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Cyclical and Intentional Activity Selection in Inquiry-Based Learning Improved by 5E Learning

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Cyclical and Intentional Activity Selection in Inquiry-Based Learning Improved by 5E Learning

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ABSRACT

The researcher investigated the attitudes toward inquiry-based learning and grades of students in middle school science as well as the significance of rubric based classroom discussion. The literature showed the researcher inquiry-based learning has been shown to increase engagement and understanding. The literature also showed classroom discussions were made more meaningful by implementation of expectations and a rubric. The researcher provided evidence of a significant improvement of classroom discussion, attitudes toward inquiry-based learning, and grades due to implementation of the actions taken by the researcher. The researcher used Kristine Bruss's discussion rubric and expectations. The researcher also used Paul Anderson's mini-lessons focused on inquiry-based learning activities. Data was collected by using students' grades and students' responses to a Likert scale survey. Data was analyzed using a one-way ANOVA test. Also student work was collected to show differences made before and after the researcher's intervention was activated. Results from the ANOVA test showed there was a significant increase in student classroom discussion because of the expectations and discussion rubric. Also, the ANOVA test showed there was a significant increase in student's attitudes toward inquiry-based learning as well as the grades of the students because of the interventions implemented.

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CHAPTER 1

INTRODUCTION

Introduction

Science teachers all across the United States are participating in science standards trainings and science curriculum standards. The new science standards in the state of Minnesota were adopted in 2019. These standards are in close alignment with the national science standards or Next Generation Science Standards (NGSS, 2019). These new standards are arranged in topics and incorporate three dimensional learning (Danielson & Matson, 2018). Three dimensional learning is designed to incorporate various skills throughout the school year into the different topics taught each year. Minnesota's Comprehensive Assessment III (MCA-III), is a standardized test administered to students in 5^{th}, 8^{th}, and 10^{th} grades. These new standardized tests will be implemented in the spring of 2024. In order to get ready for this shift, the researcher, along with colleagues and the district's curriculum director, decided the current curriculum would not be able to meet these standards. Therefore, a new science curriculum was chosen and implemented that was created using the Next Generation Science Standards and was inquiry learning-based with an Engage, Explore, Explain, Elaborate, and Evaluate (5E) learning model used.

The district and the researcher's colleagues were ready to move forward and implement the new curriculum but surprisingly the students were not. Students gave numerous blank stares as phenomenon were introduced and leading questions were asked to get students involved in wanting to learn more about the phenomenon. Students wrote the bare minimum in their responses in their workbooks and said the bare minimum in open-ended discussions. Students also asked on numerous occasions if they could go back to the old curriculum of reading and finding short answer questions from worksheets in the textbook.

This study was intended to intervene with students' feelings of not being ready for an inquiry-based, student-centered learning environment. The intention was to create more student success and make students feel more invested and successful with their new curriculum. Students were taught the curriculum for a set period of time and then given a survey to see how successful they felt in the new curriculum and standards. Students were then given the intervention (which is explained in Chapter 3), and then students were given the same survey to see changes in their understanding and feelings of success in the inquiry-based, student-centered learning environment. Students' success was also measured and shown in this study.

Brief Literature Review

These new science standards have been shown to be effective in preparing students for careers in the 21st Century. According to Mir (2016), "Quick accessibility and well equipped with the skills and knowledge in operating a computer would be very helpful for students" (p. 3). 21st Century skills include but are not limited to communication, collaboration, and problem solving. People in the 21st century live in a technology and media driven environment, marked by various characteristics including access to an abundance of information, rapid changes in technology and tools, and the ability to collaborate and make individual contributions on an unprecedented scale (Partnership for 21st Century Learning, 2015). The new science standards are arranged into topics that also involve three dimensions of learning which include science and engineering practices, disciplinary core idea, and crosscutting concepts. These three dimensions of learning are present in each of the topics as the school year progresses. This is much different from the previous styles of curriculum where the first unit is science class was called Nature of

Science. During the Nature of Science portion students would learn how science is conducted. The three dimensions of learning incorporates these practices throughout the year and into each lesson. Inquiry based learning has been shown to increase student engagement. Student engagement has been shown to have a positive correlation with students achieving learning goals. The 5E model of learning has been shown to be extremely effective at increasing engagement. The literature offers up some feasible and measurable solutions to the problem.

Statement of the Problem

Students are having a tough time transitioning to this new, inquiry-based way of learning in the science classroom. Students see student-centered curriculum activities and stop engaging. They consistently lack the confidence to apply themselves and put themselves out there. They just wanted to be told what to do and when. This is not ideal, because it is not how a majority of them will operate in 21st century careers. Student need to learn to work for themselves at their own pace. The self-regulated learning aspect of the social cognitive theory of learning stems from the part of the theory that includes the student's perceptions of themselves and how they regulate their own lives (Woolfolk, 2018). The researcher will be researching an intervention designed to help students gain these important 21st century skills while learning through a student-centered, inquiry based learning environment.

Purpose of the Study

The purpose of this study was to help students transition to inquiry-based learning environment with the 5E model of learning in place. Students need help being more successful with the open ended writing questions as well learning from each other by participating meaningfully in classroom discussions. Students do well on investigations and labs but then when they transition to writing about what they learned or talking about what they learned they struggle. Science, as done by scientists in the real world, involves sharing of their ideas, hypotheses, tests, and results. Learning how to do science in the classroom is important for students who plan to become scientists as well as students who do not plan to become scientists.

Research Questions

1. How can explanation of inquiry-based learning and mini-lessons increase students' engagement and students' attitude toward inquiry-based learning in science?
2. How can setting guidelines and grading discussions increase student engagement in classroom discussions with an inquiry-based curriculum?

Definition of Variables

Research Question 1

Variable A: The independent variable for this question was the intervention integrated in order to help students be more successful as learners in the inquiry-based student-centered learning environment. Students participating in this intervention will complete a survey multiple times as they progress through the intervention.

Variable B: The dependent variable for this question was the students' feelings towards their learning in the inquiry-based student-centered learning environment as measured by the survey results. Also included was students' grades as well some examples of student work.

Research Question 2

Variable A: The independent variable for this question was the intervention integrated in order to help students be more successful as learners in discussions during inquiry-based student-centered lessons. Students participating in this intervention will learn to participate in discussions from a discussion rubric as they progress through the intervention.

Variable B: The dependent variable for this question was the students' discussion grade in the inquiry-based student-centered learning environment as measured by the discussion rubric results. Also included was students' grades as well some examples of student work, student engagement in discussion, and the efficacy and flow of the discussion.

Significance of the Study

This study was significant in that it created a new path toward helping educators in science to shift toward teaching inquiry-based learning while using the 5E model. It helped educators to address the issue of students not being ready to learn in a student-centered environment, and get ideas for giving students guidance and facilitating this type of learning. It helped students become more comfortable and driven to learn as scientists learn about the natural world.

Research Ethics

Permission and IRB Approval

In order to conduct this study, the researcher sought MSUM's Institutional Review Board (IRB) approval to ensure the ethical conduct of research involving human subjects (Mills & Gay, 2019). Likewise, authorization to conduct this study was sought from the school district where the research project took place (see Appendices A and B).

Informed Consent

Protection of human subjects participating in research was assured. Participant minors were informed of the purpose of the study via the Method of Assent (see Appendix C) that the researcher will read to participants before the beginning of the study. Participants were made aware that this study was conducted as part of the researcher's master degree program and that it was to benefit his teaching practice. Informed consent means that the parents of participants were fully informed of the purpose and procedures of the study for which consent is sought and that the parents understood and agreed, in writing, to their child participating in the study (Rothstein & Johnson, 2013). Confidentiality was protected through the use of pseudonyms (e.g., Student 1) without the utilization of any identifying information. The choice to participate or withdraw at any time was outlined both verbally and in writing.

Limitations

The study was limited by the amount of time to implement the intervention and see the student's progression throughout the entire school year. This study should have been extended for a multiple year study that would follow these students and compare them to their counterparts who did not receive the intervention.

Another limitation of the study was that the study would only be successful if the students in the study would openly and honestly participate. The students needed to be receptive to learning about the new curriculum and inquiry-based learning. Students also needed to be accepting that there was a problem to be fixed.

Conclusions

This was the background of the situation the researcher found themselves in, which lead to the problem. The underlying problem the research found was there were students in need of intervention to assist them in shifting from a teacher-centered learning environment to a student-centered learning environment. A small portion of the literature review was outlined leading into the purpose of the study, which is to help students get more out of their own student-centered learning environment. The variable and the significance of the study were outlined. The next chapter contains a deeper discussion of the review of the literature.

CHAPTER 2

LITERATURE REVIEW

Introduction

As the new State of Minnesota Science Standards become implemented, the researchers professional learning community chose a curriculum that would help fit the needs of the students with the new standards in mind. The new curriculum was chosen and purchased by the school district at the end of the school year, which was the spring of 2020. Anticipation and excitement was notable due to this inquiry-based, student-centered curriculum which came with an interactive online version of the students' workbooks. The curriculum followed the 5E framework for inquiry from which the researcher found more information on during this step in the research. The researcher and his colleagues were elated to be using a new and updated curriculum.

Students did not necessarily share in this excitement. They were used to "cookbook" labs as Bruss (2009) would call it. Students were also very used to worksheets and textbook readings. Unfortunately, they had gotten used to and comfortable with simply finding the right answer out of the book and filling it in. The students were also used taking a test after memorizing a number of terms and their definitions. According to Song (2014) many teachers are still confined to the textbook. Before the purchase of this curriculum the researcher thought it was districts' not waiting to purchase curriculum that would be holding teachers back. The researcher had come to learn that not all learners are ready for the complete shift to inquiry. There were some amazing insights the researcher discovered during this research. With regard to one aspect, there many more things the research can do to make classroom discussions much better. For example, according to Bruss (2009), the researcher needed to set expectations and grade them on their discussion participation. In regard to another aspect of making the inquiry-based learning better, there are some aspects of the curriculum in which students should be given a second try and they will more likely be successful (Wiseman, 2020).

With so many of these great improvement ideas, it is important to focus on and conquer one. For this reason, the researcher implemented an intervention to explain to students the importance of their own level of effort and engagement. According to Fraser et al. (2017):

> What was found lacking from some of the tutorial material were sets of actions that teachers should perform in the classroom, which would allow learners to engage with scientific material that encourages inquiry based learning, and exploratory and discovery opportunities. (p. 45)

Students should be introduced properly to their curriculum and given time to discover how it works. These ideas need to be shared with students so that they know the reasoning behind this new curriculum and its shift to student-centered, inquiry-based learning.

Body of the Review

Theme 1 – Inquiry and Engagement

Many school districts are currently in the shift from traditional teaching practices in science classrooms, which involve explaining a phenomenon to students and then having them explore the phenomenon in labs or activities, to inquiry-based teaching practices in science classrooms, in which students start by exploring a phenomenon and forming a driving question about this phenomenon, then explaining the phenomenon to students. Educators are having a hard time letting go of the traditional teaching practices. According to Song (2014), "inquiry instructional practices have been advocated for a few decades and still schools are largely confined to textbook learning" (p. 226). Students and educators still want there to be a textbook to tell them what to learn. Song (2014) investigated inquiry-based learning in science in an upper primary class. Their study used a cyclical approach of an intervention involving the adoption of the 5E inquiry-based learning model. Ultimately, according to Song (2014) it, "was found that pedagogical design premised on the 5E inquiry-based learning model helped students to remain focused on purposeful inquiry tasks" (p. 233). These 5E activities are helping students be engaged during science.

Inquiry-based learning has shown to increase engagement but there is more work to be done on improving our inquiry-based practices. According to Langbeheim (2020) in "Science Teachers' Attitudes towards Computational Modeling in the Context of an Inquiry-Based Learning Module", "Teachers' implementation of instruction that involves both experimental classroom inquiry and construction of computational models, remains an open field of research" (p. 786). There is still so much research to be done with inquiry-based learning, especially different ideas for making this learning model better or more effective. According to Wiseman (2020), "Frequently inquiry-based experiences consist of a single laboratory session at the end of a traditional laboratory class…there are few examples in the literature analyzing the effects of multiple rounds of inquiry" (p. 100). Wiseman (2020) measured the effects of multiple rounds of inquiry during their experiment using two sections of an undergraduate developmental biology class. One section was taught traditionally and the other course was redesigned to feature three distinct rounds of structured inquiry-based experiments (p. 101). Wiseman (2020) explained the surveys at the end of the semester. These studies are just some of the ways in which educators are looking to improve inquiry-based learning. Ultimately, the authors decided that the second and third rounds showed large qualitative improvements in students' skills but they really couldn't compare to the other section of the class because the rubric did not match up very well.

A lack of literature pertaining to measuring the effects of inquiry-based learning outside of measuring engagement and tracking grades is apparent. According to Turner (2018):

> Inquiry-based learning methods are only one component of an integrated set of pedagogical processes and assessments that facilitate the investigation of concepts, the development of skills and the mastery of objectives, and an understanding of the building, communicating, and critiquing of knowledge. (p. 1456)

Turner (2018) introduced an instrument developed to measure inquiry-based on specific types of learning processes (p. 1457). Measuring engagement in an inquiry-based learning environment is important but there is certainly a need for different aspects of learning. Engagement is not the only necessary metric in assessing students. Turner (2018) categorized the distinguishing types of learning activity types. An important aspect of judging a practice's efficacy is to measure multiple aspects of the practice. Turner (2018) brought into view why there was a need for a way to measure inquiry-based activities. Turner (2018) used their measurement and set out to observe the different types of inquiry activities and found the most commonly used inquiry activity was the "manipulation of materials" type. This should lead educators to reflect on judging the efficacy of inquiry-based learning if many educators are mostly using the same type of inquiry activity.

5E – Engage Explore Explain Elaborate Evaluate

According to Mulyeni (2019) in "Improving Basic Science Process Skills Through Inquiry-Based Approach in Learning Science for Early Elementary Students", "[Their study] can, contribute to planning and implementing inquiry-based approach of science learning to increase the basic science process skills" (p. 190). Mulyeni explained their methods as a cyclical action research method using an implementation of 5E learning activities (p. 191). Mulyeni (2019) show improvements can be made to students test score averages by using the 5E activities implemented on multiple cyclical occasions. 5E Learning includes five major steps to organize the storyline of an inquiry-based lesson (Oteles, 2020). The first step, Engage, is step involving introducing students to the phenomenon and allowing students to think about it. The second step, Explore, is a major step in which students take charge complete student-centered activities ideally designed by them to help with their understanding of the phenomenon. The third step, Explain, is where students and educators collaborate on how to best explain the phenomenon. The fourth step, Elaborate, is where students look deeper at the phenomenon, possibly a real-life application of the phenomenon. The final step is to Evaluate the students' understanding of the phenomenon and what skills they have gained from the phenomenon (Oteles, 2020). According to Oteles, "The 5E learning model contributes to the motivation of students and covers various activities in which they control the learning process themselves" (p. 113).

The literature ideates that the most effective way to plan and produce these five steps is to first start with making the evaluation from a learning goal. According to Hendrickson (2006) in "Backward Approach to Inquiry", "Because of the more open-ended nature of these activities compared to traditional science lessons, implementing Standards-based inquiry activities concordant with NCLB poses a major challenge—how do we assure that academic standards are met during student-centered, inquiry-based investigations?" (p. 30). Students actually do struggle with these open-ended questions and trusting themselves to think through problems. Hendrickson explained why the use of the backwards design makes sense with a quote "a means to an end" from Wiggins and McTighe (1998, p. 13). Hendrickson (2006) then laid out how educators would use the test and learning goals or objectives to find activities based on these standards-based goals. Ultimately, according to Hendrickson you are using these activities and investigations to build a learning environment.

Theme 2 – Engagement in Experiences

When it comes to engagement, students are going to build a learning environment through engaging in activities. These activities cannot only include entertainment or curriculum goals but should also be geared toward the student gaining skills applicable to their futures. According to Ton de Jong (2021) in "Understanding teacher design practices for digital inquiry-based science learning: the case of Go-Lab", "[We need] a change in educational approach, with a strong emphasis on forms of engaged learning in combination with the acquisition of twenty-first century skills." (p. 426). According to Sun et al. (2018), "there continues to be significant challenges in designing pedagogical learning scenarios in which learning takes place in both formal and informal space" (p. 147). There is a debate between researchers who think there is a lesser form of learning, in the informal spaces (Daner et al, 2020, p. 148). This is because learning in informal contexts do not receive as much support as formal contexts (Rogoff, 2016).

Daner et al (2020) explained and implemented the Boundary Activity Based Learning (BABL) principle in order to increase engagement in multiple modes of learning by a significant amount using a paired sample t-test. The BABL principle has been developed to guide the design of learning in multiple settings and incorporates three components: a boundary object, structure, and learning objectives. The BABL principle is used to try to get students to be able to generalize their skills throughout multiple settings during the school day. The boundary object is a designated object that helps students link different settings. The structure is a pre-, during, and post-activity pattern. The learning objectives are based on the curriculum (Sun & Looi, 2018; Sun & Looi, 2019).

According to Bruss (2009) in "Improving Classroom Discussion: A Rhetorical Approach", "Classroom discussion, with its focus on active learning, critical thinking, and cooperative inquiry, is attractive in theory but often disappointing in practice" (p. 28). It is assumed that experiencing discussion in such classes is sufficient for improvement, but research has yet to confirm that outcome (Gall & Gall, 1990). To remedy this, Bruss (2009) introduced RID as the Responsible Intellectual Discussion project which aimed to take the dread out of discussion in the classroom. The three major elements of RID included criteria for evaluation, instruction, practice and feedback. Bruss included faculty perspectives and student perspectives in his study. Bruss stated, "Classroom discussion improves noticeably when students are provided with the knowledge and strategies necessary for effective rhetorical performance" (p. 41). There are an exorbitant amount of educators who lead discussion but have never taken time to set up criteria for the discussion or instructed students what a great discussion has as its major components. The best idea the literature has shown the researcher regarding grading students during discussions is to have students build a rubric together as a class. Students read and critique each other's comments to give honest and up front feedback on not only how many times they contribute to the discussion, but also the quality of their contribution. How many educators out there have critically graded their students on their discussion skills?

Theoretical Framework – Inquiry Based Learning

Inquiry-Based Learning is a learning theory that is rooted in developing a driving question that gets students involved in asking their own questions about a phenomenon, and also deciding how to investigate and find out the answers to their own questions. Students are much more likely to be engaged when they are involved in deciding what they are learning about. According to Ness (2016), "The benefits of inquiry-based instruction are well documented; students hold more ownership and control of their learning, develop their metacognitive skills and are more motivated and engaged in learning tasks" (p. 190). This is especially useful and consistent with science and learning how science works in the real world. Students find out how scientists actually study things by doing the work a scientist would do. Students are also more likely to want to share what they learned through their investigations. This also parallels what scientists do in the real world: As they regularly form ideas and test them, they also share their findings and thinking with others.

Research Questions

1. How can explanation of inquiry-based learning and mini-lessons increase students' engagement and students' attitude toward inquiry-based learning in science?
2. How can setting guidelines and grading discussions increase student engagement in classroom discussions with an inquiry-based curriculum?

Conclusions

Inquiry-based student-centered learning has shown to increase student engagement and help students be successful. Minner et al. (2010) emphasized the importance of this relationship by claiming that, "Teaching strategies that actively engage students in the learning process through scientific investigations are more likely to increase conceptual understanding than are strategies that rely on more passive techniques" (p. 474). This does not mean every learner is ready to learn this way. Students need to be given guidelines and expectations for how to be successful in this type of classroom. Students also need to be given a second or third time through an investigation in order for them to learn how to get the most out of the experience.

The literature contains many great ideas for how to help students with this transition from a traditional teacher-centered classroom to a student-centered, inquiry-based classroom.

CHAPTER 3

METHODS

Introduction

According to the Minnesota Department of Education's (2020) website which has a "Minnesota K-12 Academic Standards Review Schedule," the science standards were revised in 2018-19 and were to be implemented by 2024. As of 2019, new standards in science in Minnesota schools has led to a shift in curriculum. The researcher's school district was poised and ready to purchase new curriculum to help the researcher and the researcher's colleagues with this shift. The district provided excellent opportunities for professional development and time devoted for the shift. The researcher's school district's new curriculum relied heavily on inquiry-based student-centered learning. The problem arose when students were not prepared to learn using this new inquiry-based, student-centered learning method. The researcher has found literature to support how well inquiry-based learning increases engagement as well as student success. The literature also pointed the researcher to ways that inquiry-based learning can be improved upon. The researcher's interventions had students learn about inquiry-based learning by completing mini-lessons designed to help students become comfortable with this way of learning. Students were also given expectations and grades when it came to discussions. This was to assist students with staying engaged while listening to peers' ideas. According to McKinney (2018), "Educators must provide accurate student evaluations, a grading rubric that consistently assesses student performance and provides meaningful feedback is vital" (p.199). These interventions are important for increasing student understanding of the new science curriculum as well as improving student's attitudes toward learning in the inquiry-based learning model and improving students' grades. The researcher aimed to show how these interventions would make students' attitudes toward inquiry-based learning and student's grade better. This was to help student become life-long learners.

Research Questions

1. How can explanation of inquiry-based learning and mini-lessons increase students' engagement and students' attitude toward inquiry-based learning in science?
2. How can setting guidelines and grading discussions increase student engagement in classroom discussions with an inquiry-based curriculum?

Research Design

The researcher used a mixed method design so as to analyze student grade success along with students' attitude toward the curriculum. Also, qualitative analysis was used in order to exemplify student participation in the intervention.

Setting

The researcher completed this study at a public middle school which was in a small town ten miles south of the third largest city in the state. This large city was home to an internationally renowned hospital and healthcare system. This large hospital played an important role as many of the study participants are children of people who work in this hospital system. The small town where the study took place is a bedroom community for people who work in the larger city ten miles to the north. It was also partially a rural community. Many of the participants were either students growing up on farms or students growing up in town with a parent who worked in healthcare. The community of the small town was very involved and proud of the school district with exceptional participation and success in activities and athletics. The entire school district includes 2,117 students with a 16:1 teacher ratio. The district has an 8% minority, which consisted of 4% Black and 4% Hispanic students, enrollment and 85-89% graduation rate. Participants in the action research study that participated consisted of 11.6% students who were receiving special education services. According to the Minnesota Department of Education (2020) the middle school where the study took place had 16.63% of students approved for free and reduced-price school meals.

Participants

Participants in this action research study included 7th graders who are either 12 or 13 years of age. The participants were 56% girls and 44% boys. The participants' ethnicities were 92% White, 4% Hispanic, and 4% Black. There were eight students who were in the special education program. The family structures of the participants were 57% multi-parent homes and 43% single parent homes during this action research study. These statistics were found on the researcher's Stewartville school district website (2020).

Sampling

The participants were gathered via convenience sampling as they were already part of the researcher's scheduled class rosters. These students were not chosen in any particular way for this action research study. They were in the researcher's class already and so they were asked to participate in the study.

Instrumentation

A Likert scale survey (see appendix D) was used to collect quantitative data on the participants of the 7th grade life science classroom. Students were given the survey during the third week of the school year. Students were given the survey after three weeks of school to give students time to get used to the curriculum. The initial survey was given to give a baseline of students' attitudes toward the inquiry-based learning curriculum. The researcher also recorded students' grades as the survey was being taken, giving the researcher a baseline for students' grades before the intervention was implemented. The same Likert scale survey was given to students and their grades recorded before, during, and after the intervention was implemented. Students were able to complete the survey through a link in their learning management system in approximately 5-10 minutes. This Likert scale survey was written by the researcher and validated by three of the researcher's colleagues. This survey was written specifically for this action research study. The survey aligns with the first research question in that it asks students about their comfort level and understanding level with inquiry-based learning.

The researcher will be using mini-lessons developed and written by Paul Anderson of Bozeman science (Anderson, 2020). The researcher will also be using a discussion rubric (see appendix E) and grading developed and written by Kristine Bruss who slightly modified the rubric from John Tyler and Richard Murnane of Brown University and Harvard respectively (Bruss, 2009).

Data Collection

Data was collected by the researcher by giving students a Likert scale survey (See Appendix D) every three weeks. The survey was given three times: once before the intervention, once during the intervention, and once after the intervention. The grades of the participants were also collected every three weeks. The grades were collected three times: once before the intervention, once during the intervention, and once after the intervention.

Data Analysis

The data was analyzed using descriptive statistics in order to measure whether or not the intervention affected students' attitudes towards inquiry-based learning and students' grades. The means of each question of the Likert scale survey (see appendix F) were compared from before, during, and after the intervention. Also the means of student grades were compared from before, during, and after the intervention. An ANOVA test was used for descriptive statistics in Microsoft Excel 2013. The one-way ANOVA (analysis of variance) test was used to help the researcher compare the variances of particular results from the student discussion grades collected (Statistics, 2014). This helped the researcher analyze whether or not the researcher's interventions made a significant impact on students' attitudes toward inquiry-based learning and their grades.

Research Questions and System Alignment

Table 1.1. provides a description of the alignment between the study Research Questions and the methods used in this study to ensure that all variables of study have been accounted for adequately.

Table 1.1.

Research Questions Alignment

Research Question	Variables	Design	Instrument	Validity & Reliability	Technique (e.g., interview)	Source
How can explanation of inquiry-based learning and mini-lessons	Independent Variable: Lesson on Inquiry-Based Learning	Mixed Methods Action Research	Likert Scale Survey Before, During, After Lessons	Students were given the same survey three times on	Survey before, during, and after intervention.	7th grade students that were assigned to the class of the

increase students' engagement and students' attitude toward inquiry-based learning in science? How can setting guidelines and grading discussions increase student engagement in classroom discussions with an inquiry-based curriculum?	Mini-Lessons on Inquiry-Based Learning Dependent Variable: Student Attitude and Academic Success		Student Work	their attitude towards inquiry-based learning. Students' academic grades were recorded.	Student grades before and after.	researcher.

Procedures

The researcher began informing students of this study during the second week of school by sending the informed consent letter home to parents. As the third week of school ended the researcher gave students the Likert scale survey (see appendix D). The researcher also recorded students' grades as well as collected work examples. This was intended to be students' baseline attitudes and understanding of inquiry-based learning. During the sixth week of school, twice per week for three weeks, students participated in mini-lessons developed by Paul Anderson of Bozeman science (Anderson, 2020). Students also, in tandem with the mini-lessons, participated in discussions in which expectations were laid out and the rubric was given (see appendix F). As the sixth week of school ended the researcher gave students the Likert scale survey. The researcher also recorded students' grades. Finally, as the ninth week of school ended the researcher gave students the Likert scale survey. The researcher also recorded student's grades as well as collected work examples. This was intended to be students' final test of students' attitudes and understanding of inquiry-based learning.

Ethical Considerations

By review of MSUM's Institutional Review Board (IRB) as well as the researcher's school district to ensure the ethical conduct of research involving human subjects there was assuredly no harm done to the participants (Mills & Gay, 2019). Great care was taken by the researcher to explain and create understanding of the study by participants and their parents. Parents and participants were assured no grades would be used with any identifying information and great care would be taken to make sure participants were not embarrassed by their grade being used in a study.

Conclusions

The shift in Minnesota State Science Standards as of 2019 created a necessary change in many science classrooms all over the state of Minnesota. These changes lead the researcher to notice a problem that his students were having with a newly developed curriculum specifically for the new standards. Students were having a hard time understanding how they could get the most from their new inquiry-based learning curriculum. The research found through reviewing the literature that inquiry-based learning increases engagement and grades. The researcher also found there were interventions to be implemented that could help increase students' understanding of the reason behind the purpose of the new inquiry-based learning methods. These interventions were outlined in this chapter in order to give an understanding of the participants and where they live, the instrumentation used, and the procedure. The next chapter includes the results found by the researcher.

Chapter 4

DATA ANALYSIS AND INTERPRETATION

As should be, every ten years the science standards are reviewed and updated. The new science standards lead to shifts in which sciences were taught at which age for middle school students in Minnesota. To be exact, eighth grade earth science was shifted to sixth grade as well as sixth grade physical science being shifted eighth grade. This made the researcher's colleagues including the researcher's curriculum director interested in getting a new curriculum. The new curriculum was to be inquiry-based and student centered. The researcher's administration supported the purchase of this new curriculum and the researcher's colleagues were excited to have a new, updated curriculum that they knew was more interactive for students. As the new curriculum was implemented, it became apparent that students were not ready for so many open-ended questions. Students seemed withdrawn from the curriculum which was specifically designed to draw them in and keep them active in their learning. Student made comments that lead the researcher and his colleagues to believe they were not ready for student-centered, inquiry-based learning.

The researcher set out to find ways to help students be more successful growing learners in inquiry-based, student-centered learning. The researcher found many research based ideas that could help students through the inquiry process. The researcher found Paul Anderson of Bozeman Science (2020) was also working on a similar problem and producing mini-lessons teachers could use to help students navigate student-centered, inquiry-based learning. The researcher also found discussion during inquiry-based lessons to be problematic as students disengaged when important questions were being asked and answers were right in front of them. The researcher found Bruss' (2009) research on discussions to especially helpful and decided to use Bruss' discussion rubric and Anderson's mini-lessons simultaneously. The intention of the implementation of these interventions was to increase students' success academically in an inquiry-based learning environment as well as increase students' positive attitudes toward inquiry-based learning.

Data Collection

Students were three weeks into school when the researcher introduced the action research intervention to be done in class and distributed parental consent letters to be taken home by students. Students had questions and were very receptive and interested in participating. During the third week of school students were given a student survey (see Appendix D). Students' academic grades were then recorded as a baseline as well. After initial baseline grades and surveys were collected the intervention began. Student were given an explanation of the researcher's background to the problem and subsequent research. Students were then given explanations of what inquiry-based learning was as well as an explanation of expectations for classroom discussions. Students participated in the intervention each week. The survey was given out again after the sixth week of school along with grades being recorded. The intervention continued each week. Lastly the survey was given out again after the ninth week of school as well as grades being recorded. During this time, each week during the intervention students were graded on their discussion participation based off of the discussion rubric presented to them at the beginning of the class.

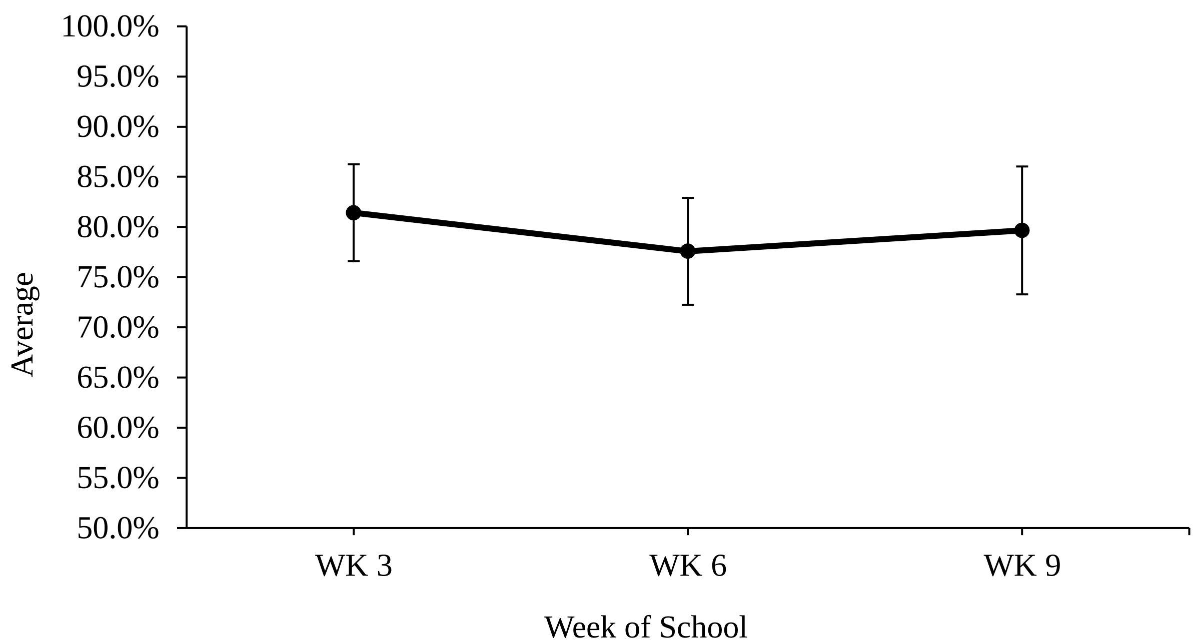
Results

RQ 1: How can explanation of inquiry-based learning and mini-lessons increase students' engagement and students' attitude toward inquiry-based learning in science?

Student grades were collected along with survey results every three weeks in order to address the research question. Starting with student grades, the average for the third week of the school year was 81 percent with median of 85 percent, and SD of 14.5 percent. As the interventions were underway for three weeks, during the sixth week of school student grades averaged 78 percent with a median of 77 percent, and SD of 16 percent. Finally, the ninth week of the school year student grades averaged 80 percent with a median of 80 percent, and SD of 19 percent. Figure 1 shows students' average grades as the school year progressed with the interventions taking place from week 3 to week 9. Figure 2 shows the amount the students' average grades dropped from week 3 to week 6 and from week 3 to week 9.

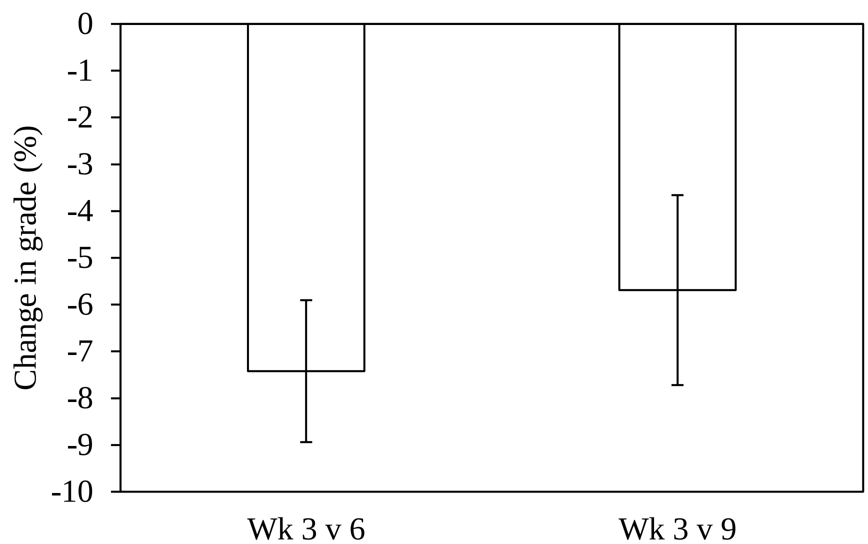
Figure 1

Grade Percentage



Note. Mean ± SE student grades before (week 3), during (week 6) and after (week 9) the pedagogical intervention.

Figure 2
Change in Grade (%)



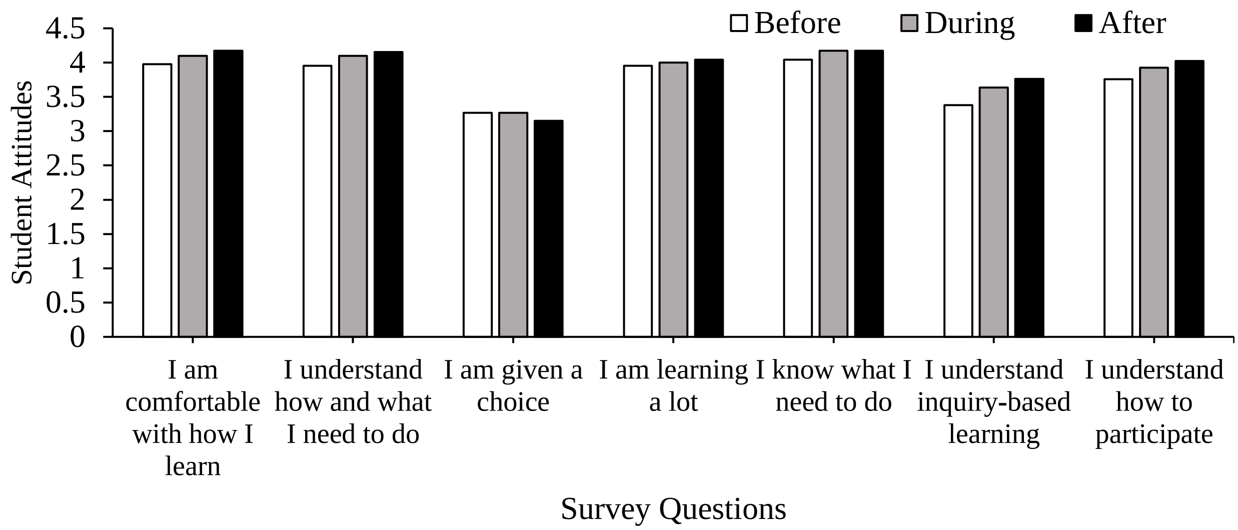
Note. Student grades dropped from week 3 to week 6 more than they did from week 3 to week 9.

Students' attitudes toward inquiry-based learning were also collected by survey every three weeks. The data in Figure 3 shows students' responses increasing in positivity before, during, and after the intervention except in question 3. Each response was assigned a number as a score with 5 = Strongly Agree, 4 = Agree, 3 = Neither, 2 = Disagree, and 1 = Strongly Disagree. The average score for each question before, during, and after the intervention is shown in Figure 3. Table 2 (see Appendix F) shows all of the survey data including number of responses with these responses in percentage form as well. The first survey had 45 responses. The second survey had 41 participants respond. The third survey had 46 responses.

As students' responses shifted to "Strongly Agree" the "Agree" responses declined, except for question 3 (Figure 4).

Figure 3

Survey Responses: Student Attitude per Question

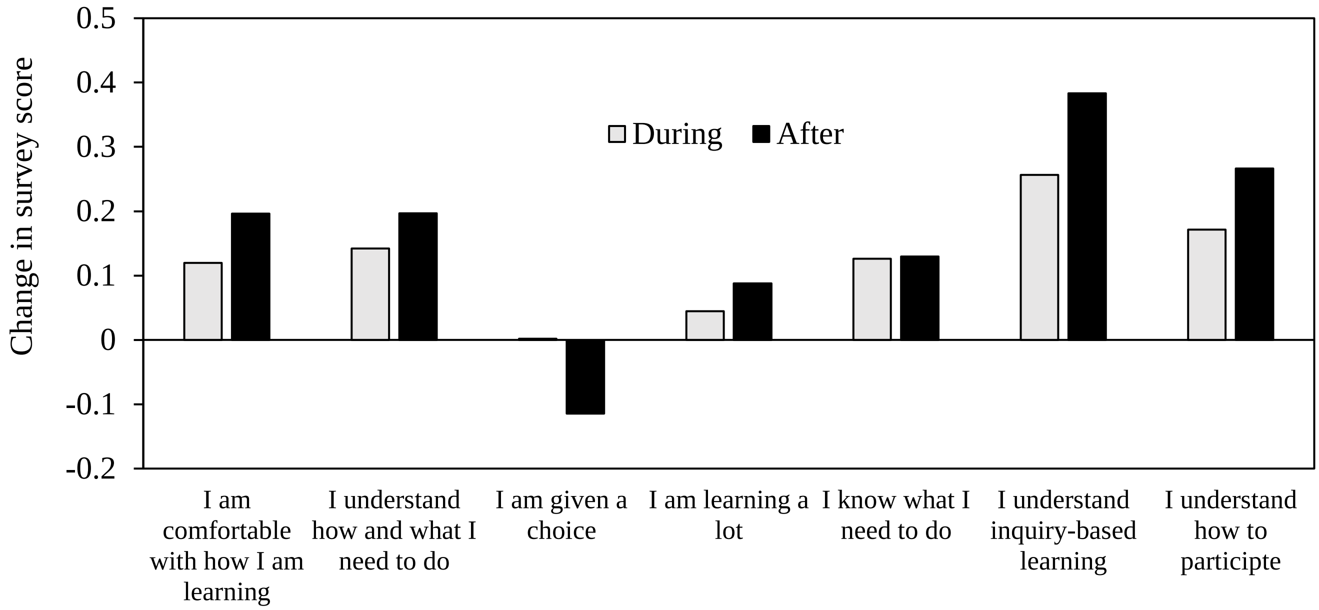


Note. This shows each question response score for before, during, and after the intervention which also shows an overall positive response toward inquiry-based learning.

In the interest of increasing students' attitudes toward inquiry-based learning the researcher focused on increasing students' agreement to the questions in the survey (see Appendix D). The data shown in Figure 4 are students' change in responses to each question on the survey. These changes were the differences of the scores shown in the Figure 3, "During" was the score change from week 3 to week 6 and "After" was shown as the score change from week 3 to week 9.

Figure 4

Change in Survey Score During and After the Intervention



Note. This was each survey question's student response change showing an overall positive result.

Data Analysis

First, the research question asking about student attitude and student grades with the intervention in place will be addressed. Although at first when looking at the student grade averages they seem to be level and not giving any definitive answer to the question, it is actually good that the grades are staying relatively steady. In the beginning the school year from the first day of school until the end of the third week when the researcher implemented the intervention, there were only six assignments and the first two were graded on completion. The first two assignments of the year were an icebreaker activity for the researcher to get to know students and a scavenger hunt activity for students to get to know their new science classroom. The data showing an increase from week three to week six is the most positive piece of this data. It shows that students were responding well to the inquiry-based learning curriculum as well as the interventions in place.

Another piece of data to use as evidence to make the case that the intervention was a success is the survey data. There were slight increases in students' responses to specific questions the researcher sees as success. The only exceptions was is shown in Figure 4 which shows results for Question number three of the survey, "I am given choice in what I want to learn in my science class." The researcher attributes this to students not realizing what the question is asking. Students were given choice almost every single day in class with things such as which example species to choose to learn about or which investigation to learn from. The researcher thinks participants were seeing question three from the survey as referring more to which driving questions were going to be asked in the class. Question numbers six and seven are, "I understand what inquiry-based learning is" and "I understand how to participate in inquiry-based learning." The students responded with a significant increase in the percentage of students who chose "Agree" to these questions. Response overall were consistent but the researcher noticed participants' responses shifted from either from "Agree" to "Strongly Agree" or from "Neither" to "Agree." The research showed that student engagement helps increase students' grades. The research also toted inquiry-based learning as a great way to increase student engagement. The piece that was missing for the researcher was, "Do the students know this?" and "Do the students understand the reason for doing what they do in science class." From the survey data, it is clear that students were becoming more aware of the reason behind why they were learning science this way. Paul Anderson's (2020) mini-lessons were helping to students to see the consistent concepts.

Results

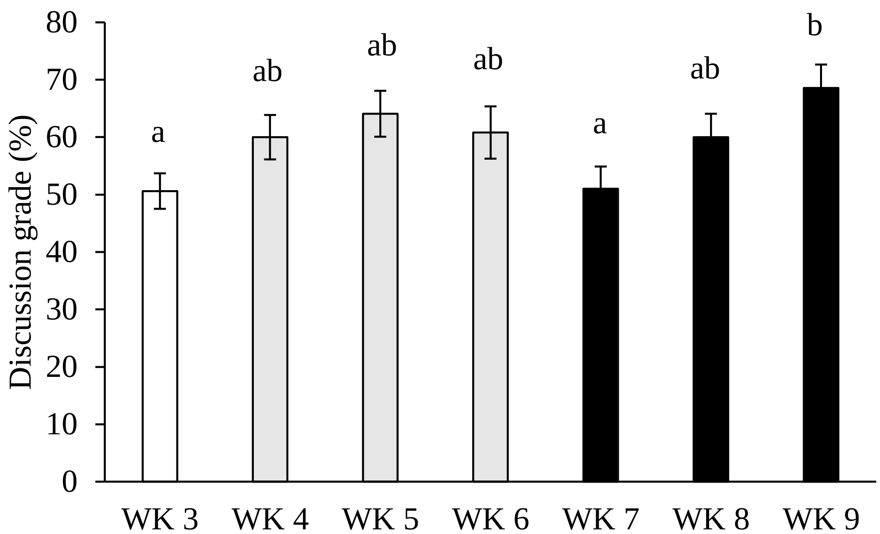
RQ 2: How can setting guidelines and grading discussions increase student engagement in classroom discussions with an inquiry-based curriculum?

Beginning the first week of the intervention which was the third week of school and every week until the ninth week of school, the researcher graded each student on their discussion engagement during inquiry-based lessons. The grade on their discussion engagement was based on Bruss' discussion rubric (see Appendix E). Discussion grades were out of 5 points. Table 4.1 shows each weeks' discussion grade average, median, and SD. The researcher focused on weeks three, six, and nine and noticed that each of those three before, during, and after checkpoint weeks there were increases in student success during inquiry-based discussions. Based on an ANOVA Test discussion grades showed a significant increase during the course of this intervention between week 3 and week 9 ($F_{6, 336} = 2.727$, $p = 0.013$, Fig 5.). This increase can then be attributed to the intervention.

Figure 5 shows students' average discussion grade percentages per week for the six weeks of the intervention analyzed with Student-Newman-Keuls (SNK) post hoc test. Student-Newman-Keuls post hoc tests can be used when an ANOVA test shows a significant result to analyze which means pairs are different. Shared letters, which are a, ab, b in Figure 5, are not different in variance, therefore different levels show a significant level of variance caused by the intervention. Had the researcher collected data containing all the same letters in an SNK post hoc test, the analysis would have showed the variance to be random or nonexistent. However, since there are not shared letters, the variances in the data support the hypothesis that the intervention was the cause of increase in student discussion grades.

Figure 5

Students' Average Discussion Grade Percentages per Week of School



Note. Shared letters are not different (P>0.05 Student-Newman-Keuls test). This is a graphical representation of the same data from Table 1. Focus was put on the third, sixth, and ninth week but the data shows how students' discussion scores increase with time. Bar colors were kept consistent with previous graphs to show before, during, and after the intervention.

Table 4.1

Discussion Grade Mean, Median, and Standard Deviation

Discussion Grade	Mean	Median	Standard deviation
WK 3	51%	21%	0.60
WK 4	60%	27%	0.60
WK 5	64%	28%	0.60

WK 6	61%	32%	0.60
WK 7	51%	27%	0.40
WK 8	60%	28%	0.60
WK 9	69%	28%	0.80

Data Analysis

The second research question was, "How can setting guidelines and grading discussions increase student engagement in classroom discussions with an inquiry-based curriculum?" To address this question data was taken on students' inquiry-based discussion grades after introducing to students the expectations for classroom discussions and the classroom discussion rubric as developed and modified by Bruss (2009). Classroom discussions increased in quality substantially and students' discussion grades increased as they became more familiar with the expectations. As shown in Figure 5 and Table 4.1, students' discussion grade averages increased as the weeks passed. The notable drop during week seven in Figure 5 is most likely due to the researcher noticing and announcing to students they are in some ways starting to sound robotic during discussions. The researcher paid most attention to weeks three, six, and nine and noticed that each of those three milestone weeks there were increases in student success during inquiry-based discussions. The ANOVA Test and SNK Test used to analyze the discussion grade data shows a significant increase in discussion grade and that these increases were not random. This increase can then be attributed to the intervention. Classroom discussions can be the most difficult activity to facilitate in a classroom, but if the students understand the necessary parts of discussions and how to engage they can be much more productive.

Recommendations for Future Research

The results of this action research may be limited to the researcher's setting. Not all educators will be working with an inquiry-based learning curriculum that is new to them and their district. Also not all educators may be experiencing the standards changing. For these reasons this action research may have limitations as to the generalizability of the intervention. The next steps in research stemming from this study could be include a longevity piece or a repeatable piece. As students gain more experience, how do their views change about this way of learning? Also, if students are given more time to repeat some of the driving questions of the lessons with differing ways to explore and explain, how would their academic success change? If the researcher were to complete this action research again, they would focus less on student academic grades and more on student attitudes toward their learning in inquiry-based learning. One way the researcher would focus more on student attitudes toward their learning is to analyze student work to see how much students are writing above and beyond the minimum requirements. This would give the researcher insight as to student interest level as well as their attitude toward inquiry-based learning.

Conclusion

This action research resulted in confirmation that the implemented interventions contribute to an increase in their positive attitudes towards inquiry-based learning. The participants' grades dropped. The researcher saw this grade drop as normal and not necessarily a function of the intervention. Also students' survey results show an increase in positive attitudes towards learning with an inquiry-based, student-centered learning environment. Student surveys stayed consistent with an increase in positive responses. Student discussion quality and discussion grades increased as students participated more because they learned how to participate properly. Therefore, students' success in discussions was an example to other students how to participate in discussions.

Chapter 5

IMPLICATIONS FOR PRACTICE

The researcher set out to help students understand how to engage and participate with more purpose during inquiry-based, student-centered science lessons. Students' grades and attitudes toward learning science with inquiry-based, student-centered science lessons were recorded three weeks into the school year as a baseline followed by the commencement of the intervention. The intervention included two parts to increase engagement during inquiry-based, student-centered science lessons which were mini-lessons and a discussion rubric. As the weekly mini-lessons and classroom discussions were taking place students' grades were recorded and a survey of their attitudes were given during the sixth week of school and ninth week of school. Data from students' grades, students' survey responses, and students' discussion grades have shown that the researcher was correct in that students were more successful with mini-lessons that help connect all the science lessons as well students' ability to engage in discussions more successfully if they are given expectations for how to do so and graded on discussions.

Action Plan

Moving forward with teaching science, the researcher will know now that students do know how to participate in inquiry-based, student-centered science lessons. These same students may not necessarily be making as many connections as they could from lesson to lesson though. As the educator in the room, the researcher's practices have shifted from stand and lecture to facilitating connections. Students' abilities to understand inquiry-based, student-centered science lessons is at the level it should be but students may need help recognizing the consistent connections and how to generalize these connections from lesson to lesson. The researcher will continue to use the discussion rubric to facilitate great discussion. This will lead to assisting other students as they hear ideas from their peers. The researcher will also continue to use Paul Anderson's mini-lessons but devote more time to them and only use them once every three weeks instead of once a week. The researcher will find more places in the curriculum where the mini-lessons fit better so as to use the mini-lessons in a timelier manner.

The researcher would consider partnering with colleagues to help them implement the interventions in their inquiry-based, student-centered science classrooms. The researcher would be interested in investigating if there would be more or less of an impact on students' academic grades, attitudes toward inquiry-based learning, and discussion grades. This would give students more than one year to work towards bettering their understanding of discussions in science class as well as the connections that can be drawn in science class. This could very well end up being a part of larger shift in practice in order to help students be more successful in inquiry-based, student-centered science lessons.

Plan for Sharing

The researcher plans to share this study with his colleagues who are science teachers. With the main objective of helping them help their students be more successful in inquiry-based, student-centered science lessons, the researcher would mainly be sharing this action research with science teachers in the district in which the researcher works. The main points the researcher would share would be the mini-lesson material and the discussion rubric along with the data to show why the researcher believes that it is helpful. The researcher would consider sharing this action research at conferences or with online professional networks if invited.

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APPENDIX A

School District Authorization

ISD #534
STEWARTVILLE PUBLIC SCHOOLS
301 2nd St. SW – Stewartville, Minnesota 55976
Mrs. Belinda Selfors, Superintendent – belinda.selfors@ssdtigers.org
Telephone (507)533-1438 - Fax (507)533-4012

August 30, 2021

To Whom It May Concern:

The purpose of this letter is to grant Mitchell Miller permission to conduct an action research study at Stewartville Middle and High Schools during the 2021-2022 school year. I understand that this study poses no risk to those persons involved or to the Stewartville Public School District. I also understand that all information received will be kept confidential and will only be used for the purpose of this study.

Sincerely,

Belinda Selfors

Belinda Selfors, Superintendent
Stewartville Public Schools

District Aims
High Student Achievement
A Safe, Welcoming, Engaging Learning Environment
Effective and Efficient Operations

APPENDIX B

CITI PROGRAM

Completion Date 27-May-2021
Expiration Date 26-May-2024
Record ID 42729855

This is to certify that:

Mitchell Miller

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

Social & Behavioral Research - Basic/Refresher
(Curriculum Group)
Social & Behavioral Research
(Course Learner Group)
1 - Basic Course
(Stage)

Under requirements set by:

Minnesota State University Moorhead

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?we08c158f-1c6e-419e-a166-2861d8f518ba-42729855

APPENDIX C

Dear Parents,

As a graduate student of Minnesota State University Moorhead in the Curriculum and Instruction Program, I have been looking to answer the question, “What steps can be taken to help students in inquiry-based science classrooms?” In order to address this question I will be implementing an intervention to two of the science sections and will not be implementing the intervention to the rest as they will be the control groups.

Data will be collected for this study by anonymous use of your student’s grades. As soon as the data are collected any identifying information will be removed from the data. Your student’s identity will be kept confidential and will not be part of the study. Only your student’s grade will be used and it will only be used in order the gauge the success of the above mentioned intervention. More information as to the details of the intervention will be forthcoming.

Please do not hesitate to contact me if you have any questions at all.

Thank you,

Mitch Miller
7th Grade Life Science Teacher
Stewartville Middle School
507.533.1570

APPENDIX D

Student Survey

Please choose whether you strongly agree, agree, neither, disagree, or strongly disagree with each of the following statements.

1. I am comfortable with how I am learning science in my science class.

Strongly Agree Agree Neither Disagree Strongly Disagree

2. I understand how and what I am doing in order to learn in my science class.

Strongly Agree Agree Neither Disagree Strongly Disagree

3. I am given choice in what I want to learn in my science class.

Strongly Agree Agree Neither Disagree Strongly Disagree

4. I am actually learning a lot in my science class.

Strongly Agree Agree Neither Disagree Strongly Disagree

5. I know what I need to do in order learn in my science class.

Strongly Agree Agree Neither Disagree Strongly Disagree

6. I understand what inquiry-based learning is.

Strongly Agree Agree Neither Disagree Strongly Disagree

7. I understand how to participate in inquiry-based learning.

Strongly Agree Agree Neither Disagree Strongly Disagree

APPENDIX E

Discussion Rubric

Kristine S. Bruss

Minimal preparation for classroom discussion requires that you read, think about, and bring to class the text; be prepared to discuss the text; and show respect for other participants. The following guidelines differentiate contributors in the following areas: mastery of material, quality of ideas, effectiveness of argumentation, and general impression.

“A” Contributor Contributions in class reflect exceptional preparation as evidenced by frequent authoritative and/or creative use of textual/material evidence. Ideas offered are always substantive (i.e., unusually perceptive, original, and/or synthetic) and provide one or more major insights as well as direction for the class. Agreements and/or disagreements are well substantiated and persuasively presented. If this person were not a member of the class, the quality of discussion would be diminished markedly.

“B” Contributor Contributions in class reflect thorough preparation as evidenced by competent and occasionally authoritative and/or creative reference to textual/material evidence. Ideas offered are usually substantive and provide good insights and sometimes direction for the class. Agreements and/or disagreements are fairly well substantiated and/or sometimes persuasive. If this person were not a member of the class, the quality of discussion would be diminished.

“C” Contributor Contributions in this class reflect satisfactory preparation as evidenced by at least some acquaintance with textual/material evidence. Ideas offered are sometimes substantive and provide generally useful insights but seldom offer a new direction for discussion. Sometimes insightful disagreements and agreements are voiced with little to no substantiation. If this person were not a member of the class, the quality of discussion would be diminished somewhat.

“D–F” Contributor Contributions in class reflect inadequate preparation. Ideas are seldom substantive and provide few if any insights and never a constructive direction for the class. Integrative comments and effective challenges are absent. If this person were not a member of the class, valuable airtime would be saved.

Nonparticipant Little or nothing contributed in class; hence, there is not an adequate basis for evaluation. If this person were not a member of the class, the quality of discussion would not be changed. Said persons need to leave this category and move into a contributor category.

This is a slightly modified version of a guide credited to John Tyler of Brown University, Richard Murnane of Harvard, and others (http://www.brown.edu/Departments/Italian_Studies/dweb/pedagogy/particip-assessm.shtml).

APPENDIX F

Survey Data

Table 2

Survey Data

Survey	1	2	3		1	2	3
Survey Responses	45	41	46				
Question 1: I am comfortable with how I am learning science in my science class.							
Strongly Agree	8	9	15	Strongly Agree	17.8%	22.0%	32.6%
Agree	29	27	25	Agree	64.4%	65.9%	54.3%
Neither	7	5	5	Neither	15.6%	12.2%	10.9%
Disagree	1	0	1	Disagree	2.2%	0.0%	2.2%
Strongly Disagree	0	0	0	Strongly Disagree	0.0%	0.0%	0.0%
Total	45	41	46				
Question 2: I understand how and what I am doing in order to learn in my science class.							
Strongly Agree	4	9	11	Strongly Agree	8.9%	22.0%	23.9%
Agree	35	27	31	Agree	77.8%	65.9%	67.4%
Neither	6	5	4	Neither	13.3%	12.2%	8.7%
Disagree	0	0	0	Disagree	0.0%	0.0%	0.0%
Strongly Disagree	0	0	0	Strongly Disagree	0.0%	0.0%	0.0%
Total	45	41	46				

Question 3:
I am given choice in what I want to learn in my science class.

Strongly Agree	7	5	2	Strongly Agree	15.6%	12.2%	4.3%
Agree	11	14	15	Agree	24.4%	34.1%	32.6%
Neither	16	12	19	Neither	35.6%	29.3%	41.3%
Disagree	9	7	8	Disagree	20.0%	17.1%	17.4%
Strongly Disagree	2	3	2	Strongly Disagree	4.4%	7.3%	4.3%
Total	45	41	46				

Question 4:
I am actually learning a lot in my science class.

Strongly Agree	11	9	9	Strongly Agree	24.4%	22.0%	19.6%
Agree	25	24	30	Agree	55.6%	58.5%	65.2%
Neither	5	7	7	Neither	11.1%	17.1%	15.2%
Disagree	4	1	0	Disagree	8.9%	2.4%	0.0%
Strongly Disagree	0	0	0	Strongly Disagree	0.0%	0.0%	0.0%
Total	45	41	46				

Question 5:
I know what I need to do in order to learn in my science class.

Strongly Agree	13	11	11	Strongly Agree	28.9%	26.8%	23.9%
Agree	22	26	32	Agree	48.9%	63.4%	69.6%
Neither	9	4	3	Neither	20.00%	9.76%	6.52%
Disagree	1	0	0	Disagree	2.22%	0.00%	0.00%
Strongly Disagree	0	0	0	Strongly Disagree	0.00%	0.00%	0.00%

Total	45	41	46				

Question 6:
I understand what inquiry-based learning is.

Strongly Agree	6	6	6	Strongly Agree	13.3%	14.6%	13.0%
Agree	18	20	25	Agree	40.0%	48.8%	54.3%
Neither	10	9	13	Neither	22.2%	22.0%	28.3%
Disagree	9	6	2	Disagree	20.0%	14.6%	4.3%
Strongly Disagree	2	0	0	Strongly Disagree	4.4%	0.0%	0.0%
Total	45	41	46				

Question 7:
I understand how to participate in inquiry based learning.

Strongly Agree	8	9	9	Strongly Agree	17.8%	22.0%	19.6%
Agree	24	21	29	Agree	53.3%	51.2%	63.0%
Neither	7	10	8	Neither	15.6%	24.4%	17.4%
Disagree	6	1	0	Disagree	13.3%	2.4%	0.0%
Strongly Disagree	0	0	0	Strongly Disagree	0.0%	0.0%	0.0%
Total	45	41	46				