certain grade levels, discipline areas, or other factors should not go unchallenged without a great deal of additional study. The extended period of training together and then working side-by-side in a small district gave these eleven teachers ample opportunity to discuss their thoughts with each other about the compatibility of IBI and may have thus biased some or all on this belief.

<div align="center">Recommendations for Further Study</div>

As mentioned, the process of education is about the process of change. To assume that there will be no further need to study or adjust teaching practices as we proceed forward is counterproductive to the process of education. Future studies on both educational implementation process and IBI are needed. More empirical data on student achievement outcomes when using IBI would help refute or substantiate the claims being made of this teaching methodology.

This researcher believes that it would be enlightening if additional research was conducted into other alternative methods of instruction. While IBI was deemed beneficial and successful for this district, the researcher does not presume that other innovative programs which address the needs of the 21st Century students are not also available. Schools all over the nation are experiencing the same educational woes which served as the district's catalyst for their introduction of IBI. What other programs are available to help guide schools toward improvements?

Finally, more study into the specific application for IBI might assist the school in decision making for its continued use. Should this method of instruction be directed toward a particular segment of the school population? If the findings of other studies report similar teacher perspectives about the suitability of IBI at different grade levels or subject disciplines, should it even be an option for settings outside those areas? Would eMINTS, with is high degree of dependency on IBI be more effective at the higher grade levels? Is future dependence on educational technology inevitable? There is an ongoing need to improve classroom practices and schools themselves and therefore will always be a need for additional studies to help schools make those decisions.

Closing Thoughts

For many of the teachers in the Kit Carson District, IBI has become an important part of their teaching repertoire. Even though more utilization of this instructional practice currently takes place in the upper grades and in certain disciplines, all participating teachers are using it to some degree and all with positive results. The district has also grown as an organization though the extensive professional development program and increased interactions between teachers and administrators. However, the biggest winners of this process have been the students. The benefits to the students though the use of IBI has been frequently mentioned in this study, however, only time will tell the true effectiveness of the pedagogy.

What education of the future will look like is anyone's guess. However, as the world's population grows, resources become more limited, and social, political and ethnic issues multiply it will become essential that people at all levels of society become problem solvers. Educators should be assisting our students in learning skills which will

help them address these problems and inquiry-based instruction just may play a role in

those educational efforts.

REFERENCES

Albion, P. R. (1999). Self-efficacy beliefs as an indicator of teachers' preparedness for teaching with technology. *Technology and Teacher Education Annual 1999, (Society for Information Technology & Teacher Education)* Charlottesville, VA: Association for the Advancement of Computing in Education.

American Psychological Association, (1997). Learner-centered psychological principles: Retrieved August 23, 2008, from http://www.apa.org/ed/lcp2/lcp14.html

Baumfield, V., (2006) Tools for pedagogical inquiry: the impact of teaching thinking skills on teachers. *Oxford Review of Education*. 32 (2) 185-196.

Beers, G. & Bowden, S. (2005). The effect of teaching methods on long-term knowledge retention. *Journal of Nursing Education,* 44(11), 511-514.

Beeson, E., & Strange, M. (2003, February). *Why rural matters 2003: The continuing need for every state to take action on rural education. A report of the Rural School and Community Trust Policy Program* [Online]. Retrieved August 23, 2008 from
http://www.ruraledu.org/site/apps/nl/content3.asp?c=beJMIZOCIrH&b=1000115&ct=1147039.

Bickford, A., Hammer, B., McGinty, P., McKinley, P. & Mitchell, S. (2000). MINTs project evaluation report. Office of Social and Economic Data Analysis. University of Missouri, Columbia, Missouri.

Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal*, Vol. 38, No. 4, 915-945.

Bolman, L. G., & Deal, T. E. (1997) *Reframing organizations: Artistry, choice and leadership*. (2nd ed.). San Francisco, CA: Jossey-Bass.

Bogdan, R. C. & Biklen, S. K. (1998) *Qualitative research for education: An introduction to theory and methods*. Boston, MA: Allyn and Bacon.

Bridges, Edwin M., & Hallinger, Philip. (1997). Using problem-based learning to prepare educational leaders. *Peabody Journal of Education*, 72(2), 131-146.

Budnitz, N. (2000). *What do we mean by inquiry?* Retrieved August 23, 2008 from http://www.biology.duke.edu/cibl/inquiry/what is inquriy.htm.

Burns, M. (2002). From compliance to commitment: Technology as a catalyst for communities of learners. *Phi Delta Kappan*, 84(4), 295-302.

Butler, J.A. (1992). Use of teaching methods within the lecture format. *Medical Teacher*, 14(1), 11.

ChanLin, L. (2003). *Creative teaching and integration of technology into instruction*. Taiwan NRC Report: NSC91-2522-S-030-001.

ChanLin, L. (2005). Development of a questionnaire for determining the factors in technology integration among teachers. *Journal of Instructional Psychology*, 32(4), 287-292.

Chen, J. Q. (2004). Theory of multiple intelligences: Is it a scientific theory? *Teachers College Record*, 106, 17-23.

Chenoweth, T., & Everhart, R. (1994). Preparing leaders to understand and facilitate

    change: A problem-based learning approach. *Journal of School Leadership*, 4,

    414-431.

Christensen, M., (1995). *Critical issue: providing hands-on, minds-on, and authentic*

    learning experiences in science. North Central Regional Educational Library.

    Retrieved August 10, 2008 from

    http://www.ncrel.org/sdrs/areas/issues/content/cntareas/science/sc500.html.

Chung, N., & Gyoung-Sug, R. (2004). The effect of problem-solving instruction on

    children's creativity and self-efficacy in the teaching of the practical arts subject.

    Journal of Technology Studies, 30, 116-122.

Clausen, J. M. (2007). Beginning teachers' technology use: First year teacher

    development and the institutional context's affect on new teachers' instructional

    technology use with students. *Journal of Research on Technology in Education*,

    39(3), 245-261.

Copland, M. A. & Boatright, E. (2006). *Leadership for transforming high schools*. Center

    for the Study of Teaching and Policy, University of Washington.

Cote, D. (2007). Problem-based learning software for students with disabilities.

    Intervention in school and clinic. 43(1), 29-37.

Creswell, J. W. (1994). *Research design: Qualitative and quantitative approaches.*

    Thousand Oaks, CA: SAGE Publications.

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five*

    traditions. Thousand Oaks, CA: Sage Publications.

Cuban, L. (2001). *Oversold and underused: Computers in the classroom.* Cambridge, MA: Harvard University Press.

D'Angelo, J.M., & Woosley, S.A. (2007). Technology in the classroom: Friend or foe. *Education*, Summer 2007, 127(4), 462-471.

Davis, J. R. (2003). *Learning to lead: A handbook for postsecondary administrators.* Westport, CT: American Council on Education and Praeger Publishers.

Dodge, B. (1995a). Some thoughts about webquest. Retrieved August 10, 2008 from http://webquest.sdsu.edu/about_webquest.html.

Dodge, B. (2007). What is a webquest? Retrieved August 10, 2008 from http://webquest.org/index.php.

Donovan, L., Hartley, K., & Strudler, N. (2007). Teacher concerns during initial implementation of a one-to-one laptop initiative at the middle school level. *Journal of Research on Technology in Education*. 39(3), 263-286.

Dupagne, M., & Krendl, K. A. (1992). Teacher's attitudes toward computers: A review of the literature. *Journal of Research on Computing in Education*, 24(3), 420-429.

Ferretti, R. P., MacArthur, C. D. & Okolo, C. M. (2001). Teaching for historical understanding in inclusive classrooms. *Learning Disability Quarterly*, 24, 59-71.

Flage, Daniel. (2003). *The art of questioning: An introduction to critical thinking.* Prentice Hall, 1st.Ed. Simon & Schuster. Upper Saddle River, N.J.

Finn, J., & Rock, D. (1997). Academic success among students at risk for school failure. *Journal of Applied Psychology*, 82, 221-234.

Fullan, M. (1996). Leadership for change. In K. Leithwood et al. (Eds.) *International Handbook of Educational Leadership and Administration*, (pp. 701-722). London: Kluwer.

Fullan, M. (2002). The change leader. *Educational Leadership*. May, 2002, (p 16-20).

Gardner, H., & Moran, S. (2006). The science of multiple intelligences theory: A response to Lynn Waterhouse. *Educational Psychologist*, 41(4), 227-232.

Gardner, J. W. (2000). *The nature of leadership: Educational Leadership*, (pp. 3-12). San Francisco, CA: Jossey-Bass.

Greenleaf, R. K. (1977). *Servant leadership: A journey into the nature of legitimate power and greatness*. New York: Paulist Press.

Hallinger, P. & Heck, R. (1999). Can leadership enhance school effectiveness? In Bush et al. (Eds.) *Educational management: Redefining theory, Policy and practice*, (pp. 178-190). London: Paul Chapman.

Hanson, M. (2001). Institutional theory and educational change. *Educational Administration Quarterly*. 37(5). December 2001. (pp. 637-661).

Hirsch, E. D. (2006). *The knowledge deficit: closing the shocking education gap in American Children*. Houghton-Mifflin, New York, N.Y.

Honey, M., & Moeller, B. (1990). *Teacher's beliefs and technology integration: Different values, different understandings (Technical Report 6).* New York: Center for Technology in Education.

Huitt, W. (2003). Constructivism. *Educational Psychology Interactive*. GA: Valdosta State University.

Ingersoll, R. M. (2004). *Why do high-poverty schools have difficulty staffing their classrooms with qualified teachers? (Report prepared for Renewing Our Schools, Securing Our Future – A National Task Force on Public Education).* Washington, DC: The center for American Progress and the Institute for American's Future.

Johnson, B. (2001). Toward a new classification of nonexperimental quantitative research. *Educational Researcher*, 30(2), 3-13.

Jonassen, D. H. (2000). Toward a design theory of problem solving. *Educational Technology Design and Development*, 48(4), 63-85.

Katz, J. (1983). "A theory of qualitative methodology: The social science system of analytic fieldwork." In R. M. Emerson (ed.), *Contemporary Field Research*. New York: Little, Brown.

Kirschner, P.A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: an analysis of the failure of constructivist, discovery, problem-based, experimental, and inquiry-based teaching. *Educational Psychologist*, 41(2), 75-86.

Kleiman, G. M. (2004). *What does the research say? Does technology combined with inquiry-based lessons increase students' learning?* Director, EDC Center for Online Professional Education. EDC 2004. (pp. 1-10).

Koufetta-Menicou, C. & Scaife, J. (2000). Teachers' questions – types and significance in science education. *School Science Review*, 81 (296), 79-85.

Leithwood, K. & Duke, D. L. (1999). A century's quest to understand school leadership. In J. Murphy and K. Seashore-Louis (eds.) *Handbook of Research on Educational Administration* (2nd ed.). SF: Jossey-Bass, (pp. 45-72).

Marcinkiewicz, H. R. (1994). Computers and teachers: Factors influencing computer use in the classroom. *Journal of Research on Computing in Education*, 26(2), 220-237.

McCombs, B. L., & Whisler, J. S. (1997). The learner-centered classroom and school. San Francisco, Jossey-Bass. (pp. 3-34), (pp. 64-101).

McGregor, D & Gunter, B. (2001). Changing pedagogy of secondary science teachers: the impact of a two year professional development program. *Teacher Development,* 5(1), 59-74.

McKeachie, W. (1994). *Teaching tips: A guidebook for the beginning college teacher* (9th ed.). Lexington, MA: C.C. Heath.

McMaster University. Problem-based learning: History and overview. Hamilton, Ontario: Author, School of Nursing. Retrieved October 10, 2007, from http://www.fhs.mcmaster.ca/pblnursing/HistoryOverview.htm.

Merrill, D. M. (2007). A task-centered instructional strategy. *Journal of Research on Technology in Education*, 2007, 40 (1), 5-22.

Merriam, S. B. (1998). *Qualitative research and case study applications in education.* San Francisco, CA: Jossey-Bass.

Milbrath, Y.L., & Kinzie, M. B. (2000). Computer technology training for prospective teachers: Computer attitudes and perceived self-efficacy. *Journal of Technology and Teacher Education*, 8(4), 373-396.

Modell, J., & Elder, G. H. (2002). Children develop in history: So what's new? In W. Hartup & R. Wein berg (eds.), *Child psychology in retrospect and prospect: In celebration of the 75th anniversary of the Institute of Child Development,*

(Minnesota Symposia on Child Psychology, 32, 173-205). Mahwah, NJ: Lawrence Erlbaum.

Moran, S., Kornhaber, M., & Gardner, H. (2006). Orchestrating multiple intelligences. *Educational Leadership* September 2006. (pp. 22-27).

Naisbett, A. (1997). Policy and provision for more able pupils: the Nunthorpe experience. *Support for Learning*, 12(2), 83-89.

Nast, J. (2006). *Idea mapping: How to access your hidden brain power, learn faster, remember more and achieve success in business*. New Jersey: John Wiley & Sons.

Novak, J. D. (1993). How do we learn our lessons?: Taking students through the process. *The Science Teacher*, 60(3), 50-55.

Ogawa, R., & Bossert, S. (1995). Leadership as an organizational quality. *Educational Administration Quarterly*, 31, 224-243.

Ozmon, H., Carver, S. (1992). *Philosophical Foundations of Education*. (5th ed.) Englewood Cliffs, NJ: Prentice Hall.

Palmer, S., & Wehmeyer, M. (2003). Promoting self-determination in early elementary school. *Remedial and Special Education*, 24, 115-126.

Pearson, V., Wong, D. K., Kit-mui Ho, & Yu-Cheung Wong. (2007). Problem based learning in an MSW programme: A study of learning outcomes. *Social Work Education.* 26(6), 616-631.

Penuel, W.R. (2006). Implementation effects of one-to-one initiatives: A research synthesis. *Journal of Research on Technology in Education*, 38(3), 329-348.

Portin, B. S., Alejano, C. R., Knapp, M. S., & Marzolf, E. (2006). *Redefining roles, responsibilities and authority of school leaders.* Center for the Study of Teaching and Policy. University of Washington.

Perchman, E. M. (1992). Child as meaning maker: The organizing theme for professional practice schools. In M. Levine (Ed.), *Professional practice schools* (pp.25-62). New York: Teachers College Press.

Preskill, H. & Toreres, R. (1999). *Evaluation inquiry for learning in organizations.* Thousand Oaks, CA: Sage.

Rakes, G. C., Fields, V., & Cox, K. (2006). The influence of teachers' technology use on instructional practices. *Journal of Research on Technology in Education*, 38(4), 409-424.

Ramsay, J., & Sorrell, E. (2007). Problem-based learning: An adult-education-oriented training approach for SH&E practitioners. *Professional Safety*. Sept. 2007, 41-46.

Roberts, D. F., Kelley, C. L., & Medlin, D. B. (2007). Factors influencing accounting faculty members' decision to adopt technology in the classroom. *College Student Journal*, 41(2), 423-435.

Rosenfeld, B., & Martinez-Pons, M. (2005). Promoting classroom technology use. *Quarterly Review of Distance Education*. 6(2), 145-153.

Rubin, Andee. (2005, February) *Educational technology: Support for inquiry-based learning*. Retrieved October, 2008, from http://ra.terc.edu/publications/TERC_pubs/tech-infusion/ed_tech_intro.html.

Ryan, R. M., & Powelson, C. L. (1991). Autonomy and relatedness as fundamental to motivation and education. *Journal of Experimental Education*, 60(1), 49-66.

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Sandholtz, J.H., Ringstaff, C., & Dwyer, D.C. (1997). *Teaching with technology: Creating student-centered classrooms.* New York: Teachers College Press.

Schlechty, P.C. (2000). Leading a school system through change: Key steps for moving reform forward. In *Educational Leadership*, (pp.182-201). San Francisco, CA: Jossey-Bass.

Seashore-Louis, K., Toole, J., & Hargreaves, A. (1999). Rethinking school improvement. In J. Murphy and K. Seashore-Louis (Eds.) Handbook of Research on Educational Administration (2nd edition). SF: Jossey-Bass, (pp. 251-276).

Sugar, W., Crawley & Fine, B. (2004). Examining teachers' decisions to adopt new technology. *Educational Technology and Society*, 7(4), 201-213.

Tharp, S. (2006). Principals exhibiting student-centered leadership correlates with positive school climate indicators in title I eMINTS schools and higher MAP math scores in title I eMINTS classrooms. Office of Social and Economic Data Analysis, University of Missouri, Columbia, Missouri.

Tomei, L. A. (2007). The technology façade. *American School Board Journal*. September 2007.

Trimble, S. (2003). Between reform and improvement in the classroom. *Principal Leadership*, 4(1), 35-39.

Vannatta, R. A., & Fordham, N. (2004). Teacher dispositions as predictors of classroom technology use. *Journal of Research on Technology in Education*. 36 (3).

Vinograd, C., Klemick, E., (2007). Tracking US trends. *Education Week*. 3/29/2007, 26(30).

Von Glasersfeld, E. (1981). The concepts of adoption and viability in a radical

    constructivist theory of knowledge. In I. E. Sigel, D. M. Broinsky, & R. M.

    Golinkoff (Eds.), *New directions in Piagetian theory and practice* (pp. 87-95).

    Hillsdale, NJ: Lawrence Erlbaum.

Watson, K. (1999). WebQuests in the middle school curriculum: Promoting technological

    literacy in the classroom. University of Virginia. Retrieved August 10, 2008 from

    http://www.ncsu.edu/meridian/jul99/webquest/index.html.

Wehmeyer, M. (2005). Self-determination: Casual agency theory. *Journal of*

    Developmental and Physical Disabilities, 16, 337-359.

Wenglinsky, H. (2004). Facts or critical thinking skills? What NAEP results say.

    Educational Leadership, 62(1), 32-35.

Wertsch, J. V. (1985). *Cultural, Communication, and Cognition: Vygotskian*

    Perspectives. Cambridge University Press.

White, B. Y., & Frederiksen, J. R. (1998). Inquiry, modeling, and metacognition: Making

    science accessible to all students. *Cognition and Instruction*, 16(1), 3-18.

Yukl, G. (2002). *Leadership in Organizations. (5th ed.)* Upper Saddle River, NJ: Prentice

    Hall.

Zohar, A. (1999). Teachers' metacognitive knowledge and the instruction of higher-order

    thinking. *Teaching and Teacher Education* 15, 413-429.

APPENDICES

Teacher Interview Questions

Research Questions

1. To what extent do teachers newly trained in inquiry instruction integrate the teaching method into their classroom practices?

2. What factors influence teachers' ability and/or willingness to implement IBI method into their classes?

3. How can school leaders assist teachers in the implementation of the inquiry instructional methods?

Question A and B are asked to assure that terminology and concept of Inquiry is consistent.

a. Can you give some examples of IBI?
b. When you hear the term IBI, what comes to your mind?

1. Can you describe or discuss your usage of technology in the classroom and at home before you began your work with inquiry-based learning? What did you use? How did you use it? To what extent did you use it?
   a. …and after your training with eMINTS and inquiry-based learning?

2. Has your training in inquiry-based learning changed the way you teach and if so how?

3. What was it about IBI that created the most challenges for you?

4. What do you see are the benefits of IBL?

5. How did school leadership assist or hinder your efforts of this project?

6. Can you list three factors that you would have preferred done differently if you were to begin on this training today?

7. How often do you incorporate inquiry-based learning into your lessons and can you give some examples of these lessons?

8. What do you see as the future for this type of instruction? And why? (Inquiry-based)

9. Did you encounter any physical, structural, or operational barriers to the implementation of IBI?

Administration Interview Questions

Research Questions

1) What are the factors that have the greatest impact on a teacher's ability and/or willingness to implement a new instructional method into their classes?

2) How can school leaders assist teachers in this transformation in order to ensure implementation of the instructional method?

3) To what extent do teachers newly trained in inquiry instruction integrate the teaching method into their classrooms?

Question A and B are asked to assure that terminology and concept of "inquiry" is consistent.

    a. Can you give some examples of IBI?
    b. When you hear the term IBI, what comes to your mind?

1. What was the district's reasoning behind the decision to move toward IBI?

2. What types of preparations were required of the district to the move from traditional classroom instruction toward inquiry-based lessons?

3. How were the teacher participants for training selected?

4. What does the district hope to achieve by this change in instruction?

5. What has been the response from the school community (parents, students, and staff) toward the implementation of this form of teaching? How have their concerns/comments been addressed?

6. Has the educational conversation between teachers, parents, and administration changed since this project started? And if so how?

7. What were some of the structural, physical, or operational factors that have affected the rate and success of implementation of IBI?

8. What are some of the difficulties the district encountered during the transition toward IBI?

VITA

David Haggard received his primary and secondary education from the Kansas City and Lone Jack, Missouri school systems. The many opportunities for students to participate in a wide variety of activities gave David a love and appreciation of the small rural schools. What these small schools sometimes lack in their ability to provide in building size or equipment is far outweighed by what they offer students in so many other areas.

After high school Mr. Haggard attended the University of Missouri, Columbia for two years before marrying and beginning a family. His bachelor's degree in education was obtained in 1987 from Southwest Missouri State University, Springfield, Missouri. With a desire to get into the classroom, Mr. Haggard landed his first teaching job in Alton, Missouri teaching high school science where he remained for seven very enjoyable years.

A move to St. Louis and the Bayless School District gave David his next challenge as he accepted a position teaching science to middle school students. During his five years in this position Mr. Haggard came to appreciate the wonderful experiences possible with teaching this young and exuberant age students. The Masters of Administration was received during this period from the University of Missouri, St. Louis in 1999.

The next nine years for Mr. Haggard were spent in New Franklin, Missouri, where he served as principal for the middle and high school. The many duties required of school principals are extensive but also very rewarding. The opportunity to counsel and help students in need is never ending in the principal's

office. It also allows one to see the "whole child" rather than just the science or math student.

Mr. Haggard received his Doctorate of Education in 2010 from the University of Missouri, Columbia, and presently serves as Superintended of Schools for the New Franklin R-1 School District.