

COMPETITIVELY ENGAGING FIFTH GRADE STUDENTS
WITH FORMATIVE ASSESSMENT

by

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A professional paper submitted in partial fulfillment
of the requirements for the degree

of

Master of Science

in

Science Education

MONTANA STATE UNIVERSITY
Bozeman, Montana

July 2023

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ACKNOWLEDGEMENTS

First, I would like to thank the MSSE staff for their guidance. Dr. Jessi Anderson has always been an amazing role model for how teachers everywhere can improve the world.

Secondly, I would like to thank the Dog and Duck staff in Kihei, HI, for always providing me with cheap drinks and meals while I swore at my computer while trying to figure out my physics and nutrition homework. Thank you to Laura, Mick, and Chris for providing me with the opportunity to DJ and host trivia; Thursday nights behind that booth paid my tuition for this master's degree. Working at the pub was always a welcomed break from teaching, coaching, and writing papers.

Thank you to everyone for coming in week after week to play our pub trivia at the Dog & Duck. You could have spent your Thursday evenings anywhere, and you chose to spend them with us. Your patronage and tips kept me employed and fed, and seeing your wonderful faces every week gave me something to look forward to. Thank you to Tito's Vodka for being our sponsor. Thank you to Gnasty Nat and the Dingbats for getting me outside every weekend. Finally, thank you, Mom and Dad, for being very swag 24/7.

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ABSTRACT

The purpose of this study was to determine how a population of students would respond if competition was introduced in the classroom. The use of competition to engage students and promote better learning is debated in the classroom. Some students find that its use is fun and novel, while others may respond with indifference, distress, or even anxiety. In this study, a low-stakes classroom competition was introduced in hopes of alleviating any pressure students might feel to perform well. During a unit on matter and energy, three classes of fifth-grade students completed daily bellwork questions. Average values for the two treatment groups ($N=47$) were calculated and shared so students could see which class achieved a higher average. This was repeated every day throughout the two-week unit. The control group ($N=22$) received the same lessons and bellwork problems, but they were not shown how their scores compared to the other classes. Data was collected using pre- and post-tests, Likert-surveys, and teacher-led group interviews. Pre- and post-test results indicated that there were no significant differences in normalized gains between the control group to the treatment groups. Likert-surveys provided students a chance to anonymously share how they felt about competing. The results, 93.1% ($n=40$) of surveyed students *agreed* or *strongly agreed* with the statement, “Competing with my class to score higher than the other classes makes me want to do better.” Finally, guided group interviews revealed that most students enjoyed competing with their classmates; even students that do not consider themselves competitive felt that the competition motivated them to try harder in class.

CHAPTER ONE

INTRODUCTION AND BACKGROUND

Context of the Study

This study aimed to determine how a population of students would respond if competition were introduced in the classroom. Competition is commonly used in workplace settings and sports to improve performance. Utility companies have even found that households are more likely to reduce power consumption when monthly statements compare users to anonymous neighbors with houses of similar sizes (NBER, 2010). Goegans and Daniels (2022) stated that the use of competition in the classroom to motivate students is highly debated. Many teachers fear that competition can cause students to shut down in the classroom and that cooperation might decrease between students (Clark, 2018). However, competition can be used in many ways in the classroom, and how it is implemented could hugely affect students' responses to it.

Every classroom of students is different. Populations of pupils will respond differently to various approaches to incorporating competition depending on their cultural upbringing, prior experiences, and attitudes toward academics. While one student might bounce out of their seat excitedly when a teacher mentions Jeopardy or Kahoot!, other students might roll their eyes or even experience anxiety and stress (Booker, 2016). Many competition-based programs or activities that teachers use emphasize the performance of an individual (Sadler et al., 2009). Only some students respond well to this type of academic stressor. Even if a student knows the content well, the thought of utilizing their knowledge in a timed setting might cause unnecessary stress,

causing them to underperform and create misconceptions about their capabilities in the classroom.

Personal Reasonings for Pursuing this Study

My affinity for competition in any setting is the driving factor behind this Action Research Project (ARP). As a student, I thrived in competitive settings. Whenever the teacher framed a formative or summative assessment as a game, my performance would improve tremendously. To this day, I constantly challenge personal friends and coworkers to competitions to improve my performance. I turn anything I can into a competition. Despite this inclination towards competition, I tend not to include competitions in my classrooms due to my fear of alienating the students that feel negatively about competition. A subconscious goal of mine has always been to reduce competition in the classroom wherever possible to promote and improve cooperation among students. A secondary goal of this research project is to discover how I can introduce something that I love into my instruction without alienating students who do not typically enjoy competition-based learning. If students compete together as a class rather than against one another, will students feel less stress?

School Background

This action research project introduced a competition to fifth-grade students at Wailuku Elementary School (WES) in Wailuku, Hawai'i. WES is a Title I school centrally located on the island of Maui that serves 643 students in grades pre-kindergarten through fifth grade. The school serves a racially diverse group of students, with 37% identifying as Native Hawaiian or Pacific Islander, 26% identifying as Hispanic, 21% identifying as two or more races, 3%

identifying as White, and <1% identifying as either Black or Native American. The school's neighborhood is considered economically disadvantaged compared to other surrounding areas, with 53% of the students in the student body eligible for free lunch and an additional 9% eligible for reduced lunch. While WES has experienced higher academic progress in the past few years, but test scores remain below the state average. For example, 46% of fifth-graders tested proficient in English, and 34% tested proficient in Math, compared to the state averages of 57% and 44%, respectively. The administration stated that the school had seen more progress in recovering lost learning from the COVID-19 school closures than other nearby schools have seen and are hopeful that student progress will continue to grow and improve. Administrators at the nearby middle school have even stated that the lockdowns and school closures have created an excellent opportunity to reset the school cultures and claim that student behavior at school has only improved since schools reopened.

This was my fifth year of teaching in a classroom setting, my fourth year teaching in Hawai'i, and my first year teaching in an elementary school. This year was unique because I went into this grade five classroom at the start of the second semester after working as a long-term physical education substitute teacher at a nearby secondary school. Unfortunately, the classroom's teacher left early at the start of the term, so the students had been without a permanent teacher in their classroom for most of the year. The principal stated that there were two substitutes that the school has been able to rely on, but the students needed stability.

Besides running summer science camps at an observatory and coaching youth sports, my experience with elementary-aged students is minimal. The demographics of WES are like the demographics of the public school on Maui that I have previously taught at. The noticeable

difference between the two schools is that my previous school had a high percentage of Filipino students, whereas this school serves more Hawaiian and Pacific Islander populations. This school also has a higher student population that qualifies for free and reduced lunch. Anecdotally, teachers, school staff from around the island, and students from the surrounding area state that kids at this school can be more challenging to work with than what I have become accustomed to, but that the kids are very loving, and many improvements in student behavior have been made. With that, the principal is supportive of innovation and is excited to see what I can provide to prepare students for middle school. With student achievement improving and the students excited to have a permanent and experienced teacher in the classroom, this was the perfect setting for this ARP.

Focus Question

My focus question was, How does pushing individual classes of students to compete with other classes on daily science assessments affect students' attitudes towards learning and their academic performance in a unit on matter and energy?

CHAPTER TWO

CONCEPTUAL FRAMEWORK

Competition in the Classroom

Competition has been used in classrooms for many purposes. Children enjoy learning environments where they can use, practice, and display their capabilities (Pesout & Nietfield, 2021). Students thrive when their accomplishments are recognized and celebrated. Many teachers find that framing classroom assessments and activities as games helps improve student participation and retention (Goegan & Daniels, 2022). Researchers have found that using Game-Based Learning (GBL) during instruction can improve student retention compared to classrooms that do not utilize this method of instruction (Sitzmann, 2011). Turning classroom assessments, whether formative or summative, into competitions can also help students take more ownership of their learning. Researchers have found that many students enjoy competitive assessments, games, or activities. Every student and every classroom is different; there are numerous ways teachers can implement competition in the classroom. With every form of implementation, there will be varied responses.

Not all students respond well when competing with classmates (Canning et al., 2020). When a cohort of students is highly variable in abilities, students who underperform on assessments might become turned off and feel alienated. Cooperative learning and adaptive competition can be utilized to improve the performance of students that experience anxiety in high-stress settings (Hwang & Arbaugh, 2009). Cooperation and competition might be antonymous, but there are ways educators can weave both together to create an environment

where students must work together to outcompete other groups of students (Pesout & Nietfeld, 2021). Incorporating the concepts of cooperation and competition into the classroom can lead to positive learning outcomes, reduce the stress felt by students, improve classroom relationships, and promote problem-solving behavior (Slavin, 1999). Formative assessments used in the classroom can be framed so that students compete against outside groups rather than each other. However, while framing formative assessments as competitions in the classroom has taken place for a long time, there are many arguments that it can cause anxiety and underperformance in otherwise high-achieving students.

Formative Assessment in the Classroom

Formative assessment is integral to the learning process. Teachers use formative assessments daily to check for student learning (Bailey & Jakicic, 2012). Reeves (2009) defines true formative assessments as activities that provide feedback to students and teachers. DuFour, Eaker, and Karhenek (2010) add that formative assessment needs to identify which students need help understanding content. Teachers need to provide additional time and opportunities for those students to acquire what learning outcomes are expected of them. While formative assessments provide teachers with important information on how students perform in class, their use can also provide students with the information needed to monitor their own learning (Bell, 2002). Proper use of formative assessments in the classroom can have a lasting impact on a child's learning.

With proper use of formative assessments, teachers can identify which students need additional time and help and which teaching methods are successful in their setting. Students gain much-needed feedback, which they can use to improve their understanding of content. Much can be gained with the use and analysis of formative assessments in the classroom, and

teachers can adjust how assessments are designed to gain different responses from students (Carnegie, 2015). Bell (2002) stated that the assessment must match the views of the learning, meaning that teachers need to acknowledge that the learners have to construct understandings for themselves. The learners come to class with varying prior knowledge, attitudes, and ways of thinking. Teachers can create and deliver formative assessments that elicit student engagement, provide quick and thoughtful feedback to individuals, and build secondary skills that students require to succeed (Greenstein, 2010).

Competition and Students

Competition is common in many classrooms. Researchers argue about the benefits and drawbacks of its implementation in schools. While many students respond positively to its use, some might feel anxious or uncomfortable competing against their friends or classmates. To make its use a more effective learning tool in the classroom, competitions can be altered or adapted to meet the needs and wants of individual students in a group. Competition can be used to help relieve stress, promote teamwork amongst classmates, and build persistence and other skills important for a person's growth and well-being.

Competition

Educators have explored various methods of assessment. Using competition as a motivator in the classroom is not new. For decades, Jeopardy and Trivial Pursuit style review games have been staples in American classrooms. As technology improves and more schools acquire computers or computer-like personal devices for their students, competitive-style assessment games like Kahoot! and Quizizz have grown in popularity. Their use by teachers to

engage students and acquire needed data about student understanding has only increased since the COVID-19-driven school closures. Many teachers view competition as necessary in the classroom, while others may use it in their formative assessments without realizing it (Licorish et al., 2018). While competition has been used as a motivator for students for some time, there are conflicting opinions on its effectiveness in learning.

Benefits of Competition

Educators have explored various assessment methods, including using competition connected to assessment as a form of motivation. Nebel et al. (2016) also say that competition increases enjoyment and can impact intrinsic motivation, attention, excitement, and participant involvement. It can also foster attention, persistence, and academic motivation. Devonshire et al. (2014) found that introducing risk-based competitive games into the classroom heightened motivation and led to greater recall abilities for students. In a study conducted in New Zealand, students were interviewed about their perceptions of Kahoot! use in the classroom. In response to Licorish et al.'s (2014) study, students responded that Kahoot! motivated them to pay attention during lectures. The researchers also found that students were more likely to examine the lecture material with more focus. Students also explained that the competitive game felt like a much-needed break in class and reported feelings of joy and excitement when they played it. In this event, students found delight in playing games in class because it allowed them to unwind and relax and gave them a reason to pay better attention during the lectures (Licorish et al., 2014). This strategy can be applied in other educational settings.

Beyond learning content, games and competition can benefit students in several ways, although it is important to remember that not all learners share the same feelings and opinions.

One study by Nemerow (1996) found that events tied to happiness are remembered longer. Many students in the New Zealand study felt the game also worked as an icebreaker and helped them to interact with their classmates. Colonnello (2011) found that games and competitions used in classrooms help students relate to their peers and can help students develop skills for coping with high levels of stress. Some students in the New Zealand study said that the discussions that resulted from the game's use were where their most valuable learning occurred. Although most students in the study felt optimistic about competition and Kahoot! in their class, some students felt it took away from their learning and became a distraction (Colonnello, 2011). These responses are a reminder that not all students learn the same way, and outcomes for different assessments will vary depending on who is participating.

Arguments Against Competition

While social learning benefits students of all ages, there are arguments against using competition in the classroom. Goegan and Daniels (2022) explained that avoiding competition and social comparison practices is one of the most common recommendations from researchers. They go on to explain that competition focuses on performance rather than learning (Goegan & Daniels, 2022). Many researchers have found that classroom competition negatively impacts students' confidence, learning, and well-being. Students who are not accustomed to competition are more likely to experience anxiety and distress (Canning et al., 2019). These arguments state that it is essential that teachers move away from competition and that it is not beneficial to students. With how common competition is outside school, researchers suggest that it is good to have a place away from that (Canning et al., 2019). Some educators wonder if competition needs to be removed from the classroom because some students respond negatively in a number of

ways (Canning et al., 2019). The arguments for and against the use of competition in the classroom are growing louder, and researchers are doing more to study students' responses to its use.

Cooperative Learning and Adaptive Competition

The varying opinions and findings about the use of competition in the classroom as a motivator for academic achievement have led educators to find ways to improve how competition can be used to promote learning and engagement in school. The use of adaptive competition is a method that has shown positive outcomes. Adaptive competition is where competitors are evenly matched (Jagušt et al., 2018). Many schools in the USA have mixed-ability populations of students (Greenstein, 2010). With this, it can be more challenging to group students to compete based on their abilities. One way around this is to focus on cooperative learning. In cooperative learning, students work together to answer questions and solve problems (Hendrix, 1996). Cooperative learning emphasizes the importance of group goals and holds individuals accountable. It also positively impacts students' metacognitive development (Pesout & Neitfield, 2021). Johnson and Johnson (1989) added that working toward the same goal promotes students' desire to help each other to do better and contribute to a team. Students on teams with a goal are more likely to cooperate and help each other improve, succeed, and grow (Johnson & Johnson, 1989). Using adaptive competition and cooperative learning, students can be grouped. In these groups, students can work towards accomplishing a goal while competing with other groups (Jagušt et al., 2018).

The data suggests that students will respond positively to a team competition because it is a social learning event. Students who typically suffer from anxiety and stress might not be

pressured to outperform their immediate classmates. Instead, they will contribute to their team's success or failure. In addition, knowing that a formative assessment, similar to a Kahoot!, is coming and that their performance on that assessment will impact their team's standing could engage students to better focus on the materials and is connected to the goals of this study. Research needs to be conducted to find how students placed in large teams with a shared goal while competing with other similarly skilled and sized teams can impact student learning.

CHAPTER THREE

METHODOLOGY

Introduction and Demographics

This study aimed to see how students reacted to being in a competitive environment and if the use of competition motivated them to retain the knowledge from the unit better. The research methodology for this project received an exemption from Montana State University's Institutional Review Board, and compliance for working with human subjects was maintained (Appendix A). Three classes were utilized in this study. The study included my class and the two classes closest in size and academic performance. Grades, demographics, and teacher input determined which classes participated in the study.

Treatment

For this study, separate classes of students enrolled in fifth grade at Wailuku Elementary School competed with one another to have the highest average scores on daily formative assessments during their unit on mass and energy. Students in different classes completed a formative assessment in the form of daily bell work at the start of each science lesson. Every day's bell work was assigned to students as a Google Form, and the questions were formatted as multiple-choice or fill-in-the-blank questions. The problems focused on the content covered in previous lessons from the unit. Upon completing their bell work, individual students immediately saw their scores for that day's assessment. No student's score was made public and viewable for the rest of the class. The bell-work scores from each class were averaged by finding the mean

after all periods had completed that day's lesson. According to Mertler (2020), the mean is the most used measure of central tendency. While some students occasionally produced outlier scores that affected classroom data, I wanted every student to be included in their class's daily score. The mean scores from each period were formatted on an easy-to-read bar graph displayed at the start of the following class for students to see. The bar graph showed which class period had the highest average score, the second highest, and which scored the lowest on the previous day's assessment.

Data Collection Instruments

This study aimed to find if pushing individual classes of students to compete for the highest average score on daily formative assessments would affect students' attitudes toward learning and their academic performance in a unit on matter and energy. Different instruments were created for this study to collect qualitative and quantitative data. A unit pre-test was given at the start of the science unit, and a post-test was given at the end of the unit to measure student academic gains. The pre- and post-tests were made of the same question sets and used the same Google Forms formatting. The differences in scores between the two assessments helped determine if the treatment groups saw more gains than the control groups. Likert-scale surveys were administered daily as exit tickets on Google Forms to gather quantitative data about student feelings towards the treatment. Finally, group interviews occurred at the end of the unit to gather student quotes and feedback about the treatment. Analysis of the qualitative and quantitative data sets helped determine the treatment's effects on student learning and performance.

Class Groupings

To reduce the stress that individual students might feel and to improve cooperation in the classroom, students were grouped by class to form teams and competed against other classes of similar students. With students grouped in teams, individuals were held accountable to perform better on assessments to positively affect their class's overall standing.

Two fifth-grade classes received the treatment to see how students responded to team competition in the classroom, while one acted as a control group. The Unit Pre-Test helped determine which classes would participate and which class would serve as the control (Appendix B). The selection of participating classes was based on class size, average overall grades, and performance on the pre-assessment. Each class's pre-assessment scores were averaged using the mean. Then, mean scores for the pre-assessments of each class were compared to the means of the post-assessment after completion of the unit to determine which groups saw the most overall growth.

All classes received the same assessments and lessons through the unit, but the treated groups were pushed to compete with other treated groups. Students in every class participated in daily formative assessments. These assessments featured three or four questions at the start of every class. The questions were formatted as multiple-choice or fill-in-the-blank and assigned to students in Google Forms. Google Forms automatically collects and scores student work, making daily data analysis a painless effort. Students received their scores when they submitted their work. At no point were individual scores made public for other students to see. Instead, the mean for each class was found at the end of the day, and a slide showing how each participating class averaged compared to the other classes was displayed at the start of each class. This was to show students how they did as a group and which class "won" during the previous day. By showing

the standings of the different classes and knowing their scores, students could tell how they contributed to their class scores.

Data Collection and Analysis Strategies

Data Collection Methods

Many teachers utilize competitive games, such as Kahoot! and Quizziz, in classrooms and during unit reviews (Munuyandi et al., 2021). The goal of this project was to see how students responded to competitive elements in the classroom, how grouping students together as teams for the competition affected their attitudes and academic achievement, and if students saw any substantial academic gains when put in an academic setting. Throughout the unit, data were collected using various instruments explicitly designed for the study. Because this research aims to compare results from multiple groups exposed to different conditions, a group-comparison design was used. In addition, because true experimental research is challenging to implement in classroom settings, a quasi-experimental design was utilized. A quasi-experimental design was effective in this setting since it is not feasible to randomly assign students to different treatments because the tested variable will be applied to whole classes (Johnson, 2008). Table 1 shows the instruments used to gather data to answer the focus question.

Table 1. Data Triangulation Matrix.

	Focus Questions
Data Collection Instruments	How does pushing individual classes of students to compete with other classes on daily science assessments affect students' attitudes towards learning and their academic performance in a unit on matter and energy?
Unit Pre-test and Post-test	x
Student Perception Survey	x
Student Group Interviews	x

Unit Pre-Test and Post-Test. A Unit Pre- and Post-Test was created to assess what content students knew prior to the matter and energy unit, and the knowledge they gained after the implementation of the unit (Appendix B). An initial unit pre-test was administered to gain a baseline for each student within the different fifth-grade classes. Two of these classes received treatment, and one acted as a control. The mean score for these pre-tests was found for each period during analysis. The averaged class scores were used to determine which groups received the treatment and which was the control group. A post-test was administered at the end of the unit to detect academic gains made between the different classes throughout the unit. The mean of the students' post-test scores was measured against their pre-test scores.

Student Perception Survey. Students in the treatment group completed two Likert-scale surveys during the unit on matter and energy to share their thoughts and perceptions on the unit and the treatment (Appendix C). The control group did not participate in the surveys since the questions focused mainly on the practices given to the treatment group. One was given at the end of the first week, and another was given at the end of the second week after the conclusion of the unit. The surveys were identical. The Student Perception Survey questions were created with

Google Forms, and students located them daily in their Google Classroom. The three declarative statements that the students responded to for the survey were:

1. I feel confident that I am learning the content from this unit.
2. Competing with my class to score higher than the other classes makes me want to do better in this unit.
3. I enjoy competing to have a better score than other classmates on our daily bell work.

The Student Perception Survey provided students with four options ranging from *Strongly Disagree* to *Strongly Agree*. Students were not given a *neutral* option; this forced students to think about their responses before submission (Mertler, 2020). Students' interpretation of the neutral midpoint may vary, so leaving that point out reduced any chance of confusion (Gracyalny, 2017). Leaving out a neutral option seems to be the best method for this group of students due to their age and some of their indifferent attitudes toward schoolwork.

The Student Perception Surveys provided important data, which was used to understand how each student felt about the unit's content and the competitive aspect of the study. The Likert-scale surveys worked as a quick way to gather data from the class (Gracyalny, 2017). The questions being asked for this survey were focused on student feelings and perceptions rather than content-based questions. Because of this, a rating scale was appropriate. Mertler (2020) states that rating scales "can be used very effectively to measure students' attitudes, perceptions, or behaviors" (p. 146). The Student Perception Surveys asked students to explain why they selected their responses with a space for a short answer. The quotations collected from this provided important qualitative data and allowed students to elaborate on their responses. The

data collected from the surveys was vital in helping to determine student attitudes toward the study.

Student Group Interviews. Student interviews were conducted at the end of the unit (Appendix C). Three interviews took place with various groups of students, all recorded and transcribed. Four students were invited to participate in each interview, meaning that eight students from each treatment class were interviewed, and 12 students were interviewed overall. The interviews were managed in a semi-structured format, with the teacher taking an active role in the answering process to help students structure their answers. According to a statement made by Slayton (2018) in an instructional video, “The purpose of an interview is to gain an insight into someone’s perspective.” Allowing for an open conversation, directed by the teacher in a semi-structured way, provided students time and space to think about their responses (Slayton, 2018).

Each interview began with the same four questions. Students were asked: (a) How do you feel about the content from this unit? (b) Do you consider yourself a competitive individual? (c) Did competing with other classes as a team affect your attitude in any way? (d) Did seeing data from your class and other classes influence your effort in class in any way? Additional questions were asked in a less structured format as students responded. This was done to gain clarification or to push the interviewees to think more about their responses. Pilot mock interviews took place prior to the actual interviews. The pilot interviews provided practice for structuring the interviews and helped me craft appropriate follow-up questions (Mikuska, 2016). These interviews were not connected to content from the action research project. Instead, an interview

guide was utilized to help gather information and keep the conversations on the topic (Mertler, 2020).

Analysis Strategies

A mixed-methods design was used for this research project, as both qualitative and quantitative data sets were used. The qualitative and quantitative data sets were vital in determining the impact of this research project on the students. As Mertler (2020) said, “quantitative data provide information that can be analyzed statistically,” while qualitative data “provide opportunities for individuals to express their own opinions and perspectives...” (p. 106). Analyzing both types of data provide a better understanding of how the students responded and felt about the project. Therefore, a triangulation mixed-method design, in which both the qualitative and quantitative data were collected at the same time and given equal emphasis, was utilized in this study.

Unit Pre-Test and Post-Test. The class periods receiving the treatment were averaged together against the combined scores of the control class periods with a simple independent-measures *t*-test. The Pre-Test and Post-Test and Student Perception Surveys provided sizable quantitative data sets. The Pre-Test and Post-Test provided a measure of the central tendency, which was used to determine how each of the participating classes performed as a whole. To ensure every student was included in this data, the mean for both the Pre-Test and Post-Test in each class was used to determine any substantial academic gains seen in the treatment groups.

The Pre-Test and Post-Test provided data to answer the study’s focus question. Students should have experienced growth throughout the unit, whether they received the treatment or were in the control group. Therefore, the differences in scores between the control and the treatment

groups' Pre-Test and Post-Test were analyzed to see any substantial differences in students' performance. Bamberger and Mabry (2023) say that any significant difference in the post-test scores between the control and treatment groups could be considered evidence that the treatment potentially had an effect. Suppose there were significant differences between the average scores of the treatment group when compared to the control groups, whether positive or negative. In that case, it is possible that the competitive aspects of the formal assessments impacted the students' focus and desire to learn in class.

Student Perception Surveys. The Student Perception Surveys for each class were treated as an ordinal data set, with the median response for each question used to find the central tendency. In addition, trends in student responses were analyzed and compared with qualitative data collected during the group interviews to determine how students felt about the project.

Student Interview. The Student Interviews provided large amounts of data that needed to be organized and reduced. The copious amounts of collected data quickly became overwhelming, so proper inductive analysis was needed. Mertler (2020) says that inductive analysis reduces the volume of information collected by organizing the data into essential patterns and themes. From there, key findings from the action research can be found for presentation. I used a coding scheme to organize the data from interview transcripts. This process, referred to as thematic analysis, was time-consuming since the transcription of interviews took a great deal of time and energy (Guest et al., 2012). After transcription, categories were created from the patterns and themes in the data, and data sets were assigned codes.

Coding took much practice, and the interviews provided valuable data and plenty of unnecessary data. To add to the objectivity of the thematic analysis and coding process, other

educators in the school district were asked to read through the coded data. The analysis provided data compared to the information found with the Likert-scale surveys. The Likert-scale and the interviews revealed important information about student attitudes toward learning during and throughout the treatment.

CHAPTER FOUR

DATA ANALYSIS

Impact of Competition on Post-Test Performance

The unit pre and post-test results showed significant growth in content knowledge for all the classes that participated ($N=57$), although no major differences were present between the scores of the treatment and control groups. The treatment group's ($n=35$) mean score on the pre-test was 27%, while the post-test average score was 47%. The control group saw similar scores, with a mean of 29% on the pre-test and 50% on the post-test (Figure 1). The treatment group ($n=35$) saw a mean normalized gain of 0.21, while the control group ($n=22$) saw a mean normalized gain of 0.28. The difference of 0.07 indicates that the treatment did not have any major effect on the students' performances on the summative assessment at the end of the unit.

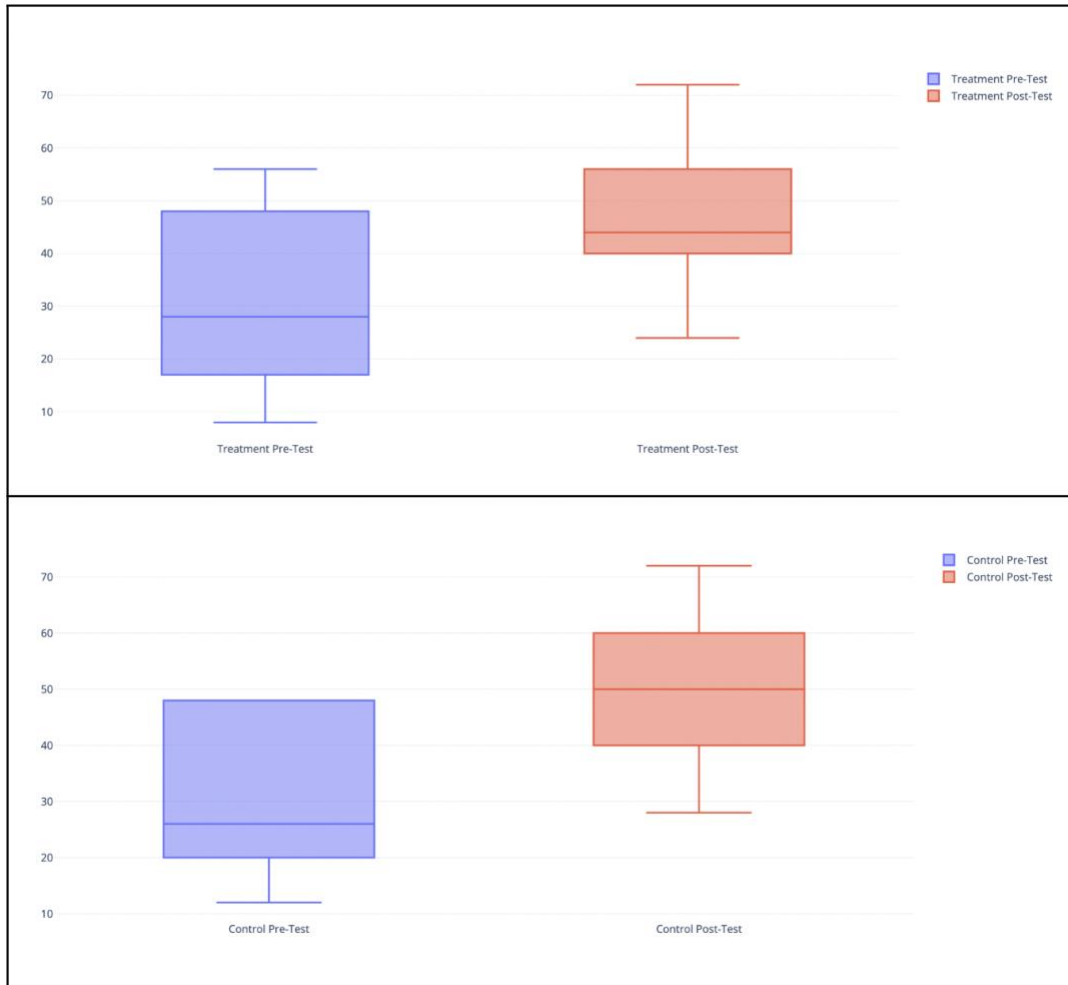


Figure 1. Pre- and Post-Test data for the treatment group ($n=35$) and control group ($n=22$).

Many factors, including changes in classroom leadership, absences, the timing of the unit, and planning logistics, affected students' performance on the summative assessment. First, one of the classes of students in the treatment group did not have a permanent teacher for the year's first half. This group had missed out on half a year's worth of learning notetaking, test-taking, and study skills. That class had a reputation at the school for having many behavior issues and had even driven a few substitutes to not return to the school at all. Their behavior during the unit compared to the other participating classes was challenging. However, that class did not have

any official IEP or 504 students, while the other classes did. The treatment group and the control group did not receive the unit at the same time. The treatment group was taught the unit in the two weeks leading up to spring break, with the post-assessment taking place just before their dismissal for the break, while the control group received the unit after their spring break. This also meant that the control group was receiving lessons that had already been taught with improvements made by the teacher in the instruction and timing.

Coordinating, planning, and executing the unit with the cooperating teachers posed challenges too. A major hurdle arose when two of the teachers that had agreed to participate were placed on administrative leave, and a revolving door of substitute teachers was put in their place. The lack of stability meant that these classes were no longer available to participate, and other teachers had to be convinced to share their class time. This would be less of an issue in the secondary setting where one teacher likely has more available class periods of their own to work with. Time constraints, communication, and other factors negatively affected the implementation of the unit. During the unit, a letter was found at the school containing threats of violence against classmates. Some parents opted to keep their students home the day after they were notified about the letter. When the summative assessment was administered in the other classroom of the treatment group, eight students were missing. This was not made known to me until after the school day had ended, and because it was the day before spring break, conducting make-up tests within an appropriate timeframe was not possible. The pre-test data from those students had to be removed from the data set. The teacher of the control group was more liberal with the amount of time allotted for lesson implementations. While efforts were made to keep lesson times like those given to the treatment group, lessons would often go over time.

Positive Impacts of Competition on Students' Mood and Effort

Data points and quotes from the Student Perception Surveys and the Group Student Interviews showed that students mostly had positive feelings toward the intervention. Likert-scale data from the Student Perception Surveys showed that most students in the treatment group felt that they were learning from the unit, felt that the use of competition throughout the unit motivated them to do better in class, and shared that they enjoyed competing against the other class. In response to the prompt, “I feel confident that I am learning content from this unit,” 17 of the responders selected *agree*, while 22 of the responders selected *strongly agree*. Only four of the 43 surveyed selected *disagree*, while none of the students selected *strongly disagree*. Responses to this prompt were similar the second time the survey was given, with two fewer students selecting *Strongly Agree* and one student selecting *Strongly Disagree* (Figure 2).

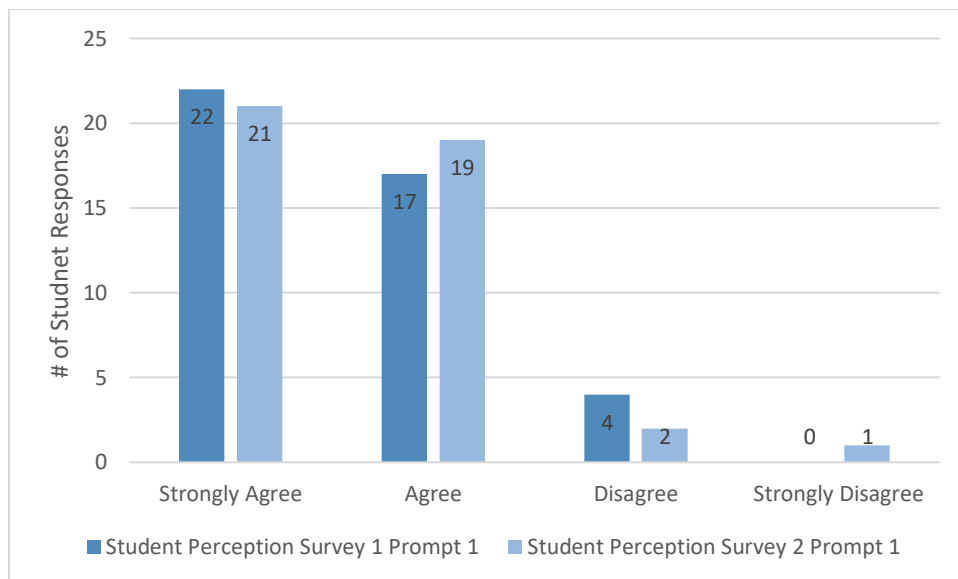


Figure 2. Student responses to Prompt 1 of the Likert-Scale Surveys, “I feel confident that I am learning content from this unit,” (N=43).

Responses to the second prompt, “Competing with my class to score higher than the other classes makes me want to do better in class,” were also positive. Upon taking the first survey, 27 of the respondents selected *strongly agree*, and 13 selected *agree*. Only three selected *disagree*, and no students selected *strongly disagree*. Results of the second survey were similar, with 22 of the students selecting *strongly agree*, 17 selecting *agree*, four selecting disagree, and one of the respondents selecting *strongly disagree* (Figure 3).

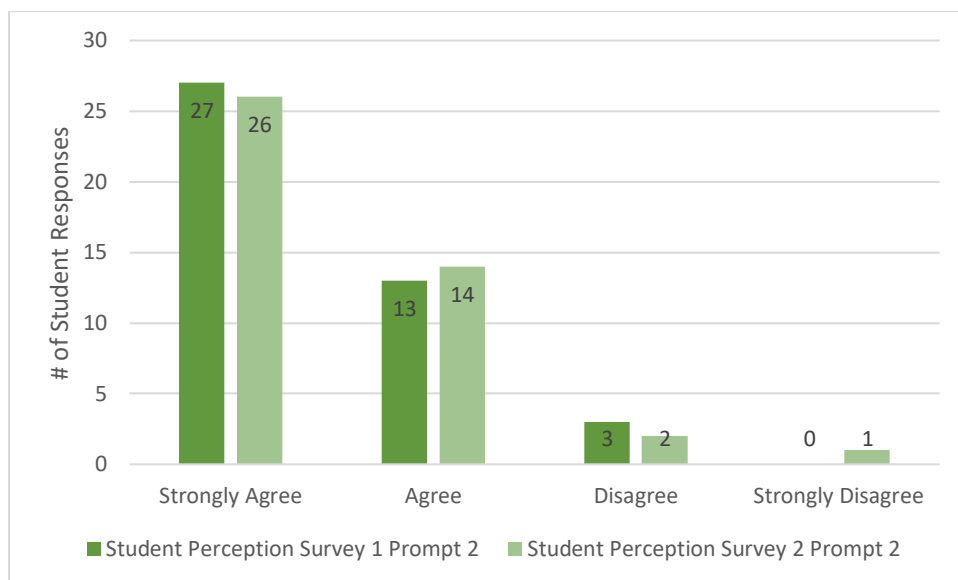


Figure 3. Student responses to Prompt 2 of the Likert-Scale Surveys, “Competing with my class to score higher than the other class makes me want to do better in this class,” ($N=43$).

At the end of the Student Perception Surveys, students could share why they selected their responses. The quotes from these responses provided more insight into student attitudes toward the use of competition in the class. When asked to explain why students selected their answers, they responded with positive, negative, and neutral answers. Student quotes from the surveys will be written in this research project exactly as they were written by the students. One student responded, “I chose these ratings because I enjoy competition and I feel like I’ve learned new things.” Another student responded, “I love competing with Mr. Lopez’s class and it makes

me want to do better.” Quotes like these, when paired with the Likert-scale data from the Student Perception Survey, helped show that many of the students enjoyed competing and found it helpful in motivating them to focus during class. Of the 49 quotes collected, 38 indicated positive feelings about the use of competition in the classroom. Many shared that they wanted to win, that they just enjoyed science, or that the subject matter was interesting, which pushed them to try harder on the bellwork assessments. Overall, most students shared positive and constructive thoughts. Quotations from students such as, “It helped me learn...” and “Because i love science now” help show that the intervention resulted in students feeling positively towards the subject matter and competing.

The Student Group Interviews helped further reveal how students felt about the unit on matter and energy and how they felt about the use of competition in the classroom. The first question, “How did you feel about the content from this unit?” gave students a chance to share what they felt about the content. Responses varied from “It was interesting because I like learning about certain stuff. I like science,” to “I felt some parts were interesting and some parts were a little dull,” to “I don’t like science.” Most interviewed students shared that they enjoyed the unit and had positive things to say. The second question allowed students to share whether or not they considered themselves competitive or not. In the first group of four students, three considered themselves not to be competitive, while one shared that she felt extremely competitive. The second and third groups of interviewed students were both split evenly, with two in each group considering themselves to be competitive and two in each group considering themselves to be the opposite.

For the third question of the interview, students were asked, “Did competing with your class as a team against the other class affect your attitude in any way?” This question resulted in a variety of responses. Some students stated that competing made them try harder. Some stated that they felt they put in the same level of effort that they typically would, and some explicitly felt that it did not impact them in any way because they knew their class was going to lose. One student said it did not impact them because they knew they “were going to lose.” After making that statement, the student was reminded that their team ended up winning half of the days in the unit. The student went on to respond, “I would try more, like, after we won and stuff, but that’s when I actually tried to, like, do it better.” A different student stated that winning made them want to try harder, while another said that losing made them want to try harder. Some students even shared that competing against another class made them want to learn more. One student stated, “It changes my attitude because I know that I’m versing another class, so it... makes me do good.” Just the thought of competing against another person or group motivated some students.

Negative Reactions to Competition in the Classroom

Data from the Student Group Interviews and the Likert-Scale Surveys also revealed negative attitudes that a few students felt about the unit and the intervention. Of the three questions asked of the students in the Student Perception Survey, the third prompt had the most negative responses. The prompt “I enjoy competing to have a better score than other classmates on our daily bellworks” had the highest number of students selecting *disagree* (eight students) and *strongly disagree* (one student) when asked the second time (Figure 4). This is an increase of three students selecting *disagree* when compared to the first round of questioning. The open

responses of the Student Perception Surveys helped show why students selected the *disagree* and *strongly disagree* options for this prompt. Between the two Likert-scale surveys, only 11 quotes shared negative or indifferent feelings toward the unit and the use of competition as a motivator. Some students shared that they enjoyed learning content but that they are not competitive people. One student said, “I felt like I’ve learned a lot [but] I am not a competitive person.” Another shared, “its all right learning it’s just i don’t want to do the competition part :))))).” Other students shared that they just do not enjoy science, do not like competing, or felt the unit was enjoyable but rushed.

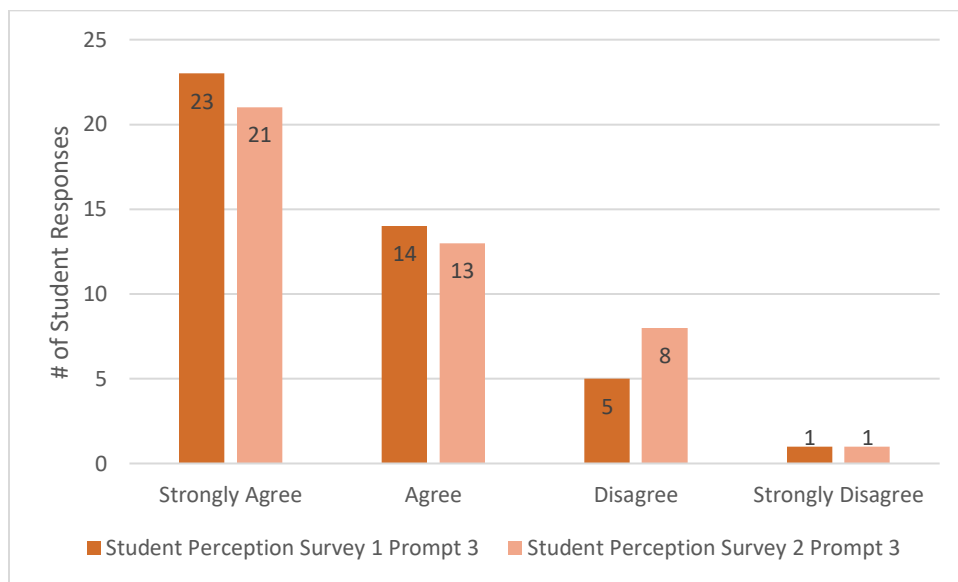


Figure 3. Student responses to Prompt 3 of the Likert-Scale Surveys, “I enjoy competing to have a better score than other classmates on our daily bellworks,” ($N=43$).

Some students shared more neutral responses, with some sharing that they enjoyed or learned from the unit but did not like competing. Some said that they enjoyed the competition, but they are not particularly interested in science. Some students felt that the results of their class’s score affected their mood in the lesson too. One student shared “I really like to compete but then i also don’t like to because if i get a lot wrong it makes me feel sad.” Another shared “I

LIKE COMPETING BUT I SOMETIMES IT FEELS UNFAIR.” Still, some students felt that they did not enjoy the competition but enjoyed the learning. One student shared, “I don’t like competing, but i also like to do my best.”

Some of the responses from students during the Student Group Interviews provided more information on why some students had negative feelings about the intervention. One student stated that she did not try because she felt that her class was going to lose anyway. One interviewed student did not find science interesting at all, so she felt no interest in competing. One student shared that they enjoyed competing at first but then found it to be a bit annoying sometimes. One student felt that their score did not significantly impact their class’s standing, so it did not matter what score they received. Thoughts like these add weight to Goegan’s and Daniels’ (2022) claim that competition can cause students to focus more on performance rather than on learning content.

Other Findings

To wrap up the interviews, students were asked if there were any changes they would make if they were in charge of the competition and if they had any final thoughts to share. Students were quick to share that prizes and the inclusion of more classes would make things more exciting. Some shared that students in the control group felt left out, and they wanted to compete against their friends too. One student shared that they felt the use of competition made the unit more memorable.

CHAPTER FIVE

CLAIMS, EVIDENCE, AND REASONING

Claims From the Study

Three major claims can be made from the findings of this study: (a) competing with your classmates in a team competition mostly increases engagement and effort in class; (b) most students find enjoyment in competing with their classmates in school, and (c) competition is not for every student and some might benefit from being able to opt-out. Further studies are needed to find how the use of competition affects student performance on a post-assessment. Data collected during the action research project and findings of other researchers support these claims. The findings are also beneficial to me as an educator.

Team Competition and Participation

Data points and quotations collected from the Likert-Scale Surveys indicated that student engagement and effort increased during the unit on matter and energy because of the class-wide competition. In the Likert-Scale Surveys, students indicated that competing with their classmates made them want to do better in class, and they felt that they were learning from the unit. Post-test data shows growth in content comprehension in both competing classes. Group student interviews revealed that even students that felt indifferent towards competing felt compelled to try better and harder during the lessons.

Value of the Research and Consideration for Future Research. Many studies have found that a student's focus and effort in class increase when competition is used as an instructional

tool (Licorish et al., 2014). Nebel et al. (2015) found that competition can positively impact student persistence and academic motivation. These themes were present during this action research project.

Throughout the implementation of the unit, students in the treatment group were eager to find out how their class compared to the opposing group. Anecdotally, students in both competing classes would ask if they could see the results of the prior day's formative assessment as soon as they walked in the door in the morning. The teacher from the opposing class often shared her students' excitement or frustration after she revealed that they had won or lost the prior day's formative assessment. Students were also able to see how their average results improved throughout the unit. While one class scored higher and won on the first three assessments, the other class could see their scores increasing, and their excitement improved as they began to catch up to the opposing team. Even students who said they did not see themselves as competitive said they wanted to do better because they did not want to lower their class's score. In teaching, any improvement in student engagement is beneficial.

Beyond student engagement, teacher engagement and collaboration increased as well. This improved morale in our grade level, which was much needed, with two of our grade-level teachers being placed on administrative leave for reasons that were never made clear to us. The use of competition in this school's fifth grade was beneficial. Students were engaged. Collaboration between teachers in the grade level improved, and students in other classes got a chance to know the other grade-level teachers better. Improvements in teacher collaboration can have lasting impacts on the students' classroom experiences.

Competition will be utilized in my classroom in the future. Depending on classroom makeup and setting, tweaks will be made to its implementation. While implementing competition in the elementary school setting had many benefits, coordinating with other teachers and other logistics made conducting research challenging. In the elementary setting, this practice would need to take place in a unit where all participating teachers are familiar with the unit's content and lessons. In the secondary setting, where one teacher teaches multiple periods of the same class, the teacher would have more control and fewer variables to account for, making implementation less time-consuming and stressful.

Enjoyment

Educators strive to increase feelings of enjoyment and happiness in the classroom wherever possible to help students associate positive feelings and attitudes with their schooling. Most students in the treatment group indicated that they enjoyed competing with their classmates in the Likert-Scale Surveys and Student Group Interviews. Students saying statements like, "... I enjoy competing with Mr. Lopez class and it makes me want to do better," and "... I hope we can keep doing it because it's very fun and I hope Mr. Lopez won't stop it until we leave this school grade." It is clear that feelings of enjoyment had increased in the classroom. Student quotes such as "Science is fun and even more when competing with the other classes" and "Competing is fun. It made it more memorable" show that the treatment helped students associate feelings of joy and happiness with the unit. This was especially reassuring to hear when one of the classes in the treatment group lacked a permanent teacher during the first semester of this year and did not have the most positive experience.

Value of the Research and Consideration for Future Research. Researchers have found that positive feelings, such as happiness and amusement, can have lasting impacts on a student's learning abilities (Nemerow, 1996). These positive feelings can lead students to unwind and relax and remember what they have learned longer (Licorish et al., 2014). Competition can also foster student collaboration and help students relate better to one another, which is a vital social and emotional learning skill that students should build throughout their time in school. This semester, finding ways to increase positive feelings in this grade level was very important. The students in this grade level had to endure three years of COVID-19-impacted learning, and one of these classes lacked a permanent teacher for the first semester of their fifth-grade school year. Coming into the classroom halfway through the year has its challenges, and implementing this competition helped the students feel excited and engaged in the classroom. It also helped me relate to and build a better relationship with my students. Since the completion of the unit on matter and energy and the accompanying competition, students in my class have had a better attitude toward me and toward learning, and their efforts in class have improved tremendously. While there are many factors that have impacted student attitude in my classroom, it is hard to assume that the implementation of this unit had little to do with my students' improvements.

Indifference Towards Competition

While most students responded positively to the intervention, it is important to remember that few teaching methods are universally effective. During the Student Perception Surveys and Student Group Interviews, some students shared negative feelings about using competition in the classroom. Some students shared that they did not care at all. Some enjoyed competing until their class would lose, then they would feel sad and stop trying. This an interesting point since others

felt that losing motivated them to try harder. Some stated that it meant nothing to them since it did not affect their grade in the class. Some students just are not fans of science, so they did not care for the competition aspect. One high-performing and self-described highly competitive student found it enjoyable but said that she would get annoyed with some of her classmates when her class would lose since she did not feel that she was not one of the people bringing the class's score down.

Value of Research and Considerations for Future Research. Researchers argue the effectiveness of competition's use in the classroom for improving student learning. Goegans and Daniels (2022) stated that competition can push students to focus on performance rather than learning. In the case of this study, the post-test results did not show any major difference in the performance or the learning of content when compared to the control group. It is important to know that there are many factors that could have impacted student performance on the post-assessment, and further studies would need to be conducted to find more meaningful quantitative data.

Not all students learn the same way, and effective educators must have multiple tools ready to reach every student. Going forward, adaptations can be made when competition is used as a tool in the classroom. Allowing students to opt out of the competition might help reduce feelings of stress and anxiety that these students might otherwise feel. Switching between the use of team and individual competitions can change how certain students respond to its implementation since every student has their preference. As competitive classroom apps and learning games become more prevalent and accessible in classrooms, it is important that further studies on their use and effectiveness in the classroom take place. Many of my students ask at the

start of each day if we are going to do a Kahoot! or if we are going to play GimKit. While the 20 minutes of peace and quiet that comes with the games is tempting, I am still not sure their use is positively impacting each, or even most, of my students' learning. With competition also being so prevalent in society outside of the classroom, keeping it out of the classroom might be a welcomed haven away from it for many students.

Impact of Action Research on the Author

The use of competition in the classroom has varying results. Some students embrace it as a game to make things more interesting, while others respond to it with stress and anxiety. The preference for participating as an individual and on a team is also a factor to consider when including competition as an educational tool. Personally, I found this study interesting. As a student with ADHD, I always had a hard time focusing in class when content was given in traditional ways. As an educator, I have typically tried to teach content in a way that I would have found interesting as a student. Lessons that involved kinesthetic learning or that turned things into games or competitions are what I remember most.

Through the unit, many students shared that they enjoyed competing against the other class during the unit. Many students from the control group stated that they wanted to participate too. While this was all helpful, hearing from the students that did not particularly enjoy competing was very helpful. Quotes from these students were a sobering reminder that not all students learn the same way. Not every student I have will share that feeling just because I find a learning method or tool useful. Classrooms are diverse, and students have infinite preferences. As an educator, this study has served as a reminder that it is my responsibility to find practices that reach as many students as possible. When it comes to using competition in the classroom, it

is a tool that some students benefit from, while to others, it is a detriment to their learning and well-being.

Going further, I plan to use competition in the classroom to engage and motivate students. Most of my students responded positively to its inclusion in the unit, and allowing students to opt out will give students more control over their education. This unit was initially designed to be given in a secondary school setting with multiple periods of students participating in the same science unit simultaneously. Implementing it at the elementary level led to several speedbumps and variables that would have been avoided had it taken place in a middle or high school classroom. Timing, teacher availability, classroom differences, and other factors made the implementation of the unit and data collection challenging.

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APPENDICES

APPENDIX A

EXEMPTION BY MONTANA STATE UNIVERSITY INSTITUTIONAL REVIEW BOARD



NoReply@topazti.net <NoReply@TOPAZTI.net>

February 1, 2023 at 10:10 AM

IRB Protocol #2023-529-EXEMPT APPROVED

To: jessica.anderson40@montana.edu, v69c669@msu.montana.edu & 1 more

[Details](#)

****External Sender****

Hello Lopez, Daniel,

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

PI: Lopez, Daniel

Approval Date: 2/1/2023

Title: CLASSROOM COMPETITION: CAN COMPETITION ENCOURAGE COMPREHENSION FOR KIDS IN CLASSROOMS?

Protocol #: 2023-529-EXEMPT

Review Type: Exempt Review

Expiration Date: 2/1/2028

Work described under this protocol may now commence. The PI is responsible for ensuring that the protocol accurately describes 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) is 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 in the 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://nam10.safelinks.protection.outlook.com/?url=https%3A%2F%2Fmontanaprod.topazti.net%2F%2FElements%3FemailLink%3D11%252c102%252c9021&data=05%7C01%7Cdaniel.lopez3%40student.montana.edu%7Cbba0dd6afb043b44e9d08db0477111e%7C324aa97a03a644fc91e43846fbced113%7C0%7C0%7C638108682116533703%7CUnknown%7CTWFpbGZsb3d8eyJWljojMC4wLjAwMDAiLCJQIjoiV2luMzliLCJBTiI6Ikl1haWwiLCJXVCi6Mn0%3D%7C2000%7C%7C%7C&sdata=T7kJVyPLnBb76l0X9Ydz7WEV3MaC3y89%2FTASUmiDLxI%3D&reserved=0.>

APPENDIX B

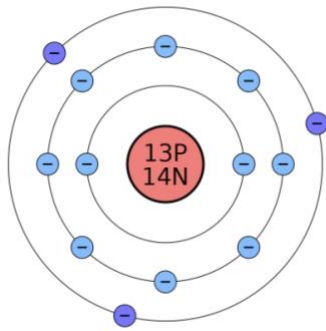
PRE- AND POST- TEST

Name: _____

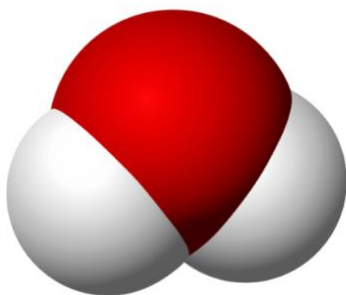
Period: 1 2 3 4 5 6

PAPER COPY. ONLINE FORM AVAILABLE [HERE](#).**Directions:** Complete the following assessment to the best of your ability. Do not leave answers blank.**Part I: Atomic Structure**

1. Protons and Neutrons are in the _____ of an atom.
 - a. Electron Cloud
 - b. Energy Levels
 - c. Nucleus
 - d. Electron Shell
2. Does the model below have a positive, negative or neutral charge?



- a. Positive
 - b. Negative
 - c. Neutral
3. What is the name of the subatomic particle with a negative charge?
 - a. Electron
 - b. Neutron
 - c. Proton
4. An atom has 5 neutrons, 5 protons, and 5 electrons. What is its mass? (Enter your answer below).
5. What is the name of the subatomic particle with a neutral charge?
 - a. Neutron
 - b. Electron
 - c. Proton
6. The picture below is an example of a(n):



- a. Atom
 - b. Molecule
 - c. Compound
 - d. Mixture
7. What is the atomic number of the element below? (Enter your answer below).
- | |
|-----------|
| 79 |
| Au |
| Gold |
| 196.967 |
8. How many protons does the element below contain? (Enter your answer below).
- | |
|-----------|
| 50 |
| Sn |
| Tin |
| 118.710 |
9. What is the name of the subatomic particle with a positive charge?
- a. Proton
 - b. Neutron
 - c. Electron
10. Electrons in the outer energy level of the electron cloud are called _____ electrons.
- a. Positive
 - b. Balance
 - c. Valence
 - d. Neutral
11. How many atoms are in the chemical formula of **Fe₂O₃**. (Enter your answer below).

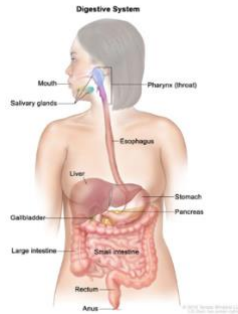
12. A cube of ice melting after sitting out in the sun is an example of a _____ change.



- a. Chemical
- b. Physical
- c. Symmetrical

Part II: Energy

13. The healthy breakfast you ate this morning digesting in your stomach is an example of a _____ change.



- a. Chemical
- b. Physical

14. “The energy of motion, observable as the movement of an object, particle, or set of particles” is the definition for what term?

- a. Chemical energy
- b. Thermal energy
- c. Mechanical energy
- d. Kinetic energy

15. What type of energy is increasing as the passengers on the roller coaster approach the peak of the track? (Enter your answer below).

16. What type of energy is produced by pulling a rubber band on a sling-shot back? (Enter your answer below).

17. What are two forms of renewable energy that we use here on Maui? (Enter your answer below).
18. What type of energy is input for a lightbulb?
- a. Electrical
 - b. Kinetic
 - c. Gravitational
 - d. Light
19. What type of energy is stored in a battery?
- a. Elastic
 - b. Chemical
 - c. Mechanical
 - d. Thermal
20. What is the process where vibrating particles transfer energy to neighboring particles?
- a. Conduction
 - b. Convection
 - c. Radiation
21. A motor transfers 300j of energy. 225j are transferred to kinetic energy. Calculate the efficiency. (Enter your answer below).
22. What are the three common types of fossil fuels? (Enter your answer below).
23. A machine has a useful power output of 900w and a total power input of 1200w. Calculate the efficiency. (Enter your answer below).
24. The transfer of heat energy in liquids or gases by the movement of heated particles is...
- a. Conduction
 - b. Convection
 - c. Radiation

25. Which of the following is an example of electrical energy being transformed into light energy?
- a. Heater
 - b. Radio
 - c. Fan
 - d. Lamp

APPENDIX C

LIKERT-SCALE SURVEYS

Student Perception Survey

Please complete the "Wrap-Up" task that is projected on the screen, and then complete this survey as honestly as you can. How you answer will not affect your grade in any way, but you do need to complete this survey to receive full credit for today.

You will receive three prompts. Please read each prompt *thoroughly* and answer by selecting the option that suits you best. You will have four options to choose from.

- 1 - Strongly Disagree
- 2 - Disagree
- 3 - Agree
- 4 - Strongly Agree

 dpl33@nau.edu (not shared) [Switch account](#)



Prompt 1: I feel confident that I am learning the content from this unit.

	1	2	3	4	
Strongly Disagree	☐	☐	☐	☐	Strongly Agree

Prompt 2: Competing with my class to score higher than the other classes makes me want to do better in class.

	1	2	3	4	
Strongly Disagree	☐	☐	☐	☐	Strongly Agree

Prompt 3: I enjoy competing to have a better score than other classmates on our daily bell works.

	1	2	3	4	
Strongly Disagree	☐	☐	☐	☐	Strongly Agree

Optional short answer:

Please briefly tell me your responses to these prompts. This can be a just a sentence or two. Why did you come pick the ratings you chose?

Your answer

APPENDIX D

STUDENT INTERVIEWS

Student Interviews

First names of participating students:

Class Period: 1 2 3 4 5 6

Interviewer: Danny López

1. _____
2. _____
3. _____
4. _____

Instructions:

- Begin voice recording device at the start of the interview. Remind students that the interview is being recorded, so they are to speak loud and clear.
- Tell students that this should only take 5-10 minutes and they will be given a treat for their participation.
- Tell students to respect each other, but that they are allowed to share their thoughts when they feel they are constructive.
- Remember to end the recording and name it as so: "ClassPeriod_TimeDate".
- Transcribe interview after excusing students.

Interview Questions:

"Hi folks, thank you for joining. This will only take five to ten minutes of your time. This meeting will be voice recorded on my cellular device and transcribed for later. Please speak loud and clear. Try not to interrupt anyone but share your thoughts when you feel they add to the conversation. Okay, let's go."

1. How did you feel about the content from this unit? Do you feel that you found the content interesting or dull?
2. Do you consider yourself a competitive individual?
3. Did competing with other classes as a team affect your attitude in any way?
4. Did seeing data from your class and other classes influence your effort in class in any way?