THE EFFECTS OF CASEL BASED SEL LESSONS ON A MIDDLE SCHOOL SCIENCE CLASSROOM

by

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DEDICATION

This paper is dedicated to all the incredible teachers that I have had the pleasure of learning from and teaching with. Without your belief in me as a student, colleague, teacher, and most importantly as a human being, I would not be who I am today. Thank you. It is my belief that, as teachers, we have the opportunity to create a legacy that continues to keep on giving. That each time we impact students we may also impact innumerable amounts of future people via a ripple effect that is impossible to measure or predict. I strive every day to continue the legacy you have begun.

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ABSTRACT

Middle school years are often filled with significant academic, social, emotional, and routine based changes for many students. These struggles were exacerbated by COVID-19, which caused major gaps in social, emotional, and academic development. The purpose of this mixed-methods study was to determine if content-based bellringers could be replaced with social emotional learning discussions to improve three areas of student success in a middle school science classroom: social and emotional success, behavioral success, and academic success. To understand the changes in student success, a control and treatment unit were compared to one another. During the treatment unit, the typical content-based bellringers were replaced by SEL prompts and discussions. Pre- and post-assessment data were collected for both units, Likert student reflection surveys were conducted at the end of both units, observational behavior data was collected during both units, and a student questionnaire was completed at the end of the study. The assessment data indicated a decrease in academic growth throughout the treatment unit compared to the control unit, while both behavioral data and responses to the questionnaires and surveys suggested the treatment unit had no significant impact on social and emotional, or behavioral success in the classroom. Multiple students reflected that although they thought the SEL discussions were useful, they didn't learn anything that they didn't already know. Additionally, the lack of content-based bellringers seemed to significantly impact their academic success in a negative way. Based on both qualitative and quantitative data, it appears that replacing content-based bellringers with SEL discussions is not a justifiable way to implement SEL in a middle school classroom.

INTRODUCTION & BACKGROUND

Context of the Study

Esko High School is a combined middle and high school in the Esko Public School District (ISD 99) that serves just over 600 students in Grades 7-12. ISD 99 is located about 15 miles southwest of Duluth, MN and the district includes one high school and one elementary school. According to Minnesota Report Card, 93% of students at Esko High School (EHS) identify as Caucasian, and 10% of the student body qualifies for free and reduced meals (2023). At EHS there are 102 seventh grade students, 13 of these students receive special education services outlined in Individual Education Plans (IEPs) for a variety of reasons such as Developmental Cognitive Disabilities, Specific Learning Disabilities, and Emotional/Behavioral Disorders. Aside from academic struggles, many students who receive special education services experience more difficulties finding their place amongst peers and navigating social situations compared to students who do not receive services.

Over the past five years, as a middle school science teacher, I have noticed significant changes in the social and emotional behaviors of both general education students, and special education students. Even under normal circumstances, middle school can be a tumultuous part of adolescence for many pre-teens, but COVID-19 did not provide normal circumstances for kids to develop. Valenzano et al. (2020) found that students experienced a significant amount of additional social and emotional stress during the COVID-19 pandemic, resulting in gaps in social, emotional, and regulatory skills. The findings from Valenzano (2020) were congruent with my own observations of decreased abilities in self-regulation, problem solving, self-efficacy, and willingness to interact with peers outside of one's own social groups. In addition to

the social implications the pandemic had on adolescence, Ollila (2021) also found a significant rise in mental health concerns within public school systems, due to COVID-19. The trends that Ollila (2021) identified in other public schools, were present at Esko High School (EHS) as well. The Minnesota Department of Education (MDE) conducts student surveys every three years to monitor the risk and behaviors among adolescents in Minnesota. According to MDE's Student Surveys, in 2019, as eighth graders, 71% of the graduating class of 2024 reported never feeling depressed or hopeless (2019). In 2022, as juniors, only 42% of the same students indicated that they never feel depressed or hopeless (Minnesota Department of Education, 2022). The results of MDE's survey indicate that the global increase in depression, anxiety, and post-traumatic stress disorder is also present at EHS. In addition to the increase in reported mental health concerns, teachers at Esko High School have also observed increased incidences of disruptive classroom behavior and attendance issues related to anxiety and depression after the pandemic. In the post-pandemic educational environment, there is significant need for social and emotional supports at all schools, including EHS and it is from these observations and findings that the purpose of this study emerged.

Focus Question

My focus question was, How do CASEL based SEL discussions effect a middle school science classroom?

My sub-questions include the following:

1. What effect do CASEL based SEL discussions have on the social emotional environment within 7th grade Life Science classes?

2. What effect do CASEL based SEL discussions have on student behavior within 7th grade Life Science classes?
3. What effect do CASEL based SEL discussions have on academic achievement within 7th grade Life Science classes?

CONCEPTUAL FRAMEWORK

Introduction

In the last decade, educational institutions and educators themselves have observed a rising need for new classroom strategies to support students in building emotional intelligence and exercising resiliency. The purpose of this literature review is to examine the use of Social Emotional Learning (SEL) as a strategy to support students in both their academic and social-emotional endeavors. By diving into the related literature, this review will provide justification for the implementation of SEL strategies, as well as a deeper understanding of how social emotional learning impacts the environment within a middle school classroom in a multitude of ways.

Social Emotional Learning

Social and Emotional Learning has become common practice in the field of education. According to the Collaborative for Academic Social and Emotional Learning (CASEL) (2023),

> SEL is the process through which all young people and adults acquire and apply the knowledge, skills, and attitudes to develop healthy identities, manage emotions and achieve personal and collective goals, feel and show empathy for others, establish and maintain supportive relationships and make responsible and caring decisions (para. 1).

While not all people have experienced formal SEL during their educational journeys, all people develop some level of social and emotional intelligence throughout their lives. The goal of social emotional learning is to formally teach these skills and guide adolescents towards developing strong and healthy social and emotional skills that will be used during their school years and ultimately throughout life.

A History

In the past, it was widely assumed that SEL happened naturally over the course of development throughout the primary, middle, and high school years. However, according to Souza (2023), "When children don't master [social and emotional skills], they often develop behavior problems that, in turn, can interfere with their functioning in school and their ability to learn" (para. 4). As the gaps in social and emotional skills became more and more apparent, educators and psychologists began to research and develop solutions to these deficits. According to the George Lucas Education Foundation (2011), the term social emotional learning was officially coined in 1994 and was closely followed by the emergence of the CASEL organization. Although SEL is a relatively new idea in the field of education, it is widely implemented today. McGraw Hill (2021) estimates that in 2021, 91% of primary school teachers were aware of their districts plans for implementing SEL. The awareness of SEL has been steadily on the rise since it's official birth, but in recent years, the need for and implementation of SEL has significantly increased.

Need for Social and Emotional Learning

The need for SEL does not disappear when primary school ends. In fact, the many developmental changes students face during the early teen years indicate a strong need for SEL. The Centers for Disease Control and Prevention (CDC) (2023) agree, explaining that children experience both extremely high expectations and extremely low confidence during adolescence, a time of hormonal development that is accompanied by stress and moodiness. These emotional changes can be overwhelming to navigate while trying to adhere to social norms or fit in amongst peers, and often lead to extreme reactions towards seemingly insignificant social

stimuli. Surprisingly, Rosso et al. (2004) found there was no correlation between emotional intelligence and age when the participants ages 9-18 were in a relaxed cognitive state. The correlation between emotional intelligence and age occurred only when participants were in stressful or emotional situations; indicating that when students are relaxed they can determine the correct responses to social stimuli but become overwhelmed by their emotions in the heat of the moment. Additionally, Miller (2011) provides further explanation as to why the overreactions occur stating that

> Among the last neural connections to be fully established are the links between the prefrontal cortex, seat of judgment and problem-solving, and the emotional centers in the limbic system, especially the amygdala. These links are critical for emotional learning and high-level self-regulation (para. 6).

To summarize, the emotional instability many middle schoolers face is caused by a fully developed emotional center that cannot be regulated because the pathways between the amygdala and pre-frontal cortex are underdeveloped. Middle school students do not have the inherent neurologic ability to regulate these emotions by themselves, so they must be taught strategies to do so.

Mental Health. Aside from the static need for SEL due to developmental changes during adolescence, COVID-19 caused a significant increase in the need for effective SEL in schools due to deteriorating mental health. In fact, 76% of schools nationwide reported an increase in evidence of depression, anxiety, and trauma within their student body (National Center for Education Statistics, 2022). While the rate at which mental health problems are rising is concerning, SEL provides hope. Bonell et al. (2018) suggests that interventions, including SEL, that focus on strengthening student-student and student-staff relationships have the potential to improve mental health concerns within the student body. While teachers are not trained to

perform one on one counseling to students with mental health concerns, implementing classroom mental health interventions, like social emotional learning strategies, may help to improve the overall mental health of the student body.

Implementation of Social Emotional Learning

While most stakeholders agree that there is a need for SEL in education, one of the main critiques of classroom SEL strategies is that teachers should not implement SEL strategies because they are not trained therapists or counselors. However, according to a meta-analysis of school based universal SEL interventions, teachers, not counselors, were the most effective implementors of SEL lessons (Durlak et al., 2011). This suggests that classroom teachers can implement meaningful SEL strategies without outside help and can do so with minimal interruptions to typical classroom procedures. While teachers may be the most effective implementors of SEL, there are valid concerns regarding how realistic it is for teachers to implement SEL given the demands of today's typical educational setting.

Time Constraints. Although the need for and acceptance of SEL have been established, there are still valid criticisms of the practice. One of the most prevalent criticisms of SEL is time. In the current climate of public education, there is great pressure to meet standards and increase standardized test scores while simultaneously meeting the widely varying emotional and behavioral needs of students. This pressure often causes teachers to face additional stress, feel constrained on time, and experience teacher burnout (Thomas & Reyes, 2024). Unfortunately, implementing SEL effectively not only requires the time to conduct social and emotional lessons, but also requires planning time for the teacher (Smiling Mind, 2024). One solution to this constraint is the idea of micro lessons or discussions. Micro lessons are lessons that can be taught

within a short period of time and are highly effective, especially when they focus on life skills (Remesh, 2013). Although micro teaching is not widely utilized in public schools, and it is not specifically used to teach SEL, it may be a fruitful technique for implementing SEL regardless of increasing time constraints. There is a gap in the research of implementing SEL via micro-lessons, and this study aims to add to the research regarding this implementation strategy.

Science Education

Although time constraints are a major concern withing the classroom, integrating SEL lessons and science curriculum may serve to be a promising approach. With the introduction of the Next Generation Science Standards, national K-12 science curriculum has shifted away from knowledge-based learning and towards scientific proficiency. The change in standards included three dimensions of scientific proficiency including: (1) Science and Engineering Practices (SEPs), (2) Crosscutting Concepts (CCs), and (3) Disciplinary Core Ideas (DCIs) (National Research Council, 2012). Within the three dimensions, communication is a common theme. By teaching students how to build explanations, use evidence as a means of persuasion, and engage in scientific argumentation, educators can support students' growth in content-knowledge, performing science, and strengthening their social emotional skills (Berland & Hammer, 2012). Leaders in the scientific community echo the need for aspiring scientists to have effective communication skills. Feliú-Mójer (2015) suggests that as science becomes more interdisciplinary, the ability to foster collaboration and innovation across disciplines relies on scientists' ability to communicate effectively. Integrating opportunities to engage in scientific discussion can strengthen content knowledge and prepare students for future careers in a plethora of scientific fields while simultaneously exercising social and emotional skills. Thus, teaching

students how to effectively communicate ideas, observations, and criticisms with peers while providing opportunities to engage in science discourse could provide successful integration of SEL within NGSS aligned science curriculum.

CASEL Framework

When implementing SEL, a specific framework must be utilized to maintain consistency. The standard SEL framework was created by the Collaborative for Academic Social and Emotional Learning and is widely referred to as The CASEL Framework. According to CASEL (2023), effective classroom based SEL approaches include explicit instruction, teaching cooperative practices, and are integrated into academic curriculum. The CASEL Framework addresses five competencies of social and emotional health: (1) Self-awareness, (2) Self-management, (3) Social awareness, (4) Responsible decision making, and (5) Relationship skills (CASEL 2023). For many middle school students who struggle socially and emotionally, the five competencies are at the heart of their discomfort, and many times, multiple deficiencies are to blame as the competencies naturally overlap one another. CASEL utilizes a SEL wheel to depict the relationships between each competency (Figure 1).



Figure 1. Image of CASEL framework wheel (CASEL 2023).

Self-awareness can be described as the ability to recognizes one's own emotions, thoughts, and values, and how they influence their behaviors (CASEL, 2023). The ability to recognize these feelings directly impact a student's ability to self-manage their emotions. Self-management is described as the ability to manage one's feelings in various situations in order to achieve one's own goals (CASEL, 2023). When students are able to identify and manage their behaviors, they are able to participate in responsible decision-making, and responsible decision-making directly impacts the relationship skills students have. In addition to responsible decision-making, social awareness is also crucial in developing strong relationship skills. Social awareness is defined by CASEL (2023) as, "the ability to understand the perspectives of and empathize with others." When students can identify the perspectives of others, empathize with them, and allow those understandings to guide their decision-making in social situations, they

can build strong relationships. The skills outlined in the CASEL framework and SEL wheel are at the very core of a social classroom and provide a framework from which to guide students towards success in the science and engineering practices outlined by NGSS.

Conclusion

In the past four years, mental health concerns have grown significantly amongst young adults, and educators across the country see the need for classroom-based interventions. However, the path to successful implementation of such interventions is not always clear, nor is it always conducive to secondary education and the time required to teach required standards in content courses. Teaching students how to effectively communicate ideas, observations, and criticisms with peers while providing opportunities to engage in science discourse is an important part of NGSS aligned science curriculum. The use of micro SEL lessons and CASEL based discussions may serve as an effective vessel for teaching SEL in middle school science classrooms.

METHODOLOGY

Demographics

The purpose of this study was to investigate the effect that implementing Collaborative for Academic, Social, and Emotional Learning (CASEL) strategies have on seventh grade science classes at Esko High School in Esko, MN. One hundred and two seventh grade students were included in the sample to create an inclusive summary of seventh grade students at Esko High School. Eleven percent of these students received special education services outlined in an Individualized Education Plan (IEP). To investigate the effects that CASEL strategies have on middle school science students, the following aspects of the classroom experience were studied:

1. What effect do CASEL based SEL discussions have on the social emotional environment within 7th grade Life Science classes?
2. What effect do CASEL based SEL discussions have on student behavior within 7th grade Life Science classes?
3. What effect do CASEL based SEL discussions have on academic achievement within 7th grade Life Science classes?

The research methodology used for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subject was maintained (Appendix A).

Treatment

To answer the focus questions, both qualitative and quantitative data was collected during a non-treatment and treatment unit using a mixed methods research approach. The non-treatment unit consisted of typical classroom instruction and the treatment unit included an implementation of micro SEL discussions which replaced content-based bell ringers with SEL prompts over a three-week period (Figure 2).



Figure 2. Example of an SEL bell ringer used during the treatment unit.

The reasoning for implementing a treatment and non-treatment unit was twofold: (1) to determine the impact that the SEL unit had on student behavior, and (2) to determine if the replacement of content-based bellringers with SEL lessons was justifiable based on student growth in assessment scores.

During the treatment unit, the SEL prompts varied by day and included a variety of photos, videos, or written stories to prompt class discussions around interpersonal and intrapersonal skills. After allowing the students silent time to think about the SEL prompt, class discussions occurred. Each week, the prompts focused on one aspect of the CASEL framework:

1. Self-awareness of emotions and behavior (Week 1)
2. Social awareness of others' emotions and behavior (Week 2)
3. Social interactions and empathy (Week 3)

The SEL prompts were intentionally scaffolded to guide students towards conducting themselves with more social awareness in a school setting. As a reflection of the scaffolding, each data collection technique was designed to measure the changes in student behavior and perceptions throughout the progression of the treatment process. The timing in which data collections took place was also intentionally structured so that the discussions surrounding individual behavior and group interactions coincided with the large group and small group observations. The schedule outlining treatments and data collection techniques can be seen in Table 1.

Table 1. Sequence of events throughout the study.

Treatment Unit	Week	Treatments and Data Collections
Non-Treatment Unit	1	Student Reflection Surveys Administered Non-Treatment Unit Pre-Test Administered
	2	Observational Behavioral Data Collected: Group & Whole Class
	3	Non-Treatment Unit Post-Test Administered
Treatment Unit	1	Treatment Unit Pre-Test Administered Week 1 of Micro SEL Lessons Completed Student Reflection Surveys Administered
	2	Week 2 of Micro SEL Lessons Completed Observational Behavioral Data Collected: Whole Class Student Reflection Surveys Administered
	3	Week 3 of Micro SEL Lessons Completed Observational Behavioral Data Collected: Group Student Reflection Surveys Administered
	4	Treatment Unit Post-Test Administered Student Interviews Conducted

Data Collection and Analysis Strategies

To encourage meaningful conclusions from this study, a triangulated mixed-methods research approach was used. According to Mertler (2020), when multiple sets of data converge and indicate the same or similar results, there is stronger credibility in the overall findings compared to when exploratory or explanatory mixed-methods designs are used. To support the study with both qualitative and quantitative data, both observational and quasi-experimental research designs were utilized. Donald T. Campbell and associates introduced quasi-experimental designs in the 1960's to test casual real-world hypothesis' (Campbell & Stanley, 1963). Quasi-experimental designs emerged as an alternative to true experiments because there are many fields like sociology, psychology, education, and geography where the setting restricts the ability to randomize participants and control constants (Stevenson, 2020). The following methods have been developed to help account for the uncontrolled variables present in the

classroom. For instance, Angrosino (2007) warns that observational researchers must be aware that the more involved the researcher is, the less objective they are. Teacher-researchers must view themselves as observer-participants and rely on structured data collection instruments to ensure that data collection methods are as objective as possible. The importance of executing mixed-methods research and the need for objectivity guided the creation of the following data collection instruments outlined in Table 2.

Table 2. Data Triangulation Matrix.

Data Collection Instruments	Focus Questions		
	1. What effect do CASEL based SEL discussions have on the social emotional environment within 7th grade Life Science classes?	2. What effect do CASEL based SEL discussions have on student behavior within Life Science classes?	3. What effect do CASEL based SEL discussions have on academic achievement within 7th grade Life Science classes?
Student Reflection Survey	X	X	X
Observational Data Collection Sheet	X	X	
Student Interviews	X	X	X
Pre-Treatment Content Assessment			X
Post-Treatment Content Assessment			X

Student Reflection Survey

While investigating the effect that CASEL based micro SEL lessons had on seventh grade science classes, special attention was given to the effect the bell ringers had on student perceptions of the classroom environment and their related behaviors. A Student Reflection Survey was utilized to for two reasons: (1) to identify general student attitudes about the social emotional climate of the classroom and (2) obtain a deeper understanding of how students

perceived their own engagement during group work (Appendix B). The Likert style reflection survey was given once before the intervention took place and once a week, during the treatment unit to track any changes in the students' perceptions due to the implantation of micro SEL lessons.

Analysis of Student Reflection Surveys. Utilizing Likert style surveys allowed student perception data to be collected in a non-invasive, efficient, and quantifiable manner. To avoid non-answers, Peterson (2000) suggests that Likert surveys should not have a neutral selection. Removing the neutral response option forced students to take a stance on each specific question resulting in decisive responses. The student reflection survey was eight questions long, and each question included four possible quantified responses: (1) Strongly Disagree, (2) Disagree, (3) Agree, and (4) Strongly Agree. Assigning each response with a quantity, allowed for the implementation of this quantitative analysis.

To analyze the student response surveys, a combination of means and repeated t-tests were used to determine whether there was a significant change in student perceptions throughout the treatment. To minimize response bias or the unintended pressure students may feel to give a *correct* answer, students identified themselves using their lunch numbers, instead of their names. This procedure allowed the tracking of responses while continuing to protect student anonymity, thus providing less biased insights into the effect the SEL lessons had on the classroom environment.

Observational Data Collection Sheet

To support the investigation into the effect the micro SEL lessons had on student behavior, observational data was collected during direct instruction and group work. The

Observational Data Collection Sheet (Appendix C) was used to focus the observations on targeted behaviors like bickering, blurting, and the need for redirection to ensure that the observations were relevant to the research questions. Not only was it important to provide an instrument to focus observations, but also to ensure the observations were as objective as possible (Lam, 2011). Recording frequency data during observations provided an opportunity to collect implicit data to compare to student response surveys. Indirect measurements of behavior are called implicit measures, because they observe responses to stimuli rather than the ideas participants have about behavior (Litwin & Ngan, 2019). According to Gawronski and De Houwer (2014), people are often unaware of the origin of their behavior, which makes implicit observations especially useful. Collecting implicit data via observational collection was especially relevant in this study because middle school students often have a difficult time communicating the reasons behind their behavior or recalling changes in behavior over a long period of time.

Analysis of Observational Data. Analyzing frequencies of behavior helped to illuminate trends in behavior that students may not have been able to verbalize during student response surveys or interviews. To isolate trends in behavior throughout the study, observational data was collected during both treatment and non-treatment units of the course. The tally marked frequency data method allowed the researcher to systematically record information about how often targeted behaviors occurred (Lam, 2011). In this study, observational frequency data from each unit was compared to identify trends in the observations using a t-test. Knapp (2017) explains that t-tests are used to show whether one group is statistically different from another.

Utilizing a t-test in this situation allowed analysis of whether there was a significant change of behaviors observed between the control and treatment units.

Student Questionnaires

To gain a deeper insight into student perceptions of social and emotional awareness and academic success, Student Questionnaires were conducted at the end of the treatment period (Appendix D). Student Questionnaires were utilized in place of student interviews to save on time and allow for a larger pool of data collection. According to Marshall and Rossman (1989), interviews aid in explaining the behaviors and events observed in social research settings like the classroom. Slayton (2018) states that it is important to have a specific direction for the conversation in mind, otherwise it is easy for interviews to produce irrelevant or unfocused data. Replacing student interviews with a questionnaire that allowed for open responses ensured that the data collected was consistent and intuitive.

According to Grey (2017) and Mertler (2020), there are three types of interviews, structured, semi-structured, and unstructured. A structured interview is one that asks all participants the exact same questions in the exact same way, like a census (Slayton 2018). An unstructured interview is one where there are no prompts for the interviewer to follow, and the interview often goes in the direction of where the interviewee's answers take it (Slayton 2018). A semi-structured interview combines the perks of each of the other interview types, allowing for flexibility in the questionnaires and room to investigate responses further without sacrificing the direction of the interview. Formatting questionnaires in the image of interviews helped build a comprehensive understanding of how students perceived the social emotional environment of the

classroom, and whether the students felt the treatment had a positive or negative impact on their academic success.

Analysis of Student Questionnaires. Using inductive analysis helped to construct important takeaways about the effect the micro SEL lessons had on the students' perceptions of the overall environment within the science classroom. The process of inductive analysis included the sorting of data into overarching themes and patterns (Mertler, 2020). This type of analysis helped identify important trends and outliers in response to each of the three research questions. Which is why Mills (2011), emphasized the importance of looking for comments about specific events or observations that repeat themselves throughout the data. Recognizing patterns and outlying perspectives in the data helps shed light on which researcher-observed behaviors are behaviors that students are self-aware of, and which are not. These patterns and outliers are significant because acute awareness of behavior and how individual behaviors impact their peers and the overall classroom behavior, is an important part of the CASEL framework. Aside from the impact on classroom environment, thematic analysis will also shed light on how students perceive their behaviors to impact their academic achievement. Triangulating the interview data and quantitative data collected throughout the study helped formulate overarching trends regarding each of the three focus questions.

Pre-Treatment and Treatment Unit Assessments

To identify whether the CASEL based SEL lessons impacted the academic success of students, Pre- and Post-Treatment Unit Assessments (Appendices E & F) were implemented. Pre and post assessments from two different content units were included, because the first content unit served as the non-treatment control group and the second content unit included the

intervention and served as the treatment group. The comparison of assessment data between the two groups was utilized to isolate the effect that the CASEL based SEL lessons had on the social, emotional, and academic environment within the science classroom. According to Mertler (2020), the use of assessment scores as a data collection technique is convenient and reliable because assessments are data collection techniques that are already utilized regularly in the classroom. However, one common limitation of assessment data is that assessment data often focuses on achievement rather than growth over time (Knapp, 2017). In this case, administering a pre and post assessment for each unit accounted for this shortfall. Measuring growth was especially important during this protocol because the content learned during the two units differed.

Analysis of Assessment Data. To analyze the assessment data collected, both the treatment and non-treatment data must be compared to one another. Comparing the two units was not as straight forward as running a singular t-test. Knapp (2017) explains that t-tests are used to show whether one group is statistically different from another. The limitation of the t-test is that it does not account for growth, it only compares the final assessment scores which may differ from unit to unit because of content (Knapp, 2017). According to Colleta and Steinert (2020), normalized gains analysis allows for the comparison between two unrelated units as the analysis measures the amount of growth over time. After normalized gains analysis, the assessment data was further analyzed using t-tests. This before and after nature of t-tests makes it especially applicable to educational research as assessment data is often analyzed in the form of pre and post-tests or pre and post treatments. By combining normalized gains and repeated

measures t-tests student learning within each unit was measured and inferences on the connection between SEL and academic success were formed.

Summary of Data Collection

Each of the data collection instruments and corresponding analysis were used to create a triangulated understanding of the effects that micro SEL lessons had on the overall social, emotional, and academic success of a student in seventh grade school science. Utilizing objective data collection techniques, that were both observational and quasi-experimental in nature, established a strong understanding of how both the student and the instructor perceived the changes in the social and emotional environment of the classroom throughout the study.

CHAPTER FOUR

DATA ANALYSIS

The purpose of this action research project was to investigate the impact that The Collaborative for Academic, Social, and Emotional Learning (CASEL) based social emotional learning (SEL) bellringers had on overall student success in a middle school science classroom. Overall student success was measured in three ways: (a) social and emotional success, (b) behavioral success, and (c) academic success. To implement this project, two different content units were compared. One unit where typical content-based bell ringers were utilized, and one unit where the bellringers were replaced by short SEL discussions based on a prompt. All students participated in the discussions and the majority of students (N=74) completed pre- and post- assessments, Likert surveys, and questionnaires. Additionally, the teacher collected observational data about student behavior during two fifty-minute lessons: (1) a large group lesson and (2) a small group lesson. To analyze and draw conclusions from the collected data, T-tests, normalized gains, frequency analysis, and thematic analysis were performed.

Impact on Social and Emotional Success

One aspect that may impact student success in a middle school science classroom is whether students feel socially and emotionally comfortable and supported in their classroom. To measure the overall social and emotional success, a Student Reflection Survey (Appendix B) and student questionnaires (Appendix D) were utilized. Each week of the treatment unit focused on a different aspect of the CASEL framework to establish social and emotional success amongst peers.

Self-Awareness

The first week's topic of SEL discussions was self-awareness and regulation of emotions. Students were asked before and after the first week's discussions to identify whether they were able to recognize and regulate their own emotions (Figure 3).

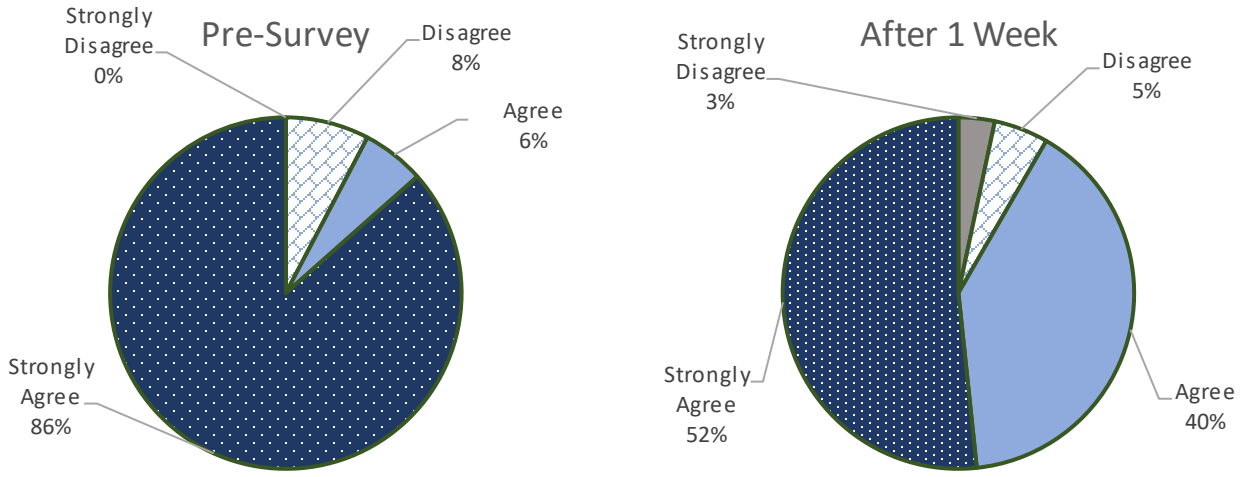


Figure 3. Responses to Student Survey Question 1: I can recognize my own emotions and regulate (control) my actions during class, (*N*=74).

When the student reflection survey data was analyzed using a t-test, no significant changes in responses due to the treatment were found ($p>0.05$). Although the number of students who either *agreed* or *strongly agreed* that they were able to recognize their own emotions and regulate their actions during class did not change significantly between the two weeks, the number of students who *strongly agreed* they were able to recognize and control their own emotions decreased by 60% while the amount of students who identified they *agreed* increased drastically Most seventh-grade students at Esko High School felt confident in their social awareness skills before the treatment began. This trend may be associated with the Dunning-Kruger effect, which

Psychology Today, defines as the overestimation of a person's knowledge or skill in a specific area due to a lack of self-awareness preventing them from truly understanding their abilities (Sussex Publishers, 2024).

Social Awareness

Another aspect of social and emotional comfort in a classroom is the ability of students to identify and predict others' emotions and behavior. The second week of SEL discussions focused on the awareness students have of others' emotions. At the end of the treatment unit, students completed a questionnaire (Appendix D) which asked if they were more aware of classmates' emotions during the past unit than they usually are (Figure 4).

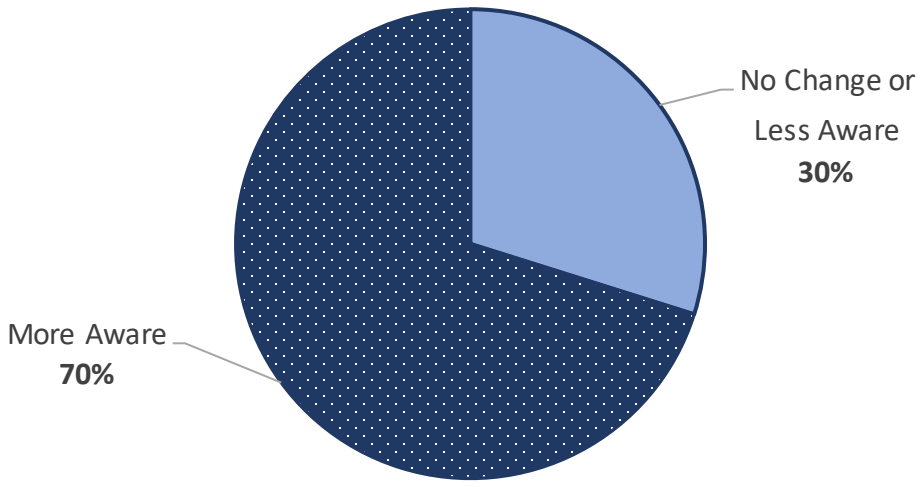


Figure 4. Responses to the Student Questionnaire Question 8: Have you been more aware of your own emotions or classmates' emotions during the past unit than you usually are? (*N*=67).

The seventh-grade students overwhelmingly indicated that they were more aware of their own emotions or their classmates' emotions during class following the SEL discussions than they were beforehand. When asked to provide an example of when they noticed this change, one

student said, "I could tell by the way they acted, did they seem to want to be alone or do they not, that kind of stuff." Although no significant changes were found in students' self or social-awareness skills, student responses did indicate that the SEL discussions helped them be more cognizant of the social environment in the classroom.

Relationships With Others

When students can recognize and control their own emotions and interpret others' behaviors, it may increase positive relationships within a classroom. The third weeks topic of SEL discussions was relationships between peers. Questions 3 and 7 of the Student Reflection Survey (Appendix B) asked students to identify how comfortable they felt amongst their peers during science class (Figure 5).

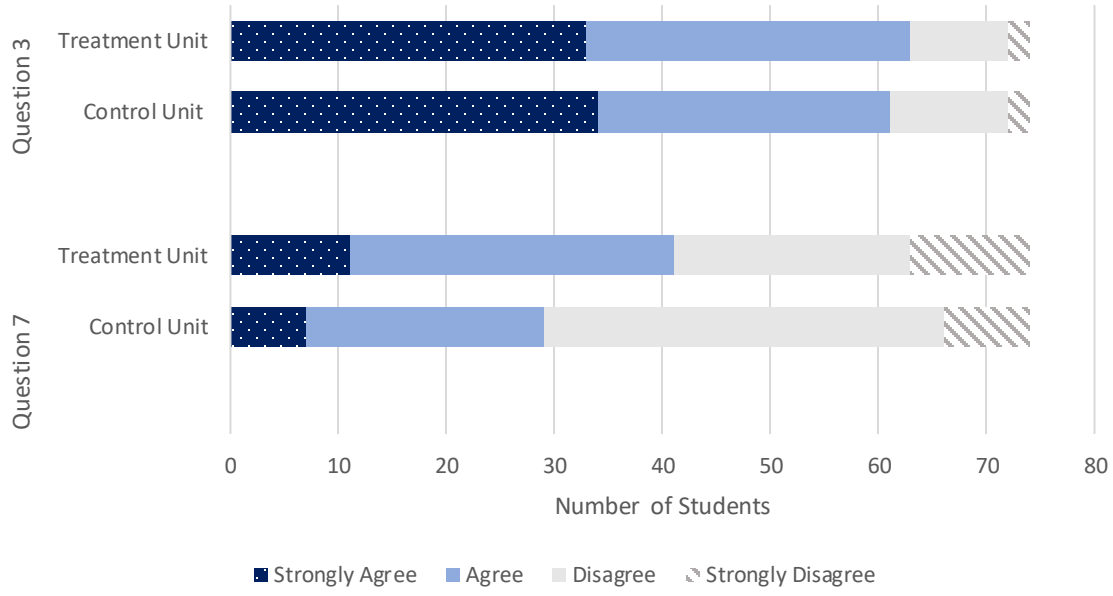


Figure 5. Student responses to survey question 3: I believe that my classmates support and encourage each other during science class and student survey question 7: I feel comfortable sharing my ideas during group work, (*N*=74).

A t-test from the student reflection surveys showed no significant change between the control unit and treatment unit ($p>0.05$). This data is congruent with some of the responses to the student questionnaire, where 52% of students indicated that they felt the CASEL based SEL discussions had no impact on the social emotional environment in the classroom. One student stated, "the SEL lessons were good reminders of how to act but did not teach me anything I did not already know." Replacing content-based bell ringers with SEL bell ringers did not significantly impact the social emotional environment within the classroom.

Impact on Classroom Behavior

Another aspect of student success that was investigated was the impact that the CASEL based SEL discussions had on classroom behavior. Classroom behavior was observed over the course of four different lessons: (1) a large group-based lesson during the control unit, (2) a small group-based lesson during the control unit, (3) a large group-based lesson during the treatment unit, and (4) a small group-based lesson during the treatment unit.

Student Engagement

One measurement utilized during classroom observations was a frequency collection of how many students were on task at different minute markers throughout the period (Figure 6).

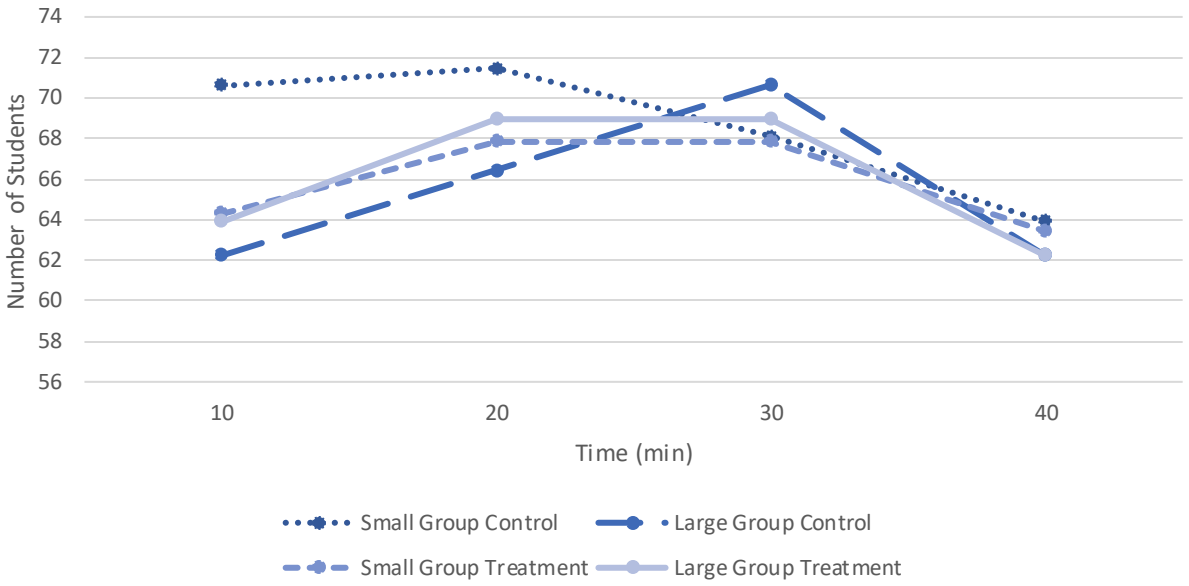


Figure 6. Frequency data of students who were on task during teacher observations, (*N*=74).

A t-test of students on task at each given increment calculated no significant difference between the number of students who were on task during large group or small group lessons during the control unit and treatment unit ($p>0.05$). Although the treatment did not impact the number of students that were on task, during both the control unit and the treatment unit observations, no less than 83% of the students in class were on task at any given increment. While SEL bellringers may not have impacted engagement, most students were on task to begin with.

Student Behaviors

In addition to the totals of on task students, a variety of specific behaviors like blurting, bickering, and need for redirection were also tallied during classroom observations. Analysis of the values for each behavior revealed an insignificant difference before and after the treatment ($p>0.05$). When students completed the questionnaire, they were also asked if they thought the SEL discussions impacted the way they interacted with their peers (Figure 7).

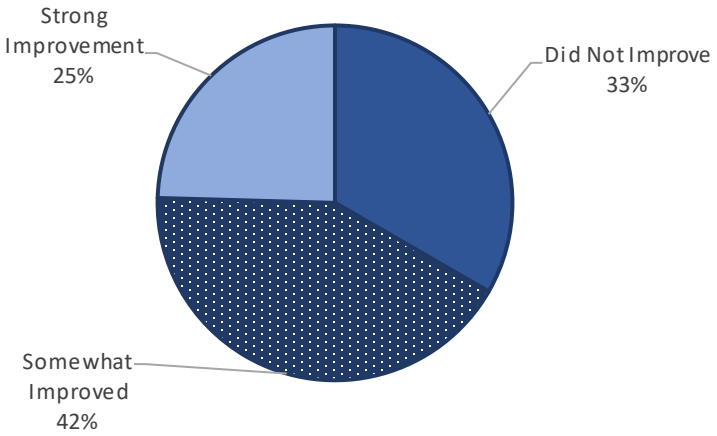


Figure 7. Response to Questionnaire Question 3: Do you feel that the SEL lessons helped improve the way you interact with your classmates during group work? (*N*=67).

Of the students who filled out questionnaires, 67% felt the SEL lessons had at least somewhat of a positive impact on their interactions with their peers. One student who indicated there was somewhat of an impact stated, "It made me think more about how I acted," while another student who indicated it had no impact wrote "I feel like we are so accustomed to what we have been doing it is hard to always think of it." While many students felt the interactions between classmates improved, the mixture of both positive and neutral student perceptions affirmed the t-test for observational data indicating no significant change in behavior based on the treatment.

Impact on Academic Success

The overall behavior in a classroom may also play an important role in academic success. At the end of the treatment unit on the student questionnaire, students were asked if they perceived the overall classroom environment to have changed during the treatment unit. If the students answered "yes," they were then prompted with a follow-up question: "Did the improved classroom environment have an impact on your academic success during this unit" (Figure 8).

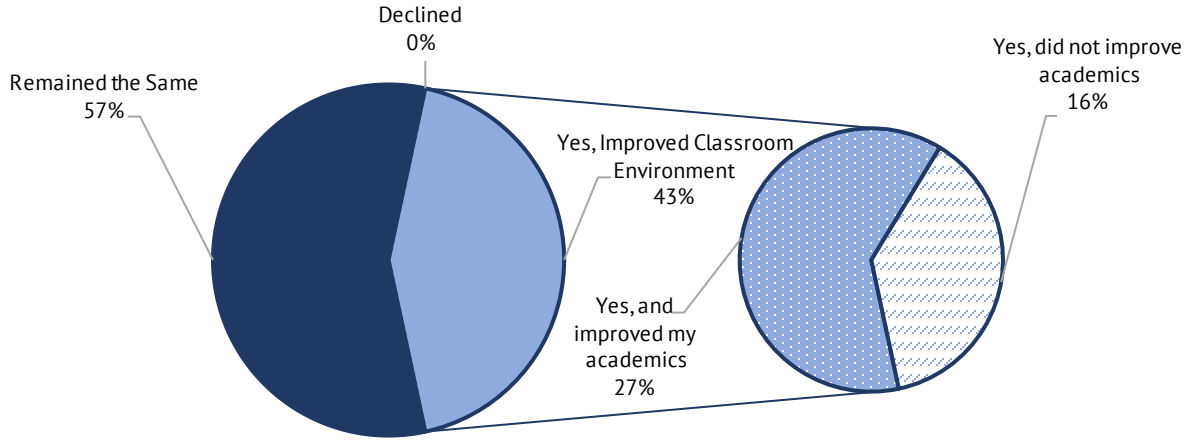


Figure 8. Response to Questionnaire Question 10: Do you think the overall classroom environment has changed during the last unit? (*N*=67).

Student perceptions of the classroom environment were mixed, as 56% of students felt there was no impact on the classroom environment and 43% of students indicated it improved over the course of the unit. Of the 29 students that noticed an improvement, 18 students (27% of the whole class) also perceived the improvement in classroom environment to improve their academic success. Although most of the class did not perceive a change in classroom environment, many that did also perceived an increase in academic success as well.

In contrast, assessment data revealed a statistically significant decline in academic achievement between the control unit and the treatment unit. Pre- and post-tests were utilized during both the control unit and treatment units to measure academic success (Figure 9).

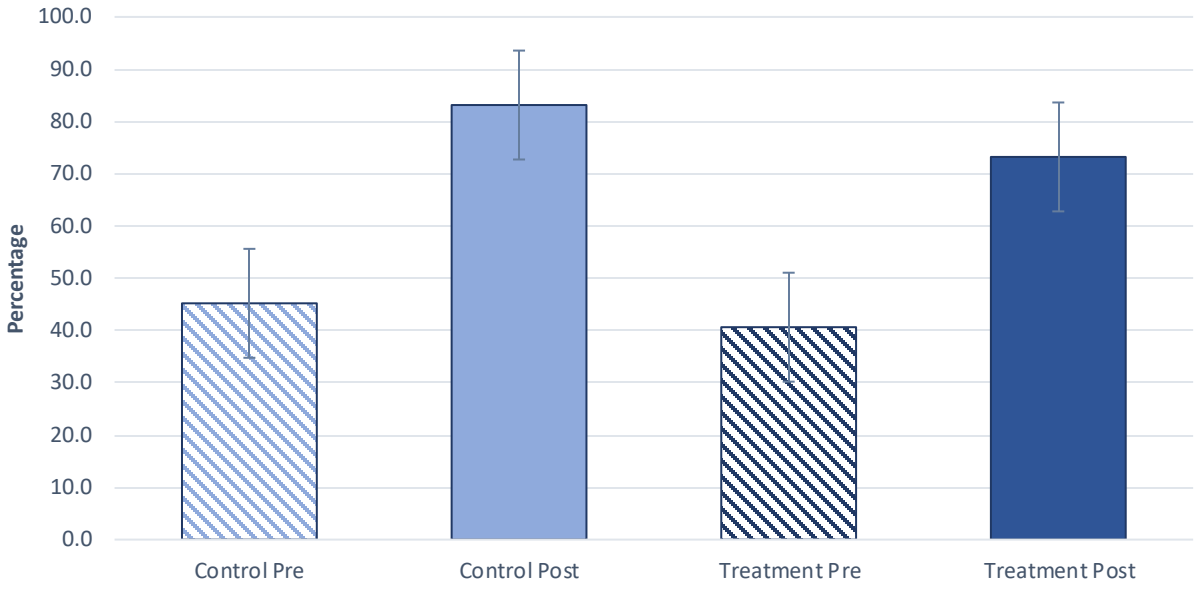


Figure 9. Pre- and post-assessment data from Control Unit and Treatment Units, (*N*=74).

Comparison of averages for both units (treatment and control) showed a significant change in academic achievement ($p<0.05$), but in a negative direction, meaning academic achievement decreased significantly. To confirm the statistical significance in achievement, normalized gains were also calculated for each unit, and compared via a t-test. The normalized gains t-test p-value ($p=0.002$) confirmed the rejection of the null hypothesis. The SEL treatment influenced assessment data, just not in a positive way. To ensure that the decline in achievement was not due to differences in initial understanding of the content, T-tests between the pre-tests scores from both the control and treatment tests were run. The p-value between pre-tests ($p>0.05$) confirmed that there was no statistical difference in initial understanding of either unit's content. The combined analysis indicates that the replacement of content-based bellringers with SEL discussions negatively impacted student academic achievement.

The absence of content-based bellringers during the treatment unit may have contributed to the decline in academic achievement. Isolating the cause of the decline was difficult when looking solely at the quantitative data, so a question in the student questionnaire was designed to investigate the possible effect of the lack of content-based bellringers (Figure 10).

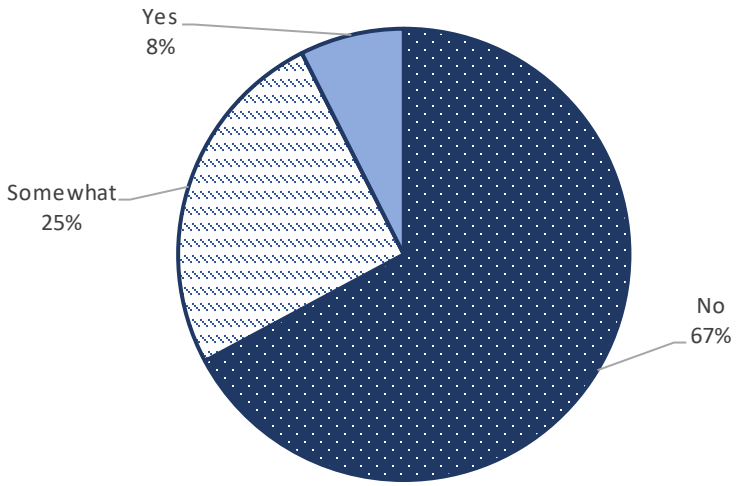


Figure 10. Responses to the questionnaire question: Did the absence of content-based bellringers negatively affect your grade, (*N*=67).

Although students achieved lower assessment scores during the treatment unit, 67% of students who responded to the student questionnaire claimed that the absence of content-based bellringers had no effect on their academic success. One student stated, "I always get the bellringers right, so they don't help me." However, of the 33% of students who indicated the lack of bellringers had at least some type of impact on their academic success, 15 students mentioned that the bellringers helped to review concepts from previous lessons throughout the unit and keep the ideas fresh in their memory. One student went on to elaborate, "The regular bell ringers help me understand the stuff that I don't get the first time in a lesson, so without them I struggled more

than I usually do." Although the majority of students seemed indifferent to the change in bellringer content, approximately one third of the class perceived the change in bellringers to negatively affect their ability to comprehend the unit and do well on the assessment.

Summary of Data Analysis

Full analysis of the quantitative data indicated a significant decrease in academic success between the control and treatment unit, while behavioral data and qualitative responses to the questionnaires and surveys suggested the treatment unit had no significant impact on social and emotional or behavioral success in the classroom. A common theme in student reflections was that although they thought the SEL discussions were meaningful, they didn't learn anything that they didn't already know. Additionally, the lack of content-based bellringers seemed to significantly impact their academic success in a negative way. Both qualitative and quantitative analysis indicate that replacing content-based bellringers with SEL discussions is not a justifiable way to implement SEL in a middle school classroom.

CHAPTER FIVE

CLAIM, EVIDENCE, AND REASONING

The purpose of this action research project was to investigate the impact that The Collaborative for Academic, Social, and Emotional Learning (CASEL) based social emotional learning (SEL) bellringers had on overall student success in a middle school science classroom. Overall student success was measured in three aspects: (a) social and emotional success, (b) behavioral success, and (c) academic success. After data collection and analysis, the effect of the treatment on each of the three focus areas was determined, and two main conclusions for the study were drawn: (1) Mini SEL discussions were not an effective way to improve classroom environment or academics, and (2) content-based bellringers are an important part of my classroom routine.

Classroom Environment Claims

Replacing content-based bell ringers with CASEL based micro SEL discussions had little to no impact on the classroom environment of a middle school science classroom. Most students perceived the SEL discussions to be a repeat of information they had already learned, and not useful. There was little change in the perception of how students interacted with one another post treatment both in student responses to Likert surveys, questionnaires, and teacher observations. It seemed like the SEL discussions were simply a repeat of things students already knew because the middle school counselor at Esko High School engages the seventh-grade students in approximately one SEL lesson per month. Additionally, a few students expressed feeling like the

SEL discussions were out of place, and not something we should have been learning in a science class. As the teacher, I had concerns about the forced nature of completing SEL discussions in the middle of the school year when it was clearly out of the ordinary from our regular routine. The impact of the discussions may have been significantly different had we begun these at the beginning of the year and continued them for a longer time period. Additionally, there may have been a positive impact if I had implemented the discussions before specific lessons involving group work.

Student Behavior Claims

Replacing content-based bell ringers with CASEL based micro SEL discussions had little to no impact on the classroom behavior of a middle school science students. T-tests run on frequency data from teacher observations indicated no statistical difference between the control and treatment units. Although students noted that they felt like they were more aware of their classmates' emotions and behavior, it did not seem to significantly alter their actions.

Academic Success Claims

Replacing content-based bell ringers with CASEL based micro SEL discussions had a significant impact on the academic success during the treatment unit. This resulted in significantly more students failing the posttest for the treatment unit and significantly less students achieving As and Bs on the treatment unit assessment. Some students indicated that they felt this change was due to the lack of content-based bellringers helping them repeat and remediate scientific ideas throughout unit. In addition to the impact the lack of content-based bellringers may have had on the study, as the researcher I chose two content units that I expected

to be of similar cognitive difficulty. However, this is my first-year teaching in the district I currently teach in, with the curriculum I am currently teaching, and I felt that the treatment unit was significantly harder for students to understand than the control unit. It is not possible to identify which of the two factors contributed most to the decrease in academic achievement during this study.

Value of the Study and Consideration for Future Research

This study helped me affirm two major ideas: (1) SEL must be authentic and (2) bellringers are an important part of our daily routine. There are a few areas to focus on if I were to continue researching ways to implement SEL in a middle school science classroom. First, I could repeat the same study, but instead of two separate units, I would conduct the study over one unit and assign different class periods as the control vs. treatment groups so that I could reduce the impact that having two different content units may have had on the academic achievement results. Second, I could conduct the study closer to the beginning of the year, and for a longer period to make the SEL discussions feel more authentic, that way students would not notice the change in routine as significantly. However, if I were to pursue this research further, I would most likely scrap the idea of replacing bellringers with SEL discussions and instead investigate other ways to implement SEL into science curricula as I suspect the lack of content-based bellringers played a much larger role in academic achievement than the students were consciously aware of.

Impact of Action Research on the Author

As a middle school teacher, I have always been interested in the place that SEL has in middle school classrooms. Although not directly related to the content, SEL has strong applications and importance when it comes to the science and engineering practices. I was hopeful that SEL bellringers may be a useful tool as SEL can often feel out of place, and insincere in science classrooms. Unfortunately, it does not seem that SEL bellringers had a significant impact on student success. In fact, the biggest impact this study had on me as an educator was solidifying my justification for content-based bellringers as a warmup in my classroom.

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APPENDICES

APPENDIX A

IRB APPROVAL

Received

Jan 18, 2024 8:05 AM

From

NoReply@TOPAZTI.com

To

jessica.anderson40@montana.edu;o.schererwojahn@ecat1.montana.edu;kelly.beiswanger@montana.edu;brenna.szott@montan

Subject

IRB Protocol #2024-1172-EXEMPT APPROVED

Hello Scherer-Wojahn, Orianna,

Your protocol was reviewed by the IRB and has been approved.

PI: Scherer-Wojahn, Orianna
Approval Date: 1/18/2024
Title: The effect that CASEL based SEL strategies have on student success in middle school science.

Protocol #: 2024-1172-EXEMPT
Review Type: Exemption
Expiration Date: 1/18/2029

Work described under this protocol may now commence. The PI is responsible for ensuring that the protocol accurately describ
research practices being conducted.

> Review Category designation determined by the IRB can be found in the final section of your protocol.
> IRB-stamped active Consent Forms are attached within your protocol where applicable.
> Any changes must be submitted via Amendment prior to implementation.
> Per the Common Rule, research only requires Interim (annual) Review by the IRB if 1) it was reviewed via Full Committee or 2
regulated by the FDA.
> All research is subject to post approval monitoring.
> All protocol types must be renewed 5 years after approval.
> Inform the IRB once your research is complete so that the protocol may be inactivated.

Please contact your IRB Program Manager with any questions or if you are in need of assistance. Thank you for your diligence ir
care of human subjects research participants.

Institutional Review Board for the Protection of Human Subjects | Office of Research Compliance | Montana State University

Access your protocol anytime at https://montanaprod.topazti.net//Elements?emailLink=11%2c102%2c11048.

APPENDIX B

STUDENT REFLECTION SURVEY

Choose a rating that aligns best with how you feel during science class. While your honest feedback is appreciated, participation in this research is voluntary and participation, or lack thereof, will not affect your grade or perceptions of you in any way.

1. I can recognize my own emotions AND regulate (control) my actions during class.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

2. I can recognize the emotions and feelings of others, such as my classmates and teachers.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

3. I believe that my classmates support and encourage each other in science class.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

4. I am usually engaged (on task) during science class.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

5. During science class, I take time to listen to my peers' ideas before responding.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

6. I feel comfortable telling my other classmates to stay on task when doing group work.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

7. I feel comfortable sharing my ideas during group work.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

8. I believe that my social and emotional behavior in science class impacts my ability to be academically successful.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

APPENDIX C

OBSERVATIONAL DATA COLLECTION SHEET

Table A1: Large group data collection table

Behavior:	0-15 min	16-30 min	31-45 min	46-60 min
Talking out of Turn				
Arguing Between Peers				
General Off Task				
Teacher Redirections				
Negative Self-Talk				
General Positive Behavior: Number of Students on Task at given time	@10 min	@20 min	@30 min	@40 min

Table A2: Small group data collection table

Behavior:	0-15 min	16-30 min	31-45 min	46-60 min
Negative Behavior				
Bickering Between Peers				
Interactions between groups				
General Off Task				
Teacher Redirection Needed				
Physical Interactions				
Positive Behavior				
Supportive Talk Between Peers				
Problem Solving w/ Peers				
Peer Redirection within Group				
General Positive Behavior: Number of	@10 min	@20 min	@30 min	@40 min

Students on Task at given time				

APPENDIX D

STUDENT QUESTIONAIRES

1. During this unit, we replaced our Bell Ringers with Social Emotional Learning Lessons. Can you provide 3 words that describe your opinion of these lessons?

2. During this unit, we replaced our Bell Ringers with Social Emotional Learning Lessons. Do you feel that the SEL Lessons helped improve the way you interact with your classmates during group work?

3. Why or why not?

4. During this unit, we replaced our Bell Ringers with Social Emotional Learning Lessons. Do you feel that the absence of Bell Ringers has impacted your understanding of the content negatively?

5. Can you describe a time in the last week in science class where conflict or disagreement arose between two people in your small group?

6. Did the people involved use any skills learned from the SEL lessons to handle this situation?

7. Have you been more aware of your own emotions or classmates emotions during the last unit?

8. Can you provide an example of when you were more away of your own emotions or classmates?

9. Do you think the overall classroom environment has improved or declined during the last unit?

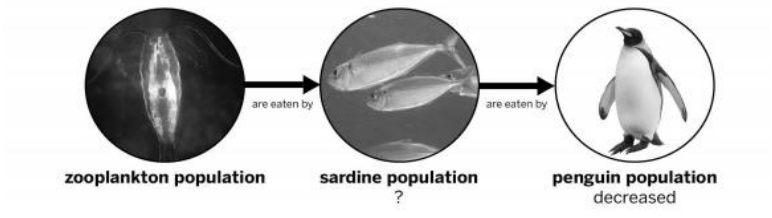
10. If yes to number 9: do you think the improved classroom environment had a positive impact on your academic performance?

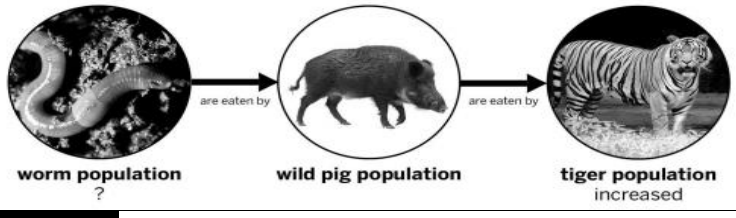
APPENDIX E

PRE-TREATMENT UNIT ASSESSMENT

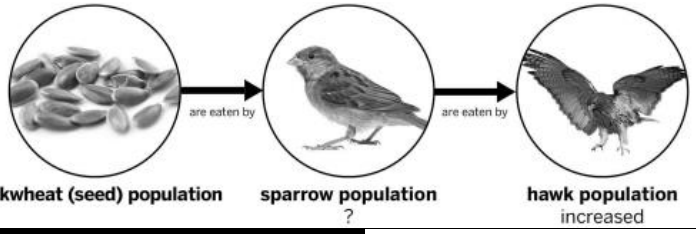
The content that was previously displayed in this section has been redacted due to publishing rights. We apologize for any inconvenience this may cause.

Populations & Resources End-of-Unit Assessment

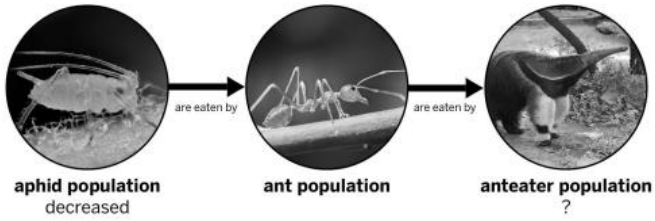



are eaten by
are eaten by
worm population
?
wild pig population
tiger population
increased

[redacted]

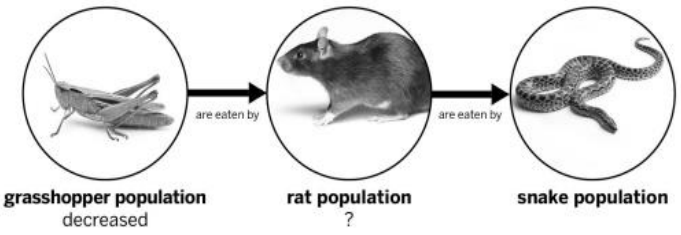


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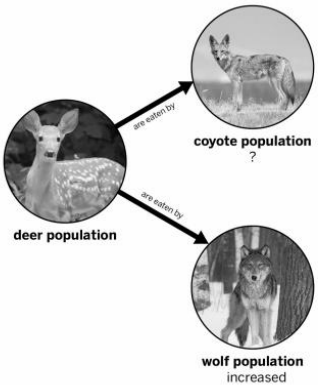


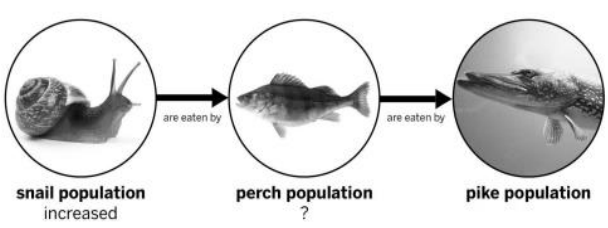
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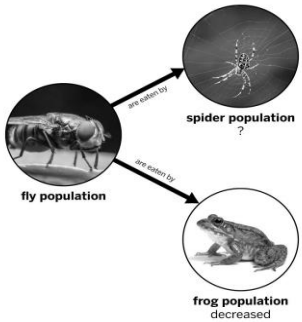


[redacted]


are eaten by
coyote population
?
deer population
are eaten by
wolf population
increased

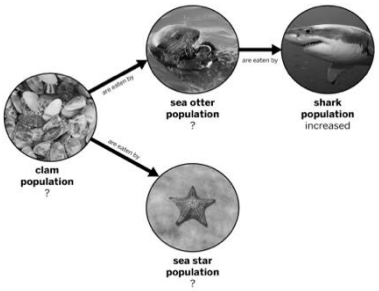


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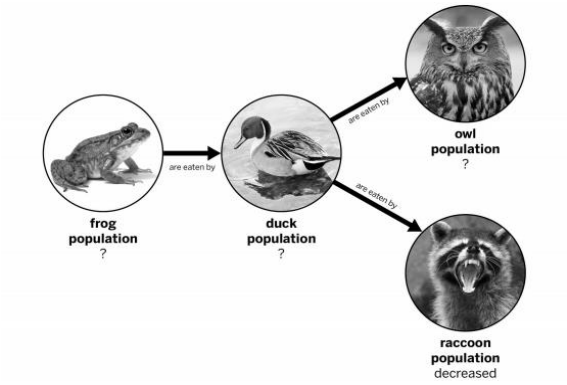
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APPENDIX F

TREATMENT UNIT ASSESSMENT

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Matter and Energy in Ecosystems End-of-Unit Assessment















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