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Inquiry-Based Learning in the Elementary and Middle School Setting

Dale Uselman
uselmand@csp.edu

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Dale Uselman

Concordia University, St. Paul

ED 590: Research & Complete Capstone Cohort #782

Professor Teresa Tyler

Dr. Oluwatoyin Akinde Fakuajo

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Abstract

There are many instructional strategies available to educators for use in the classroom. With this variety of strategies, there is a responsibility for educators to ensure the strategies selected for use have a positive impact on student learning. One such instructional strategy used in classrooms around the world is inquiry-based learning. This strategy allows students to create their own understanding of content while teachers act as facilitators. Research about inquiry-based learning in the elementary and middle school setting indicates it has a positive impact on student learning. These positive influences on learning include greater academic achievement in multiple content areas and increased learning behaviors, such as engagement, motivation, and flow. The strategy has also been shown to help students develop necessary thinking skills, including science processing skills and critical thinking. Administrators and classroom teachers can benefit from the addition of inquiry-based learning into school practices as it is suited for a range of grade levels and content areas.

Keywords: academic achievement, flow, inquiry-based learning, resistance behaviors, science processing skills

Inquiry-Based Learning in the Elementary and Middle School Setting

Chapter One: Introduction

Throughout the history of education, there have been many instructional strategies developed and utilized in the classroom to enhance student learning. School administrators and classroom teachers are continuously searching for the most effective way to teach students in order to help them gain the knowledge they need to be successful in life. As the number of instructional strategies continues to increase, it becomes difficult to decide which of these provide the greatest impact on student learning and should be chosen for use. One instructional strategy that should not be overlooked while making this decision is inquiry-based learning.

Inquiry-based learning offers a shift in pedagogy by allowing educators to give students control over their learning (Maxwell, Lambeth, & Cox, 2015). This strategy places teachers in the role of facilitator while students take responsibility for their learning. Students are given the opportunity to create their own meaning of content through exploration. Learning takes place by encouraging students to ask questions, investigate solutions, create new knowledge as information is gathered, discuss discoveries and experiences with peers, and reflect on their newly gained knowledge (Turkmen, 2009). This is a fundamental shift from traditional instructional strategies in which content is predetermined, students listen or read along while the teacher lectures on a topic, and students are assessed on their memorization of facts presented during lecture.

As inquiry-based learning is implemented in more schools around the world, educators have noticed the benefits of the strategy. Students who take part in inquiry-based learning show an increased understanding of content knowledge as well as increased thinking skills (Ergul et al., 2011). This increase in content knowledge and thinking skills is desirable for schools due to

the increased emphasis on high-stakes standardized testing. The use of inquiry-based learning in classrooms has been linked to increases in positive student learning behaviors, such as motivation and positive attitudes toward school subjects (Borovay, Shore, Caccese, Yang, & Hua, 2019). An increase in these types of behaviors is important because they can be helpful for students during the duration of schooling.

Scope of Research

The research for this study focuses on the impact of inquiry-based learning on student learning. While there is a large quantity of research on this subject in the secondary and post-secondary school setting, it is equally beneficial for elementary and middle schools, and this study focuses on the latter. The research for this study pertains to students in kindergarten through eighth grade. Research from a variety of schools around the world is desirable to provide assurance that studies in various grade levels, of diverse demographics, and at numerous school locations produce the same outcome.

The research represents qualitative and quantitative studies that assess the use of inquiry-based learning in the classroom. While inquiry-based instruction is primarily employed in science education, several studies present how it can be used effectively in other subject areas. Most of the studies note the use of a treatment group and a control group to show the difference in educational outcomes between classrooms that use inquiry-based learning and classrooms that use traditional instructional strategies. The selection of research highlights the increased benefits of inquiry-based learning in the elementary and middle school classroom regardless of subject matter, student demographics, or location.

Importance of the Study

Students in the United States rank well below many other advanced industrial nations (Pew Research Center, 2017, para. 1). According to the Organization for Economic Co-operation and Development, one of the biggest cross-national assessments, the Programme for International Student Assessment, measures reading ability, math, and science literacy every three years (2018, para. 1). The most recent assessment in 2015 shows that 15-year-olds rank 38th out of 71 countries in math and 24th in science (Gurria, 2018). Another long-running assessment, the National Assessment of Educational Progress, shows in 2015 average math scores for fourth- and eighth-graders fell for the first time since 1990 (Carr, 2015, para. 5).

These scores present the need for the evaluation of instructional strategies used in classrooms around the United States. Schools should be conscious of the strategies adopted and be confident in their ability to produce the greatest positive impact on student learning. Educational leaders have the responsibility to refer to research to identify the most effective instructional strategies. The research in this study offers school administrators the necessary information to decide if inquiry-based learning is one such strategy.

Research Question

The research compiled for this study was selected to answer the question, What is the impact of inquiry-based learning on student learning in the elementary and middle school setting?

Connection to Essential Question

The research question directly relates to the program essential question: In light of what is known about how children learn and educational policy and practice, how shall educators best lead in educational settings today in order to impact student learning? Through the study of the

presented research, educational leaders are given the necessary information to understand the impact inquiry-based learning has on student learning. These leaders are then able to make an informed decision whether or not to include inquiry-based learning in a school's current practice. To further supply educators with a firm understanding of the research, the following section contains definitions of terms found in the research.

Definition of Terms

Academic achievement refers to the level of a student's learning. This level is often measured using standardized assessments to identify whether a student has learned the necessary content. In the United States, many states use statewide tests to measure students' academic achievement in relation to the state's grade-level standards (Minnesota Department of Education, 2017, p. 1)

Flow, or *flow construct,* can be understood as the ultimate state or greatest experience of intrinsic motivation. It is a state in which a person experiences centered attention, minimized distractions, and enjoyment from interaction with a given activity. Flow experiences have been shown to increase intrinsic motivation, self-esteem, and time devoted to completing academic work (Borovay et al., 2019).

Inquiry-based learning is a process of creating new knowledge through experience in authentic situations. It requires students to ask and refine questions, collect data, elaborate on their ideas and experiences, and interpret their findings. Teachers act as facilitators and guide students in brainstorming ideas, generating questions, planning and executing investigations, gathering data, and analyzing the data (Song & Kong, 2014).

Student resistance behaviors are behaviors perceived as oppositional behaviors toward instructional activities. Examples of these types of behavior include refusing to participate in an

activity, complaining about an activity, and disrupting other students during an activity. Sources for these behaviors may include a lack of self-confidence or the use of inappropriate instructional methods (Sever & Guven, 2014).

Science processing skills are skills that apply to many sciences and reflect the behaviors of scientists. Examples of these skills are observing, measuring, recording and interpreting, formulating hypotheses, and experimenting. The skills facilitate learning in the physical sciences and help students understand the process of research (Ergul et al., 2011).

Summary

International assessments show that students in the United States are outperformed by students in many other advanced industrial nations. There is a need for schools to ensure that high-quality instructional strategies are used in classrooms to improve student learning. Inquiry-based learning is a strategy that is becoming more widely used in classrooms and may be one of these high-quality instructional strategies. The research in this study identifies whether the impact inquiry-based learning has on student learning is beneficial or not.

The following chapter contains a literature review to present and analyze the research. The review contains evidence of the impact inquiry-based learning has on student learning including academic achievement, learning behaviors, and thinking skills. The chapter also contains examples of how student learning through inquiry-based learning differs from that of traditional learning strategies.

Chapter Two: Literature Review

The second chapter of this review examines the research on inquiry-based learning and its effect on student learning in the elementary and middle school setting. The research is organized to highlight the three components of learning that are impacted by inquiry-based

learning: academic achievement, learning behaviors, and thinking skills. It is demonstrated that, in general, studies have found a positive influence on all these components when inquiry-based learning is implemented in the classroom. Multiple studies also compare how inquiry-based learning and traditional instructional strategies affect student learning.

Before exploring the research, it is necessary to understand what inquiry-based learning entails. Inquiry-based learning is a student-centered process of building knowledge through experience in authentic, or real world, environments (Song & Kong, 2014). The instructional strategy requires students to ask and refine questions, engage in collecting data, elaborate on ideas, and interpret findings. During inquiry-based learning, teachers play a facilitating role to help learners develop ideas, generate questions, design and execute investigations, collect data, search for information, and analyze findings. This strategy contrasts with traditional instructional strategies which are teacher-centered and frequently involve lecture. Other examples of traditional instructional strategies consist of students to read from textbooks, assigning worksheets, and conducting demonstrations.

Impact on Academic Achievement

Inquiry-based learning is an instructional strategy meant to help students create an understanding of the world through exploration. Using this strategy, students create and answer questions to understand various topics designated by the teacher. The intent of inquiry-based learning is that students obtain a solid understanding of the content while interacting with it during the lesson. If students are, in fact, gaining necessary understanding, then they should also make growth academically. When this growth is measured in students, it is evidence of an increase in academic achievement.

Multiple studies show a direct correlation between the use of inquiry-based learning and academic achievement (Abdi, 2014; Avsec & Kocijancic, 2016; Borovay et al., 2019; Condon & Wichowsky, 2018; Erbas & Yenmez, 2011; Hwang & Cheng, 2016; Jackson & Ash, 2012; Maxwell et al., 2015; Samarapungavan, Patrick, & Mantzicopoulos, 2011; Scott, Schroeder, Tolson, Huang, & Williams, 2014; Sever & Guven, 2012; Shih, Chuang, & Hwang, 2010; Song & Kong, 2014; Turkmen, 2009). The studies show this correlation is present regardless of grade-level, student demographics, or school location. While inquiry-based learning is most often used within the science classroom, it is beneficial for educational leaders to explore its use within other subject areas to provide educators with an instructional strategy that proves effective in increasing academic achievement regardless of the subject.

Achievement in science. The use of inquiry-based learning in the area of science became prevalent in classrooms in the United States in the late 1950s and early 1960s during the United States National Science Foundation's curriculum-reform efforts (Turkmen, 2009). While the use of the strategy is relatively new in American classrooms, inquiry-based science teaching has been used historically since it was used by Socrates (Turkmen, 2009). The strategy aligns with science content because the approach relies on the practice of skills used by scientists. By using the strategy, students' scientific understanding is supported through critical thinking and problem-solving skills (Maxwell et al., 2015).

One common example of inquiry-based learning in science is the 5e instructional model. The 5e model provides a framework for educators that features five phases of instruction including Engage, Explore, Explain, Elaborate, and Evaluate (Scott et al., 2014). In the Engage phase, students are introduced to the academic content and begin to connect their background knowledge to new ideas. The Explore stage involves hands-on activities to encourage students to

connect experiences and formulate concepts and skills. During Explain, students discuss observations and the teacher validates ideas or addresses misconceptions. In the Elaborate phase, students transfer newly acquired understanding to new and authentic situations. Lastly, students are assessed on their understanding of the content during the Evaluate phase.

A study conducted by Turkmen provided an example of the impact inquiry-based learning had on science academic achievement in comparison to traditional instructional strategies (2009). This mixed methods study utilized an inquiry-based learning approach that featured technology to instruct students in earth science concepts. The research was conducted over three weeks with 97 fifth grade students (10 to 11 years old) randomly separated into two classrooms. One classroom of 48 students acted as the control group while a classroom of 49 students was the experimental group. The two groups had approximately the same number of girls and boys. No other student demographic information was listed in the study, which was a barrier in identifying possible limitations related to participants within the study.

In the control group, science lessons were mostly teacher-centered and reflected traditional instructional strategies. The experimental group partook in inquiry-based lessons that followed the 5e model. Both instructional groups used the same text and engaged in lessons for the same amount of time. The only independent variable stated by the study was the type of instruction (Turkmen, 2009).

Quantitative data was produced by the analysis of an achievement test administered before and after the unit of study. Students were assessed on their understanding of concepts related to the sun, earth, and moon. The analysis of the assessments showed there was a statistically significant difference between the two instructional groups. The average score in the experimental group was higher than that of the control group. Through further examination, the

study concluded that inquiry-based learning was the variable that positively affected students' academic achievement. However, there were limitations to the study. As previously noted, there was limited information about study participants, which could signal an imbalance in student demographics between the two groups, such as socio-economic or special education status. Also, the two instructional groups were taught by different educators, one with 14 years of teaching experience and the other a senior pre-service teacher. This difference in teaching experience could have affected the quality of instruction during lessons.

The previous study was not the only to offer evidence of the positive impact inquiry-based learning had on science achievement. In other studies where fifth grade students participated in science lessons utilizing inquiry-based learning, findings showed a positive influence on academic achievement (Abdi, 2014; Jackson & Ash, 2012; Maxwell et al., 2015; Scott et al., 2014). These studies also noted that when compared to traditional instructional strategies, inquiry-based learning produced a greater positive impact on science achievement. Fifth-graders who participated in inquiry-based learning lessons made greater gains in science achievement than students who were instructed using traditional instructional strategies. In most of the studies, this difference was statistically significant; however, in a study conducted by Maxwell, Lambeth, and Cox it was found to be insignificant (2015). In two studies, the difference in academic achievement was present regardless of students' gender, ethnicity, or socio-economic status (Jackson & Ash, 2012; Scott et al., 2014). A study conducted by Abdi also showed evidence that the difference in science achievement between the two instructional strategies occurred when control and experimental groups were taught by the same educator (2014).

Research that involved students at other grade levels showed a similar impact on science achievement due to inquiry-based learning. Assessment scores from 185 kindergarten students involved in multiple inquiry-based science units showed statistically significant differences from those that attended units with traditional instructional strategies (Samarapungavan et al., 2012). Quantitative data from this study showed that, after a year of instruction, kindergarten students in classrooms using traditional instructional strategies scored close to the same as students in inquiry-based classrooms did at the beginning of the year. Students in fourth and sixth grade classrooms were also positively affected by inquiry-based learning in science education. Through both qualitative and quantitative methods, the students showed growth in science achievement when involved in learning that used the 5e model of inquiry-based learning (Hwang & Chen, 2016; Song & Kong, 2014).

Achievement in technology. While the use of inquiry-based learning became prevalent in science classrooms in the 1950s and 1960s, it has since become part of instruction in other subject areas. One area the use of inquiry-based learning has been studied in is technology. Research in the area of inquiry-based learning in technology-intensive education is minimal; however, studies that have been conducted show a positive relationship (Avsec & Kocijancic, 2016; Sever & Guven; 2014).

When an achievement pre-test and post-test was administered to seventh grade students in a science and technology course, results showed students in the experimental group, which utilized inquiry-based learning, had a greater increase in achievement than students taught with traditional strategies (Sever & Guven, 2014). This study further showed a positive impact on science education as well as technology education. However, the study lacked student demographic information, and therefore, left the possibility of limitation due to participant

demographics. An additional limitation of the study was the purposeful sampling of students in which only students considered to be mature could participate. This granted the possibility that only adolescents who showed qualities of a mature student benefitted from inquiry-based learning in technology education.

In another study, 429 middle school students between the ages of 13 and 15 were separated into a control group and an experimental group during a technology course (Avsec & Kocijancic, 2016). The groups were balanced in gender and age. The quantitative data from technological literacy pre-test and post-test scores showed the students in the experimental group, those participating in inquiry-based learning, scored higher than those who did not have inquiry-based learning exposure. The scores showed a statistically significant positive impact on technology achievement due to inquiry-based learning. In this study, the impact on achievement was regardless of students' gender or maturity level. Avsec and Kocijancic cautioned that path coefficients from the study indicated that if a learning environment was highly comfortable, inquiry-based learning was less effective (2017). Alternatively, they noted that well organized content, enabled feedback mechanisms, and well-designed learning processes decreased learning difficulty during inquiry-based learning. These additional notes to the research should be considered by educational leaders during decisions about how to implement inquiry-based learning in the school setting.

Achievement in mathematics. Educators use inquiry-based learning within the mathematics classroom as well. As previously stated, international assessments show the United States is outperformed by many other advanced industrial nations in mathematics achievement (Pew Research Center, 2017, para. 1). Educational leaders are exploring alternative instructional strategies to help with this issue. Project Inquiry-Based Math offers one of these strategies. The

project is a National Science Foundation-funded Math and Science Partnership. It exists to improve students' mathematical performance (Stone & Hamann, 2012). The goal of Project Inquiry-Based Math is to adopt inquiry-based mathematics materials into schools using a curriculum grounded in inquiry and cognitively guided instruction.

Stone and Hamann studied the impact Project Inquiry-Based Math had on the mathematics achievement of fifth grade students (2012). Four fifth grade classrooms from different schools in a United States school district were observed during the implementation of the project. The district adopted the project to raise the mathematics achievement level of all students and to reduce the achievement gap between American Indian students and non-American Indian students. The teachers from all four classrooms taught mathematics to their students using Project Inquiry-Based Math. Analysis of qualitative data was unable to determine whether or how inquiry-based mathematics education helped American Indian students or reduced the achievement gap. However, the authors stated that since the adoption of the inquiry-based mathematics curriculum, all students' mathematics test scores improved significantly but the achievement gap only narrowed slightly (Stone & Hamann, 2012). A limitation of this study existed in that all classrooms were facilitated by different instructors whose delivery of inquiry-based learning differed in various ways.

Many reports showed student performance in a specific area of mathematics, geometry, was greatly lacking due to numerous student misconceptions (Erbas & Yenmez, 2011). The reports highlighted the need for effective instructional strategies in geometry. In their study, Erbas and Yenmez stated that inquiry-based learning paired with dynamic geometry environments was the instructional strategy needed to help with student performance in geometry (2011). Dynamic geometry environments were programs for computers or calculators that

allowed students to represent and manipulate geometric figures in ways that were not possible with paper and pencil. The study reported that sixth grade students who participated in lessons containing inquiry-based learning and dynamic geometry environments showed a greater rate of increase between a pre-test and a post-test on polygons than did students who participated in lessons with traditional instructional strategies. However, the qualitative data also showed that both groups of students displayed the same rate of decrease in achievement on a delayed post-test. This indicated that even though inquiry-based learning had a greater positive impact on mathematics achievement, it was not effective in helping students retain the acquired understanding.

Achievement in social studies. One subject area not frequently associated with inquiry-based learning is social studies. However, inquiry-based learning and social studies, specifically the area of history, complement each other. Shih, Chuang, and Hwang state that history involves inquiry into the past (2010). During the study of history, students use the process of inquiry to reconstruct and reinterpret the past by using various sources to check credibility, validating and weighing evidence for claims, and searching for cause and effect relationships. A project which involved 33 fifth grade students combined inquiry-based learning and social studies content (Shih et al., 2010). The students completed a mobile exploration activity which facilitated the investigation of a historic site using handheld devices. Prior to students participating in the exploration, they completed a pre-class questionnaire to gauge initial understanding of the concept. After the exploration, they filled out a post-class questionnaire to provide data for learning achievement. The data found the students made a significant improvement in social studies achievement and the researchers attributed this improvement to the use of inquiry-based learning. The absence of a control group in this study posed the question of whether the

achievement scores would have been different with the use of an alternative instructional strategy. However, the data indicates that inquiry-based learning was an effective instructional strategy in the improvement of academic achievement in social studies.

Impact on Learning Behaviors

The second key component of student instruction affected by inquiry-based learning is learning behavior. Amirtha and Jebaseelan write that learning behavior is the cognitive readiness of students to learn and indicates their resourcefulness, love for their learning, high interest for reading, and a better attitude in class (2014). These behaviors also include a student's outlook, persistence, efforts in school, motivation, and engagement. Learning behaviors are an important part of student learning because they are one of many factors that influence academic achievement (Amirtha & Jabaseelan, 2014). When a student is motivated and engaged in learning, it is easier for the child to understand the content. If students show negative learning behaviors, such as bullying other students or talking during lessons, it is difficult to learn and could interfere with the learning of other students in the classroom (Amirtha & Jabaseelan, 2014).

Due to the impact learning behaviors have on students' learning, it is important for educational leaders to identify ways to increase these behaviors in classrooms. Multiple studies suggest that inquiry-based learning is an instructional strategy that increases positive learning behaviors in students (Borovay et al., 2018; Condon & Wichowsky, 2018; Erbas & Yenmez, 2011; Ergul et al., 2011; Hwang & Chen, 2016; Maxwell et al., 2015; Samarapungavan et al., 2011; Sever & Guven, 2014; Turkmen, 2009). These studies provide evidence that indicates inquiry-based learning positively affects students' motivation, flow experiences, resistance behaviors, and engagement.

Student motivation. A student's motivation to learn can directly affect the student's achievement in school (Borovay et al., 2018). In fact, Vero and Puka write that lack of motivation in education can damage the learning process for students (2017). Not only does positive motivation contribute to learning, but it is also an important outcome of any learning situation (Borovay et al., 2018). Motivation increases academic achievement, engagement, and subsequent learning (Borovay et al., 2018). It is therefore ideal for classroom teachers to include instructional strategies that promote positive student motivation into lessons (Vero & Puka, 2017).

In the study conducted by Erbas and Yenmez, in which sixth graders in Turkey took part in geometry lessons, qualitative analysis revealed a difference in motivation between the experimental group and the control group (2011). The control group, instructed with traditional instructional strategies, showed a lack of motivation during the lessons. Most of the students in the control group did not attempt to answer the teacher's questions and guessed when required to measure angles and side lengths. In contrast, all students instructed with the use of inquiry-based learning tried to participate and took part in in-depth discussions with partners about activities.

The increase in positive student motivation was not just present in the study of sixth-graders in Turkey. Borovay et al. shared similar results on the increase of student motivation due to inquiry-based learning in a study conducted with Canadian students in fifth through ninth grades in International Baccalaureate Organizations or French-immersion programs (2018). The data from this study indicated that students receiving frequent inquiry instruction had higher average scores for intrinsic motivation. Other studies showed the increase in positive student motivation was also typical of lessons involving inquiry-based learning for students in American kindergarten students and sixth-graders in China (Hwang & Chen, 2016; Samarapungavan et al.,

2011). The studies collectively indicated that the increase in student motivation due to inquiry-based learning was not restrictive to one subject, age, or location.

Flow experiences. Flow, or flow construct, is another learning behavior that is favorable for students. Whalen discusses the idea of flow:

> Flow denotes a state of immersed concentration in which attention is centered, distractions are minimized, and the person attains an enjoyable give-and-take with the activity. In this state people report they lose track of time and their daily problems; forget hunger, pain, and fatigue' and pass from a stance of control and "efforting"' into a mode sometimes described as "active effortlessness." (1998, p. 22)

Flow describes times when an individual is so concentrated on an activity that he or she is aware of nothing else. According to Borovay et al., flow experiences increase motivation and foster further learning and the development of levels of skill (2019). Because flow relates to desirable outcomes for learning, it is beneficial for students to take part in activities that increase flow experiences.

In the mixed-methods study conducted by Borovay et al., 272 fifth through ninth grade students from International Baccalaureate Organizations or French-immersion programs acted as participants to explore the connection between inquiry-based learning and flow (2019). Students in the International Baccalaureate Organizations were instructed by staff who were committed to utilizing inquiry-based learning in the classroom. The teachers from the French-immersion programs taught with more traditional instructional strategies. The students were separated into classes before the onset of the study. The classes chosen to be involved in the study were instructed in mathematics, language arts, science, French, and geography. The students were of varying academic achievement. Most of the students were average-achieving or above. Teachers

who participated in the study were chosen by administrators based on their high level of effectiveness.

Qualitative data originated from teacher and student interviews while quantitative data was retrieved from the Revised Flow State Scale administered to students two times. The data from the Flow State Scale reported significantly higher states of flow from classes incorporating inquiry-based learning. The data also indicated students in inquiry settings reported more flow experiences. The findings from interviews stated that flow experiences occurred when students interacted with knowledgeable peers and facilitators. The interviewed students also shared that they liked inquiry because they enjoyed challenging learning.

There were multiple limitations to this study. Most of the students who participated in the study were of average or higher academic achievement. This could signal that higher achieving students were more likely to have flow experiences during inquiry-based learning. Another limitation was that student responses on surveys may have been caused by other variables, such as successful performance or working with a favorite teacher. Lastly, the students chosen to be interviewed did not parallel the demographics of the collective group of participants. This may have skewed the information collected from interviews. Even with the realization of limitations, the researchers still asserted that inquiry-based learning should be implemented in classrooms due to its enhancement of flow experiences.

Resistance behaviors. While inquiry-based learning increased certain student behaviors such as motivation and flow, the instructional strategy also decreased negative behaviors. Student resistance behaviors were behaviors exhibited by students that were oppositional toward instructional activities. Sever and Guven listed examples of student resistance behaviors exhibited by participants in their study (2014). The examples included not participating in

activities, showing no interest in the material, and not respecting the teacher. Along with the examples of resistance behaviors, possible sources of resistance were also listed in the study. The examples consisted of lack of self-confidence, unfair behaviors toward students, and inappropriate instructional methods for the student demographic. The researchers noted that it was necessary for educators to decrease the resistance behaviors and their sources to improve the learning experience for students (Sever & Guven, 2014).

In the study conducted by Sever and Guven inquiry-based learning decreased the resistance behaviors in students (2014). A sampling of 95 seventh grade students was assigned to a control group, instructed with traditional instructional strategies, and experimental groups, instructed with inquiry-based learning, during a science and technology course. Observations and interviews from teachers identified seven students in the control group and nine students in each experimental group showing resistance behaviors. Qualitative data from the end of the course indicated inquiry-based learning successfully decreased students' resistance behaviors. However, the teachers shared that the changes did not persist. The study is evidence, nonetheless, that inquiry-based learning can have a positive impact on students' resistance behaviors and should be a consideration for elementary and middle school classrooms.

Student engagement. A final learning behavior that is affected by inquiry-based learning is student engagement. Student engagement is characterized by whether a student is on task and actively involved during lessons (Maxwell et al., 2015). Examples of engagement behavior consist of participating in activities and completing assignments, while daydreaming and playing with materials are examples of disengagement. According to the University of Washington, student engagement is advantageous in classrooms to ensure students are actively involved with and thinking about the lesson's learning objectives (2019).

In a study by Condon and Wichowsky, sixth-, seventh-, and eighth-graders in Catholic schools in the midwestern United States participated in lessons using an inquiry-based science and civics curriculum (2018). The students' peers in other schools in the diocese were instructed using traditional strategies. By analyzing completed surveys, researchers discovered students in inquiry-based classes showed greater gains in both science and civics engagement than those not exposed to inquiry-based learning. These findings were comparable to a similar study conducted with fifth grade students in Georgia (Maxwell et al., 2015). During this six-week study in science classrooms, researchers used an engagement checklist from observations to identify changes in student engagement. Data indicated that fifth-graders in the inquiry-based learning group were engaged 16% more often than students in the traditional group. Both studies illustrated the positive effect of inquiry-based learning on student engagement and were evidence of its need to be included in classrooms.

Impact on Thinking Skills

The third key component of student learning that is affected by inquiry-based learning is thinking skills. Gough discusses that thinking skills and the capacity to learn and make sense of new information are more important to employers than specific knowledge (1991). In career fields today, it is necessary for employees to be able to solve problems and ask and answer questions to effectively perform duties (Cotton, 1991). Cotton writes that not only are thinking skills necessary for employability, but they are also seen as a fundamental characteristic of an educated person and are essential for responsible citizenship in a democratic society (1991). She continues to note that American young people do not exhibit high levels of skill in critical or creative thinking (Cotton, 1991). However, educators agree these skills can be increased through

instruction and practice (Cotton, 1991). Inquiry-based learning is one of the instructional strategies identified as influential on students' thinking skills.

Science processing skills. The first thinking skills impacted by inquiry-based learning are science processing skills (Ergul et al., 2011). Science processing skills are applicable to many other skills and reflect the behavior of scientists. Examples of these skills are observing, measuring, formulating hypotheses, and experimenting. In students, science processing skills have been shown to guide learning in physical sciences, promote student participation, increase ownership and permanence of learning, and understand research methods (Ergul et al., 2011). Not only are these skills beneficial for students to obtain, but they are desirable in the workplace for many careers.

In a quantitative study completed by Ergul et al., 241 fourth through eighth grade students comprised a control group and an experimental group (2011). Both groups attended two semesters worth of biology, chemistry, and physics classes. The control group was instructed with traditional strategies, while the experimental group participated in inquiry-based learning lessons. The participants were all students in an elementary school in Bursa, Turkey and were nearly all mid-level socioeconomic status. The classes chosen for the study were of similar science performance levels.

A Science Process Skills Test was administered to students as a pre- and post-test. Students in fourth through sixth grade were assessed on basic science process skills, such as observing and measuring, while seventh and eighth grade students were assessed on integrated science process skills such as formulating hypotheses and experimenting. At the end of the study, results showed students in the experimental group had a better performance on both basic and integrated science process skills.

One limitation was that the study was carried out in relatively crowded classrooms. This factor perhaps decreased the quality of instruction or learning due to the number of students. Also, while pre-test scores for the two fourth through sixth grade groups of students were not significantly different, the two groups of seventh and eighth grade students were. The control group of seventh- and eighth-graders had pre-test scores that were significantly lower than the experimental group to start with, which may indicate these students already had a deficiency in science processing skills before the study took place. However, researchers noted that the positive effect inquiry-based learning had on participants was indicative of findings from similar studies. Therefore, it was noted that inquiry-based learning effectively increased students' science processing skills.

Critical thinking. Another thinking skill impacted by inquiry-based learning is critical-thinking. The University of Louisville describes critical thinking as "an ability to question; to acknowledge and test previously held assumptions; to recognize ambiguity; to examine, interpret, evaluate, reason, and reflect; to make informed judgments and decisions; and to clarify, articulate, and justify positions" (2019, para. 1). Critical thinking is a beneficial skill for students because it assists in helping solve problems. It can also be applied to many situations in and out of the classroom setting.

In Duran and Dokme's research conducted during sixth grade science and technology courses, it was recognized that inquiry-based learning was effective in helping students develop critical thinking skills (2016). The students in the study were separated into a control group that used traditional lecture methods and an experimental group that used inquiry-based methods. Results from student-completed critical thinking skills scales showed there was a significant difference between the control group and the experimental group. The researchers argued that

inquiry-based learning used in the experimental group improved the students' critical thinking skills. These findings showed the benefit of including inquiry-based learning into the classroom.

Inquiry skills. The last impact on student learning explored in this review is inquiry skills. Linde writes that inquiry skills are the skills that allow individuals to effectively ask questions, research answers, interpret information, and present and reflect on findings (n.d., para. 3). She states these skills are an important part of student learning because they can develop critical thinking, increase student responsibility, and encourage independent thinking. Inquiry-based learning relies heavily on students' ability to use inquiry skills to complete activities and interact with the content.

Song and Kong conducted research to identify if a correlation between inquiry-based learning and inquiry skills existed (2014). In the study, 27 fourth grade students were involved in six inquiry-based science lessons. The science lessons involved the adoption of the 5e model and focused on rustproofing. Through qualitative methods, student interviews were analyzed to measure any change in students' inquiry skills during the treatment phase. The findings from the study indicated students developed their inquiry skills due to the use of hands-on experiments within inquiry-based learning. While the researchers noted that the results of the research could not be generalized due to the short time span, they asserted that in the study inquiry-based learning promoted the development of students' inquiry skills.

Conclusion

The preceding literature review provided an in-depth exploration of the research pertaining to inquiry-based learning. Throughout the research, it was evident that inquiry-based learning impacts student learning in the elementary and middle school setting. There was a direct impact on three key components of student learning: academic achievement, learning behaviors,

and thinking skills. The synthesis of research represented a wide range of subject areas, grade-levels, and school locations. The synthesis also showed limitations in the existing research and should be considered in its reviewal. The following chapter provides a succinct summary of the previously presented content.

Chapter Three: Summary

The previous chapter offered an in-depth look at research connected to the use of inquiry-based learning in the classroom. As the research suggests, inquiry-based learning directly impacts student learning in a variety of ways. Chapter Three provides a review of the problem, importance of the topic, and a summary of the main points provided throughout the literature review.

Review of the Proposed Problem

The research for this body of work answers the question, What is the impact of inquiry-based learning on student learning in the elementary and middle school setting? In today's educational system, teachers have a wide variety of instructional strategies to choose from for use in the classroom. Due to this variety, it can become difficult for educational leaders and teachers to decide which strategies to use. Educators should choose strategies that positively impact learning the most in order to help students become successful. By reviewing the research on instructional strategies, such as inquiry-based learning, educators can identify the impact a strategy has on student learning and can make an informed decision on which is most effective in the classroom.

Importance of the Topic

As educational leaders select instructional strategies, it is essential that inquiry-based learning is considered. As previously stated, students in the United States currently rank well below many other advanced nations (Pew Research Center, 2017, para. 1). It is the responsibility

of educational institutions to provide high-quality learning experiences for all students. As the nation's rank declines, it is obvious that there is a need for an increase in these high-quality learning experiences.

During their time in the elementary and middle school setting, students should take part in lessons that help them to achieve academically. These lessons should also teach the skills and behaviors needed to be successful learners later in life. It is through the careful selection of instructional strategies that teachers can deliver content in a way that allows students to have these high-quality educational experiences. When teachers are successful in providing students with these encounters, students show greater academic achievement and learn the skills necessary to become lifelong learners.

Inquiry-based learning is an instructional strategy that can help teachers provide students with high-quality educational experiences and, therefore, help students in the United States show greater academic achievement. Through inquiry-based learning, students utilize a research-based instructional strategy to gain a better understanding of the presented content. The strategy also supports students in learning the important skills and behaviors necessary to succeed later in schooling and in life. It is through inquiry-based learning that educational leaders can positively impact student learning in their schools and, in turn, the nation.

Summary of the Main Points of the Literature Review

The review of literature from Chapter Two indicated that inquiry-based learning had a positive impact on student learning. The selected studies showed that when lessons incorporated inquiry-based learning, the academic achievement of students increased. The studies also showed that inquiry-based learning helped students gain behaviors and skills beneficial in becoming a successful learner. Many of the studies also demonstrated that the use of inquiry-

based learning produced a greater positive impact on student learning than did traditional instructional strategies.

The research established that students who participated in inquiry-based learning activities exhibited an increase in academic achievement. The correlation between inquiry-based learning and academic achievement was present regardless of grade-level, student demographics, or school location. The instructional strategy benefitted a range of students from Kindergarten through eighth grade. Students of both genders and varying ethnicities also increased academic achievement when exposed to inquiry-based learning. The reviewed studies represented schools from a variety of locations, such as the United States, Turkey, and China, demonstrating that the effectiveness of inquiry-based learning is not subject to school location.

Another key finding in the review was that the academic achievement of students was impacted across many subject areas. While the instructional strategy had previously been primarily used within science classrooms, it since spread to many other subject areas. Not only did science achievement of students increase through inquiry-based learning, but that of technology, mathematics, and social studies did as well. Furthermore, the increase in academic achievement in these subject areas due to the use of inquiry-based learning was greater than the increase when traditional instructional strategies were used.

In addition to the impact on academic achievement, an impact on student learning behaviors was also present in the review. Students who were exposed to inquiry-based learning showed an increase in motivation toward their learning. This was in direct contrast to the lack of motivation students showed when they took part in lessons using traditional instructional strategies. Inquiry-based learning showed a connection to an increase in the number of flow experiences exhibited by students. The increase in flow experiences took place in a variety of

classes including mathematics, science, and geography. Students also showed an increase in engagement, or on-task behaviors, during lessons incorporating inquiry-based learning. Once again, the increase of this learning behavior was greater when inquiry-based learning was used compared to traditional instructional strategies. The last learning behavior affected by inquiry-based learning was student resistance. Resistance behaviors, such as not participating in activities and disrespecting the teacher, decreased during lessons based on inquiry.

The last key component of student learning impacted by inquiry-based learning was thinking skills. The evidence listed in the review of literature showed inquiry-based learning contributed to an increase in students' science processing skills. These skills allowed students to think and act like scientists. Students' critical thinking was also positively impacted by inquiry-based learning. When students engaged in inquiry activities, the activities helped students develop their critical thinking. Lastly, a connection between inquiry-based learning and students' inquiry skills was presented. Inquiry-based learning's hands-on design promoted the development of students' inquiry skills. Considering these findings, further discussion and an application to instructional practice are presented in Chapter Four.

Chapter Four: Discussion and Application

Chapter Three offered a review of the importance of inquiry-based learning due to its impact on student learning. The chapter also presented a succinct summary of the findings from the research studies examined during the review of literature. Chapter Four provides a summary of the key insights gained from the research, examples of how the research can be applied to instructional practice, and suggestions for possible future studies on inquiry-based learning.

Insights Gained from the Research

The first insight offered by the research is that inquiry-based learning has a positive impact on elementary and middle school students' academic achievement. Many of the studies highlighted in the review show a direct correlation between the use of inquiry-based learning and academic achievement. Students who participate in inquiry-based learning show growth from a pre-test and a post-test on relevant content. The growth made by students exposed to inquiry-based learning is greater than the growth made by students who are instructed using traditional instructional strategies. The impact on academic achievement occurs throughout the studies regardless of grade-level, student demographics, school location, or subject area. This is an indication that when educational leaders and teachers decide which instructional strategies to use in classrooms, inquiry-based learning is an important consideration because it increases students' academic achievement.

The second insight from the research is that inquiry-based learning has a positive impact on the learning behaviors of elementary and middle school students. Learning behaviors are an important part of student learning because not only are they a factor that influences academic achievement, but they are behaviors that students benefit from as they continue their education. Studies show that when inquiry-based learning is utilized in the classroom there is an impact on a variety of learning behaviors exhibited by students. Inquiry-based learning increases positive learning behaviors such as motivation, flow experiences, and engagement. Not only does inquiry-based learning increase positive learning behaviors, but it also aids in decreasing negative student behaviors. When the instructional strategy is utilized in the classroom, it decreases student resistance behaviors, such as not participating in class and disrespecting the teacher.

The third insight presented by the research is that inquiry-based learning positively impacts elementary and middle school students' thinking skills. Thinking skills are critical to a student's development because these skills are needed by students as they continue their education and enter a career field. The selected research indicates that inquiry-based learning can effectively increase these thinking skills in students. In elementary classrooms, inquiry-based learning can increase basic science processing skills such as observing and measuring, while in middle school classrooms it can increase integrated science processing skills such as formulating hypotheses and experimenting. The instructional strategy also promotes a greater increase in students' critical thinking skills than traditional instruction. Lastly, inquiry skills, such as asking questions and researching answers, can be improved when the classroom teacher incorporates inquiry-based learning into the curriculum.

Application

The first example of how this research can be applied is the advocacy of its use across subject areas by educational leaders to raise academic achievement. Many schools currently face the challenge of raising student scores on high-stakes standardized testing. School districts spend a large amount of time and money deciding which instructional strategies to implement into classrooms to promote higher student test scores. As the research has shown, it would be beneficial for districts to advocate for the use of inquiry-based learning during instruction. By expecting teachers to replace traditional instructional strategies with inquiry-based learning, leaders can expect an increase in students' academic achievement regardless of the subject area. This is beneficial because both mathematics and science are heavily assessed by state education departments. Multiple studies in the literature review indicated that when students are exposed to inquiry-based learning in these two subject areas, there is an increase in their academic

achievement. This increase in academic achievement can then manifest as higher scores on high-stakes standardized tests.

A second example of how this research can be applied is through the implementation of inquiry-based learning within all grade levels to promote positive learning behaviors and thinking skills. For students to be successful in school and later in life, they must obtain and develop a variety of learning behaviors and thinking skills. While an emphasis is placed on academic achievement in schools, it is also essential that educators work to help students gain these behaviors and skills. Gaining behaviors such as motivation and engagement can aid students when they interact with challenging content in class and complete difficult tasks or projects in their future careers. Developing thinking skills such as critical thinking and inquiry skills is beneficial, as students and adults must solve problems and conduct research. Schools can help students begin to develop these skills at an early age by using inquiry-based learning. Educational leaders should advocate for its use in the elementary and middle school setting because even at early ages, students can attain and develop these behaviors and skills when exposed to inquiry-based learning.

The third example of how to utilize this research is through the continued professional development of educators in inquiry-based learning. The two previous applications have highlighted the importance of implementing inquiry-based learning into the elementary and middle school classroom to increase academic achievement, positive learning behaviors, and thinking skills. For teachers to be able to implement the strategy in their classroom and ensure it is done effectively, they must receive the proper training on how to best conduct the implementation. As mentioned in Chapter One, even though inquiry-based learning is not a recent discovery, it is not widely used within classrooms. Many teachers may not know how to

best incorporate the strategy into the classroom or even know what inquiry-based learning looks like in practice. These teachers need proper professional development in order to feel confident in the execution of the strategy. Professional development can also ensure that the strategy is implemented correctly and can, therefore, bring about the desired learning outcomes.

Recommendation for Future Research

The first recommendation for future research on inquiry-based learning is its use within language classes. During the review, research was presented on the impact of student achievement in the areas of science, mathematics, technology, and social studies. Further research on the impact of inquiry-based learning on language classes, such as English or Spanish, would be beneficial for educators looking to increase academic achievement in these areas. The research could compare the impact inquiry-based learning has on language classes as opposed to the impact seen from traditional instructional strategies. The research would provide guidance on whether the instructional strategy impacts language academic achievement as it does with other subject areas.

The second recommendation for future research is the effectiveness of closing the achievement gap by incorporating inquiry-based learning into classroom instruction. As noted during Chapter Two, while studies have been conducted to identify the impact inquiry-based learning has on closing the achievement gap, results from the studies did not offer enough evidence to draw a conclusion. Many districts are searching for ways to close achievement gaps between students of different demographics and it would be advantageous to know if inquiry-based learning would aid in closing this gap. The research could be conducted in schools in which there is a large achievement gap and inquiry-based learning could be implemented to see if there is a narrowing of the gap due to its use.

The final recommendation for future research is the comparison of the effectiveness of inquiry-based learning when paired with technology. As mentioned throughout the literature review, many studies showed an increase in student academic achievement by implementing inquiry-based learning activities that included technology. Programs such as dynamic geometry environments and the use of handheld electronic devices were used to incorporate inquiry-based learning into the curriculum in these studies. This presents a need for further research into the use of technology during inquiry-based learning activities. Possible research could include inquiry-based learning activities with and without technology to compare whether the presence of technology affects student learning during the activity. This would guide educators as they decide on materials to include during inquiry-based learning lessons.

In consideration of the research presented in the review, it becomes pertinent for educational leaders to consider the use of inquiry-based learning when deciding on instructional strategies to implement within the elementary and middle school setting. The studies referenced indicate the use of inquiry-based learning can positively impact student learning components such as academic achievement, learning behaviors, and thinking skills. Its use within the classroom ensures that students can gain an understanding of content and develop behaviors and skills necessary for success in later schooling and future career fields. The inclusion of inquiry-based learning into classrooms may prove to be a dynamic shift from ineffective traditional instructional strategies to a powerful and effective strategy that increases student learning in many ways.

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