IMPACTS OF PEER INSTRUCTION ON ENGAGEMENT IN AN ELEMENTARY SCIENCE CLASSROOM

by

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of

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in

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DEDICATION

Dedicated to my Nonna, Rose Houseman, your love and encouragement have meant the world to me. I am proud to follow in your footsteps as a teacher and do my best to carry your joy with me everywhere I go.

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I would like to thank my Capstone advisor, Dr. Chris Pavovlich, for the guidance, support, and constant communication despite time zone differences. You have helped me stay on course and make sure I could finish this project. As well as, my classmates and peer editors, your tired eyes have spotted mistakes that mine missed and you have helped me grow as a research writer.

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ABSTRACT

Student engagement in the classroom has a direct impact on how much students learn in a class. Additionally, highly engaged students in early education are more likely to remain engaged throughout their academic future. Students who have moderate or low engagement in early education tend to end up minimally engaged by middle school or high school. This leads to reduced learning outcomes in the present and in the future for these students. This study investigated the impact of peer instruction on classroom engagement of fourth-grade science students. Students were organized into pairs or small groups to read related texts and explain to their partner what they had read. Likert scale surveys, observation rubrics, and student interviews were used to determine if this treatment affected engagement. It was found that there was a small but not significant increase in engagement during peer instruction. The vast majority of students had the same level of behavioral and emotional engagement with peer instruction as they had with traditional instruction. This was verified with all three methods of data collection. This likely means that this particular mode of peer instruction was not optimal for this age group of students. More scaffolding around how the peer explanations are carried out, or use of another type of active learning may prove more effective for 4th grade science students.

CHAPTER ONE

INTRODUCTION AND BACKGROUND

Context of the Study

Springside Chestnut Hill Academy (SCH) is an independent Pre-K through 12th grade school in Philadelphia, Pennsylvania. SCH is settled in the Chestnut Hill neighborhood, in the northwest corner of Philadelphia. Although it lies within city limits the area has a more suburban feel than center city. Many houses in the area have yards, and SCH has 10 acres of woods with trails that connect it directly to the 1,800-acre Wissahickon park (SCH Academy n.d.) (Wissahickon Valley Park, n.d.). Access to trails and the Wissahickon is an important aspect of curriculum and instruction across all grade levels at SCH.

There are three different divisions within the school based on age and grade level. The three divisions consist of the Lower School, which serves students in grades Pre-K through 4th grade, the Middle School, which includes students in 5th through 8th grade, and the Upper School for students in 9th through 12th grade. SCH was formed from the union of two separate independent schools in 2016. Both original schools were single-sex schools: Chestnut Hill Academy being a school for boys and Springside School was one for girls. As the two schools merged into one, Upper School classes became co-educational. The Middle and Lower Schools enroll both sexes, but classes remain single-sex so that students can learn and develop in an environment free from gender stereotypes (SCH Academy n.d.).

This year I have joined the faculty of the Lower School where there are a total of 305 students enrolled, with 45.8% of those being male and 54.2% female (M. Telemaque, personal

communication September 15, 2025). Diversity is a core value at SCH as staff help cultivate empathy and inclusion for people of all backgrounds. SCH fosters economic diversity in the student population by offering need based financial aid, so that regardless of financial background talented students can thrive (SCH Academy n.d.). Respect for racial diversity is evident at SCH with 14% of Lower school students identifying as African American, 2% as Asian American, 51% Caucasian, 5% multiracial, .3% Native American, and 28% unreported (M. Telemaque, personal communication September 15, 2025).

Prior to moving to Philadelphia and working as a Lower School science teacher at SCH; I taught biology and physical science at a public high school in New Hampshire for 6 years. At SCH I currently instruct, 2nd, 3rd, and 4th grade boys as well as 4th grade girls. From my observations so far, Lower School students are in the process of developing physically, emotionally, and mentally; this development can influence their attitude toward school and later academic success. Despite having a desire to learn and actively participate in class, many students have difficulty sustaining the attention and engagement required to absorb the maximum information that is developmentally appropriate. Engagement can be represented by behavior such as working on the task at hand, participation in discussions, or emotions such as excitement or joy. I am hopeful that changing instructional techniques so that students are the center of pair or small group instruction helps improve classroom engagement. In this peer instruction system, students are working on explaining course content to each other.

In my experience as a student, my high school biology teacher frequently encouraged us to study in groups and work together to explain concepts to each other. In that way, we would have another person to ask questions of and could work collaboratively to navigate conceptually

difficult material to learn. I took his advice and found this strategy useful not only for that class but also beyond high school, throughout my college career. I am optimistic that by implementing a similar practice into the classroom student outcomes will improve and they will learn the information more deeply. By encouraging students to communicate and help teach each other, they may become more invested in the learning process and improve their interpersonal communication skills.

The purpose of this action research study was to examine how structured peer instruction influences student engagement in a fourth-grade science classroom. In my classroom, hands-on activities such as labs and model-building often generate high levels of visible participation. However, I observed that the transition from initial instruction to hands-on application did not always result in sustained conceptual understanding. This pattern prompted me to consider whether increasing structured peer interaction during instruction could strengthen engagement throughout the lesson and support clearer connections between scientific concepts and hands-on activities.

Focus Statement/Question

My focus question was, How does the implementation of peer instruction in pairs or small groups impact student engagement in a fourth-grade classroom?

CHAPTER TWO

CONCEPTUAL FRAMEWORK

Effect of Peer Instruction and Value of Engagement in the Classroom

This chapter reviews the educational strategy of peer instruction, with attention to how student presentation and small-group collaboration shape learning. It then examines broader concepts in the literature including the effects of collaboration, the role of engagement, and the documented impacts of active learning. Collaboration encourages students to build new concepts together, which are often more refined than if students were developing these ideas individually. Engagement plays a significant role in learning outcomes; and engagement in early education can have long term implications throughout a student's academic tenure. Active learning is a strategy that changes students' role in learning away from passively receiving information and improves engagement and learning outcomes. Together, these themes provide a foundation for the goal of this study, to understand how peer instruction may enhance student engagement and achievement.

Peer Instruction

When students explain course content to their peers, it gives them opportunities to describe information in different ways from how the teacher presents it. This also allows students to feel more comfortable asking questions they might not ask their teacher (Ozcan et al., 2024). Using peer instruction is a useful way to increase conceptual understanding without increasing teacher intervention with each individual student (Mathes et al., 2003). Boothe et al., also

recognize the critical importance of this strategy by utilizing undergraduate facilitators for study sessions of an introductory college chemistry class. Ozcan et al. utilized peer instruction with high school chemistry students, where students would discuss and share knowledge with each other if they scored between 30%-90% on a daily reading content check. Peer instruction decreases misconceptions by requiring that students answer challenging questions and work together to reach a deep understanding of the material (Ozcan et al., 2024). Collectively, Boothe et al. Mathes et al. and Ozcan et al. agree that encouraging students to assist each other in understanding class content makes students more comfortable with the material while increasing content retention.

For peer instruction to function, students must communicate with one another. For this communication to be effective, students must verbalize the information that they know and explain it in a way that others can understand. Many people in general feel anxious or nervous when presenting and public speaking (Atkinson et al., 2024). After several weeks of peer instruction, peer-to-peer discussion increased and students were generally more willing to participate in class wide discussions (Ozcan et al., 2024). Similarly, Atkinson et al. (2024) found that the students in their study also increased activity in discussions and reported feeling less anxious speaking publicly after making video recorded presentations to show their classmates.

By facilitating peer-to-peer conversations and encouraging students to teach or present to one another, learning outcomes are expected to improve in two key areas: 1) increased participation as students engage more actively with the material, and 2) decreased misconceptions as students clarify and correct their understanding through discussion and

feedback. Peer instruction depends on students' active participation. Successful peer instruction is closely linked to classroom engagement.

Classroom Engagement

Trends in classroom engagement over time generally show students differentiating and amplifying their engagement towards school, so that students who are engaged become more so and students who are withdrawn increase their disaffection (Skinner et al., 2008). Skinner et al. describe disaffection as being more than just a lack of engagement, but a behavioral or emotional state that is contrary to motivation and forward progress. According to Skinner et al., by the time students reach the late stages of middle school or early high school the majority of students exhibit behavioral and emotional disaffection, which continues to increase through their remaining school years. Therefore, if student engagement can be increased in the earlier grades there is a higher likelihood that students will not only have more positive classroom experiences in the moment, but they can continue to become engaged and motivated to be academically successful later in their schooling.

A study of student engagement in 1st-4th grade students in Turkey found that the average student involvement was moderate across the grades studied (Erdem & Akyol, 2024). Erdem and Akyol recognized the importance of Skinner et al.'s work and advocated for research-based techniques to improve student participation from moderate to high. Erdem and Akyol also expand on Skinner's definition of emotional and behavioral engagement to include that emotional engagement is when students are having fun or positive experiences in the classroom, and that behavioral engagement includes completing tasks following class rules and participating in assignments and discussions. They suggested increasing participation by utilizing techniques

such as group work to increase motivation and participation, or constructivist lessons. In constructivism students are building their understanding through discussions and activities rather than having information presented to them. Peer instruction utilizes concepts from both studies to bolster interest by increasing group work to foster engagement, and that increased engagement should positively affect student perception of school (Skinner et al., 2008; Erdem & Akyol, 2024).

Student focus and attention in the classroom is a crucial aspect of developing understanding and being able to use and apply that information at a later time (Boothe et al., 2018). Studies have shown that classroom engagement is positively correlated with retention and achievement in the classroom (Riffert et al., 2021; Skinner et al., 2008). Engagement could be increased by student collaboration, which as these studies highlight, increased involvement would improve development of a strong understanding of course content. Strategies that increase classroom engagement make teaching the class more enjoyable for teachers and produce better learning outcomes for students. Autonomy was found to be the primary factor that influences student engagement (Skinner et al., 2008). The techniques suggested by Erdem and Akyol, encourage students to learn more autonomously than in a traditional classroom environment. Increasing autonomy by including students in the instruction process makes them active participants in the lesson, increases engagement, and improves learning outcomes and achievement.

The studies in this section indicate that making the instruction process more interactive will result in students participating more completely. Increasing student participation in instruction can have lasting effects on students' attitude and contribution in class as they age

(Skinner et al., 2008). The higher the level of participation the stronger the content retention and understanding (Boothe et al., 2018; Riffert et al., 2021; Skinner et al., 2008). Increasing engagement is best achieved through promoting student autonomy (Skinner et al., 2008). One way for students show autonomy and be a part of instruction is to collaborate with peers.

Student Collaboration

Many professions, from engineering, to construction, marketing, and secretarial work to name only a few, require employees to work collaboratively to achieve a common goal. However, in school it is often the case that students work or are assessed individually so that the teacher can evaluate what each student understands or needs to improve at. When students are allowed to work collaboratively on projects, it not only helps prepare them for careers in collaborative fields, but also increases the vocabulary usage, and technical depth of the final product they create (Kitto, 2009). By encouraging students to work collaboratively, they can assist each other to fill in gaps in knowledge and hold each other accountable to the course standards in a way that they might not if working solely as individuals.

Kitto examined collaboration by studying students' work in groups to create a final product and presentation. Similarly, other researchers such as Ozcan et al., and Mathes et al. examined the impact of students combining concepts to achieve mutual learning and also found that students often achieved more than they might have individually. However, in contrast to Kitto's study Ozcan et al. and Mathes et al. only focused on understanding and assessment score instead of measuring the effect of collaboration to make a product. In all of these studies the utilization of collaboration improved student learning outcomes. By working together to

maintain accountability students may be more involved and active in the class than they would have been working independently.

Active Learning

When learning new information, people try to align it with existing mental constructs they hold about the world (Kitto, 2009). When students play a role in the acquisition of new knowledge rather than having it passively presented to them, they retain the information for longer and generally learn the material in greater detail (Ozcan et al., 2024). By having students work collaboratively and instruct each other, they are taking on the role of active learners. Numerous studies agree, when students instruct their peers or collaborate on a project or presentation, they increase their understanding of the concept and reduce misconceptions (Atkinson et al., 2024; Boothe et al., 2018; Kitto, 2009; Mathes et al., 2003; Ozcan et al., 2024). This result is likely due to students being more active in their education than traditional instruction where students are passively listening to a teacher's explanation and then undertaking a worksheet to demonstrate their knowledge. Facilitating peer instruction will empower students to become more active learners in the classroom, increasing their engagement and improving the classroom experience.

Study Goals

Because peer instruction fosters both autonomy and engagement (Skinner et al., 2008; Ozcan et al., 2024; Erdem & Akyol, 2024), it provides a promising approach for addressing the documented decline in students' classroom participation by the time they are in middle school while students are still early in their educational journey. The increase in student collaboration and communication from peer instruction should improve classroom discussions and build

communication skills that go beyond the classroom (Atkinson et al., 2024; Kitto, 2009; Ozcan et al., 2024). For these reasons peer instruction will be utilized with the aim of improving outcomes for students.

CHAPTER THREE

METHODOLOGY

Introduction

The foundational concepts that support this study are the ideas that increased classroom engagement and active learning lead to improved classroom participation, and learning outcomes. Increased participation in the classroom improves student content knowledge, and having high participation levels in young students can lead to continued high involvement in class activities throughout their time in school. It is the goal of this study to investigate whether peer-led methods of instruction increase student engagement in a 4th grade science classroom. This study uses partner-based peer instruction to determine the impact on engagement in a 4th grade science classroom compared to traditional instruction.

Demographics

This study involved four class sections, including a total of 58 students, 46 of whom chose to participate in data collection (N=46). It examined two classes of 4th grade boys one of which has 10 students, the other of which has 12. It also included two classes of 4th grade girls both of which have a class size of 18 students each. Class 1, is an all-girls class, with 44% of students identifying as African American, 44% Caucasian, 6% Asian, and 6% unknown/unreported. In Class 1, there is one student on an Official Accommodation Plan (OAP). Class 2, is an all-girls class, with 28% of students identifying as African American, 61% Caucasian, and 11% unknown/unreported. Class 2 has no students with an OAP. Class 3, is an all-boys class where 40% of students identify as African American, 50% Caucasian, and 10%

Asian. There are three students with an OAP in Class 3. Class 4, is comprised of 33% of students that identify as African American, 59% Caucasian, 8% Asian. Class 4 includes three students on an OAP.

This study took place across all sections of 4th grade as these students have the most developed reading ability at the Lower School and are able to articulate their thinking and learning process more completely than younger students. These skills are essential to collaborative learning and should help maximize learning outcomes throughout the peer instruction treatment.

The Institutional Review Board (IRB) is an organization within Montana State University that ensures human subjects research, such as the kind described by this study are carried out ethically. The IRB's approval is necessary for research like this project to be conducted. This project has been approved by the IRB and assigned project number 2287 (Appendix A). All student data collected throughout this project is anonymous and secured by being stored on a password protected account accessed through a password protected computer.

Treatment

Springside Chestnut Hill (SCH) has a schedule that operates in seven-day cycles. Each group of students has three science classes per cycle. For a period of two cycles, or slightly more than three weeks, two 4th grade sections, consisting of one boys' and one girls' class, received the peer instruction treatment. In the treatment, students were randomly grouped into pairs or groups of three as needed so that no student was alone and without a partner at the start of each class. Then each student began reading a portion of text that was related but not identical, covering the same science content area. For example, one student may be reading about weathering and

erosion while another is reading about sedimentation and deposition. Once both the partners were finished reading they summarized the reading to their partner, and discussed how the passages were connected to synthesize a more complete idea of the content together. This approach reflects on the concept of collaboration to build understanding and made learning new content more active than listening to a teacher's explanation since students were participants in explanation. Following this there was a brief class-wide discussion to check student understanding and make sure the most essential points were communicated to all students. After the two-cycle period, the two treatment groups returned to traditional instruction and the two non-treatment groups underwent the treatment for the same period of two cycles. The reason for this technique was to create a comparison with a control, while also ethically offering the benefits of treatment to all students. Additionally, this system helps confirm that any changes in engagement were due to the treatment and not a result of increased familiarity with content, the instructor, or peers as the year progresses. This process allowed for analysis of a possible correlation between the treatment and student engagement in the classroom, but can not strictly determine causation. Factors other than the format of instruction, such as interest in the topic or a student's personal circumstances outside of the classroom may influence student involvement.

Data Collection and Analysis Strategies

A Likert-scale survey was used to measure student perception of, and attitudes toward the class and personal engagement in class both pre-treatment and post-treatment. The survey was administered using Google Forms (Appendix B). This survey was based on questions from Skinner et al. (2008) that were used to measure students' behavioral and emotional engagement as well as behavioral and emotional disaffection. I have adapted Skinner et al.'s questions into a

series of 20 statements. Students responded to these 20 statements by noting their level of agreement with that statement. The response categories include: Agree, In between, or Disagree. This survey uses a three-point scale instead of the traditional five-point scale as it can be difficult for students in this age group to distinguish between the categories of agree and strongly agree, or between disagree and strongly disagree. When designing a Likert scale, it is important to consider the reading level and cognitive ability of the respondents and it can be useful to reduce the number of response categories to decrease the cognitive load on the respondents (Ferrando et al., 2025). Having a reduced number of response categories can distort the results slightly, as more individuals might choose an intermediate or neutral option with less options to choose from, but it is still more important to account for the cognitive ability of the participants in the survey than to offer more response categories (Ferrando et al., 2025). This system allows students to reflect on their own engagement and assign it to a category that can be compared from pre-treatment to post-treatment.

Direct observation with written notes was collected about student engagement, for both treatment and non-treatment groups throughout the duration of the study. A rubric was used for these observations to ensure consistency between observers and repeated observations by the same observer. The rubric for observation of student engagement has been adapted from O'Connell (2025) (Appendix C). O'Connell's format of tracking four behaviors and their duration from 0-15, 15-30, or 30-45 minutes was preserved; the rest of the rubric was modified to better fit the needs of this study. A column for additional notes was added next to each category of behavior. Another change was to edit one of the behaviors being observed. O'Connell's suggested behavioral parameter of Conducting Additional Research was replaced

with the new parameter of Showing Off Task Behavior. The reason for this was that it was unlikely that elementary age students would be conducting additional research on class content upon finishing a task. This new category gives additional insight into behavioral engagement. Finally, clarifying examples of each behavioral category were added such as the behavioral category of being On Task was given the clarifying example "Shown by following directions, working on assignment, listening to instructions." (Appendix C) These examples listed on the rubric underneath each behavior category ensure consistency in observation across time and with different observers. Data on the number of students engaging in a particular category of behavior was scored from zero to three. A score of zero indicates that no students were engaging in that behavior during the time window. A score of one meant that a few (1-3 students), two meant that several (4-8 students) and three meant that most/all students were displaying the described behavior. Building administrators recorded data using the rubric as often as their schedule allowed. During the class periods they were not present to observe I carried out these observations using the rubric.

Post-treatment semi-structured interviews were conducted with individual students on the impact of peer instruction. Interview questions were generated by the researcher to understand in detail how students perceived the peer instruction process, and the impact it had on their engagement in class. Student response to interview questions was entirely voluntary and does not affect students' class standing in any way. Students were chosen for post-treatment interviews at random. The semi-structured interview went beyond the prescribed questions shown in Appendix D to encourage students to expand further on their reasoning behind how the treatment

influenced their classroom engagement or to clarify how responses given to interview questions aligned with behavior observed in class.

Likert scale survey data were used to compare percent of responses in each category per question. Likert data were also used to compare total number of responses in each response category across a group of statements on engagement and disaffection. Comparing these changes in total number and percent of responses provide a quantitative evaluation of engagement. Data were be compared for changes in total responses per statement group and by percent of responses per individual question from pre-treatment to post-treatment. The observation rubric provided both quantitative and qualitative data in terms of time spent on different behaviors and by analyzing themes in the notes and looking for patterns of behavior. The interview data were analyzed for thematic analysis and common trends in student perception of engagement (Mertler, 2017). Together, these analyses provide both quantitative and qualitative evidence of how peer instruction influences behavioral and emotional engagement (Table 1.).

Table 1. Data Triangulation Matrix.

Data collection instruments	Measures outcome of engagement
Pre- and Post-treatment Likert-scale survey	X
Direct observation rubric	X
Student interviews	X

This combination of tools offers multiple perspectives on student engagement in the classroom. The Likert scale survey measured students' engagement by each student's self-perception of how they engage in the class. This was then analyzed quantitatively for change in direction from pre-treatment to post-treatment. The observation rubric was used to analyze the number of students spending time on a task and actively engaging in the classroom. The

observation notes were also analyzed for patterns of behavior related to engagement. The interviews provided another window into student perception of engagement with an opportunity for more open-ended responses. Together, the combination of data sources ensures that engagement was studied comprehensively using both quantitative and qualitative analysis and validates any conclusions drawn in this study.

CHAPTER FOUR

DATA ANALYSIS: CLAIMS AND EVIDENCE

Results

Following the data collection period, quantitative and qualitative data were analyzed and compared to verify the results of the study. Quantitative data came from the Likert scale survey on engagement and observation rubric scores. Qualitative data were collected from student interviews and notes on the observation rubric. Together these data sources were used for statistical, graphical, and thematic analysis to determine the impact of peer instruction on engagement in a 4th grade science classroom.

Peer instruction increased student engagement in the classroom in a small but not significant way according to Chi-squared analysis ($p>0.05$). Prior to implementing peer instruction, students reported having moderate to high engagement via the Likert survey. In the first 10 questions on the survey, students indicated their level of agreement on whether or not they exhibited signs of engagement in class. Most responses showed students agreed or were in-between on their level of engagement and at most 9% of students responded disagree to any engagement statement (Figure 1). After the peer instruction treatment was implemented, students viewed their class engagement in a slightly more positive light and eight of the ten questions had fewer responses to disagree (Figure 2). In interviews, 57% of students described peer instruction as a positive experience, with another 36% saying it was a mix of positive and negative (n=14).

The most common theme from the interviews was perspective which was identified when students described valuing others' point of view or sharing their point of view with others. This theme was typically found when students reported peer instruction as being a positive experience. Students mentioned that they enjoyed learning from other students, saying, “It is fun to be able to get multiple points of view and others’ experience.” Other students mentioned they appreciated the spotlight and getting to share the content saying “I enjoy being able to tell my partner what I learned.” These positive experiences with peer instruction helped some, but not a substantial amount of students, become more involved in class activities.

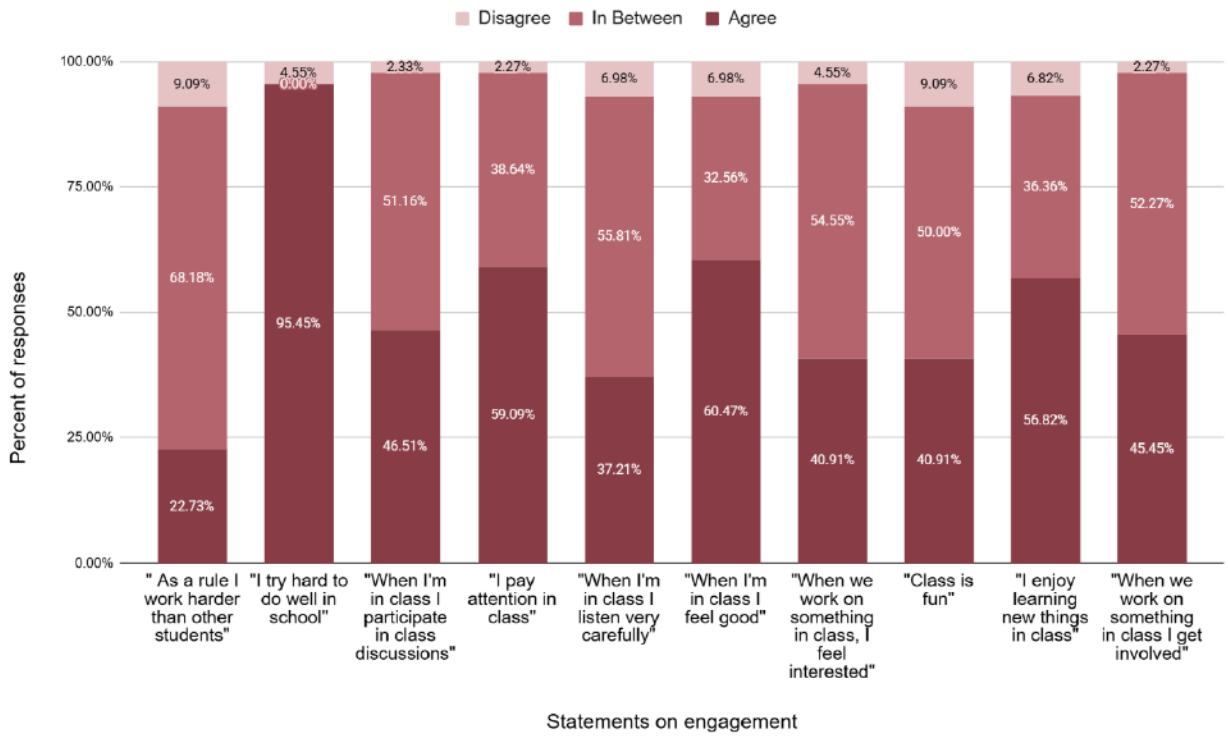

Figure 1. Student engagement survey responses pre-treatment, (n=44).

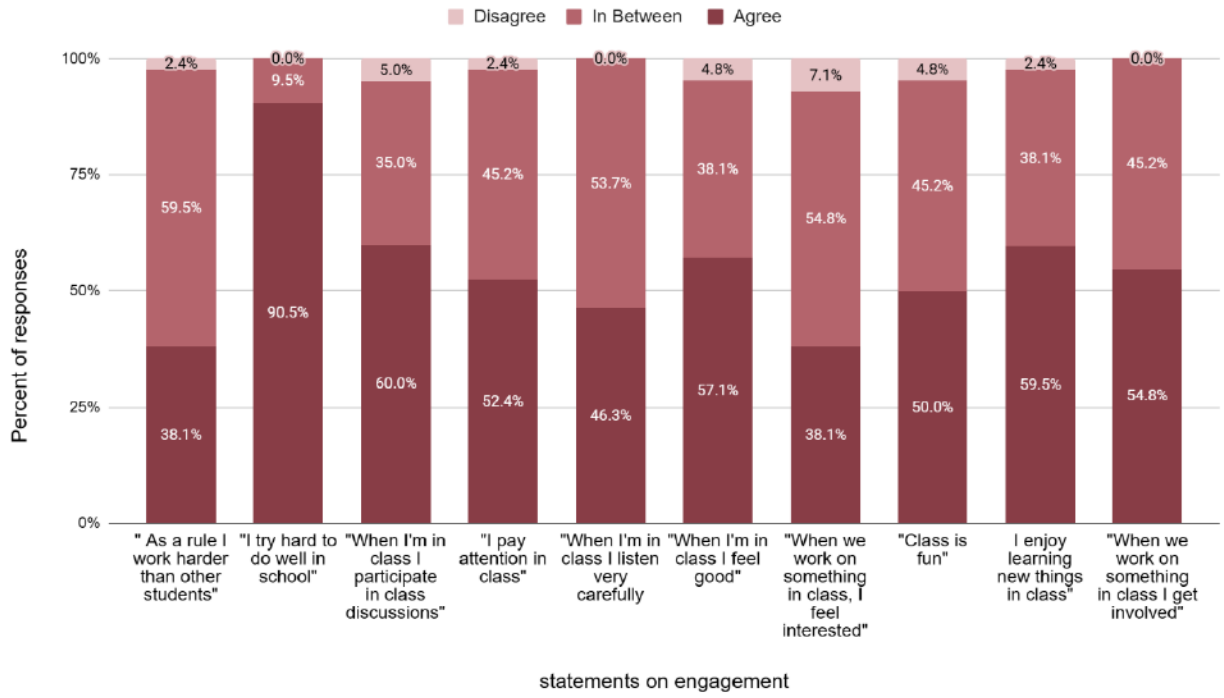

Figure 2. Student engagement survey responses post-treatment, (n=42).

When viewed as a group of all the responses to engagement statements, 50.67% of responses were agree, 43.94% in between, and 5.47% disagree (n=44) (Figure 3). Post-treatment responses to engagement statements were 54.68% agree, while 42.45% were in between and 2.88% of responses were disagree (n=42) (Figure 4). This shows that there was a small change in students' self-perception of engagement from pre- to post-treatment. The change in responses was analyzed using Chi-squared analysis and was found not to be significant ($p>0.05$). This indicates that we fail to reject the null hypothesis that peer instruction had no change in engagement. The classroom observation rubric supported the claim that there was little change in engagement between treatment and non-treatment groups. Class engagement was scored during 15-minute time intervals, on a scale of 0-3, with a 3 meaning most/all of the class was exhibiting

a behavior and a score of 0 meaning that no students were exhibiting that behavior. Peer instruction usually took place in the first 15 minutes of class time, and observations continued beyond this time for the duration of class to see if that impacted engagement later in the class period. The average engagement score in the first 15 minutes was 2.25 for the non-treatment group and 2.41 for the treatment group. Again, this shows a small increase in engagement, but is not statistically significant when considering the standard error of the mean. The mean scores of students showing on task behavior across all three 15-minute time windows were not significantly different between treatment and non-treatment (Figure 5). This suggests that while peer instruction may influence student perception of engagement, the effect is not strong enough to produce consistent or measurable change across the group.

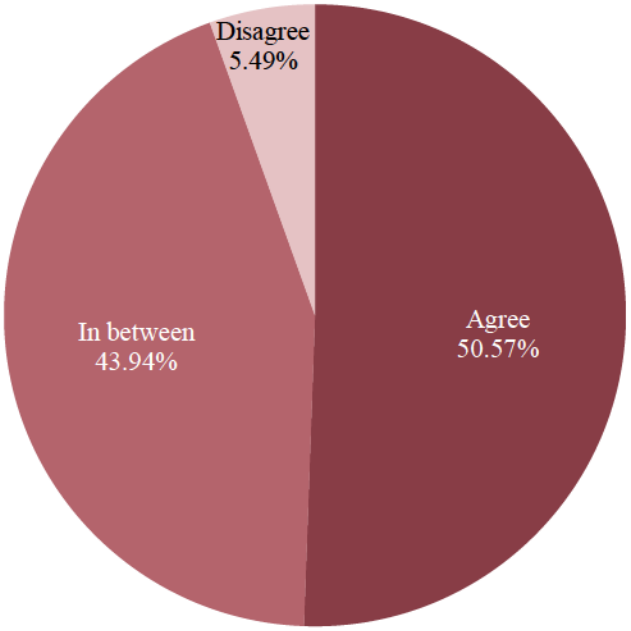

Figure 3. Student engagement survey total responses pre-treatment, (n=44)

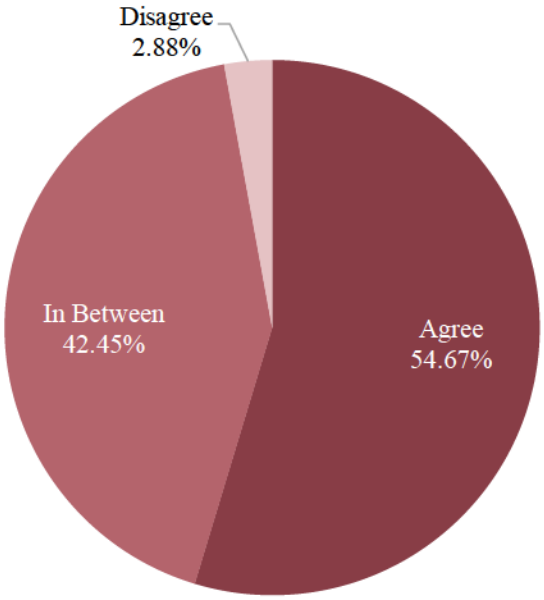

Figure 4. Student engagement survey total responses post-treatment, (n=42).

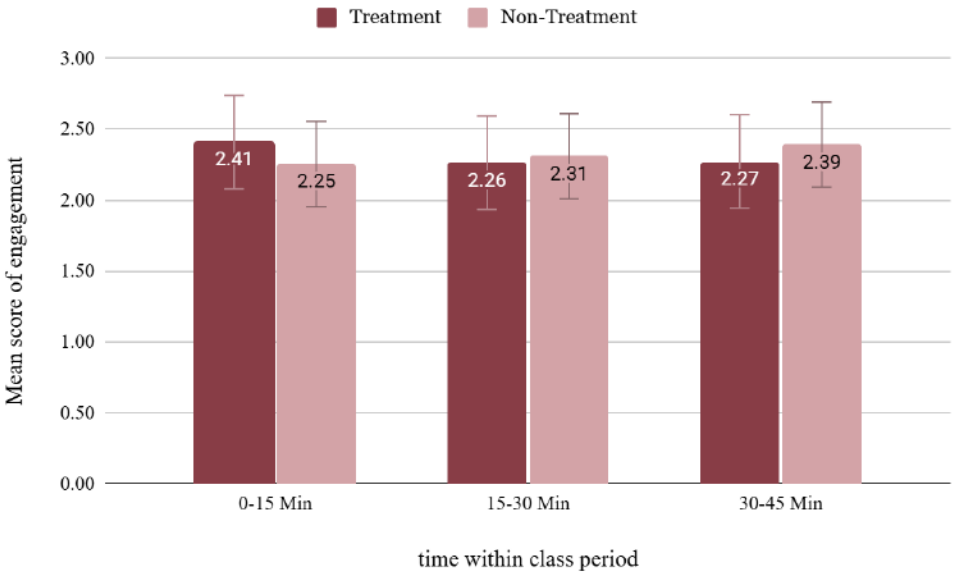

Figure 5. Mean scores of on task behavior with treatment and non-treatment groups, (N=46).

In the post-treatment interviews, students expressed a variety of opinions with peer instruction generally being viewed as positive, or a mix of having both positive and negative aspects. Interviews were analyzed for themes in responses, and the frequency of themes and the individuals who mentioned them were counted (Table 2). Partner variability was found to be the second most common theme in student interviews. Partner variability was identified when students described how some of their partners were more or less involved than others. Students expressed how this could be positive or negative including statements such as "sometimes your partner will provide a lot of information, other times the partner will only explain 1 thing that they learned." Another student described the peer instruction as being "Well, I like it when I'm in groups with other people, but there are some people I don't work as well with because they can be distracting or have friendship issues with." Responses with this theme appeared in almost all interviews where students described peer instruction in a negative or mixed way and were not uncommon among students who viewed peer instruction positively. This made it clear that many students had mixed experiences with peer instruction. The variation in partner dynamics may have limited the consistency of peer instruction's impact on engagement.

Table 2. List of Themes in Interview Responses, (n =14).

Theme Name	How many times was it mentioned (across all interviews)	How many individuals mentioned it?
Topic of study	5	5
Experience	10	7
Partner variability	15	9
Perspective	19	11
Time	2	1
Difficulty connecting content	1	1
Peer assistance	1	1
Mindset	2	1
Camaraderie	2	1

Behavioral Engagement

The statements on the Likert survey were broken down into categories of engagement and disaffection. Each of those categories were examined for the sub-categories of being related to behavior or emotion. The first 5 questions on the survey were about behavioral engagement and the next 5 were about emotional engagement. Changes in behavioral engagement were also analyzed using Chi-squared analysis and found to have no significant change from pre-treatment to post-treatment ($p>0.05$). The recorded notes on the observation rubric support that there is no behavioral change with peer instruction. Classes did not significantly change in the number of students participating as a result of peer instruction. Classes that had high involvement as non-treatment groups continued to be highly involved as treatment took place and vice-versa. Additionally, beyond the first 15 minutes of class when instruction ended and a hands-on activity began, at least half if not more of every class showed involvement regardless of whether they had experienced treatment beforehand (Figure 5). Students reported that there were aspects of

behavioral engagement that were more effective in teacher led instruction, than in peer instruction with one student saying, “I think that learning from the teacher can be helpful because you can raise your hand and ask a question; the teacher has more experience than the students do.” Most students did not exhibit more involved behaviors throughout peer instruction compared to traditional instruction.

Emotional Engagement

Emotional engagement Likert statements were also analyzed using chi-squared analysis and found to have no significant change from pre-treatment to post-treatment ($p>0.05$). The interviews addressed one aspect of emotional engagement by asking students if peer instruction affected their interest in the topics the class learned about. The most common response was that peer instruction did not affect their interest in the topic from six students (n =14). Five of these students mentioned that the topic of study influenced their interest more than the delivery of the instruction. One student said that peer instruction didn’t affect their interest in the topic “It was learning the same as what you would have learned in class from the teacher.” Another student echoed this sentiment stating “Learning more about the topics is what made it more interesting rather than interacting with peers.” Emotional engagement is also represented by how much fun students are having in class. One student described peer instruction as being more fun than traditional instruction saying, “People would be more bored if they’re not with other people and it’s more fun to work with other people.” However, other students expressed an extreme dislike of peer instruction, and upon entering the class one day and seeing the reading material one student said “Why are we still doing this?" to which another student replied "Because it's torture and they like to torture us." In interviews following peer instruction one of these two students

had only positive things to say about peer instruction and when asked to clarify why there was such a difference from the commentary in class and the interview they said "Well I know that some of my friends don't really like science so I've gotta act like I don't like science but really I do like it even more than a few years ago at my old school." From observations, students seemed consistently more excited about the activities that occurred after instruction, regardless of the mode in which instruction was delivered. This indicates that students generally did not find peer instruction more emotionally engaging than traditional instruction.

Disaffection

The subsequent 10 questions in the survey were about disaffection. Students indicated they generally did not feel much disaffection toward the class, with most responses being disagree and in-between and only one statement had as many as 25% of students agree that they exhibit disaffection (Figure 6). The change in disaffection was similar to the change in engagement from pre-treatment to post treatment. Eight out of ten questions decreased in the number of agree responses (Figure 7). Viewed as a group of responses to disaffection statements, 14.2% of responses were agree, 28.44% responses of in-between and 57.34% responses were disagree (n=44), indicating disaffection was uncommon in students (Figure 8). After treatment the total of all of the responses to disaffection statements changed to 10.1% agree, 29.33% in-between and 60.57% disagree (Figure 9). The change in responses was analyzed using Chi-squared analysis and was found not to be significant ($p>0.05$). Similarly, the observational data show the mean scores of time spent off task were not significantly different between the treatment and non-treatment periods (Figure 10).

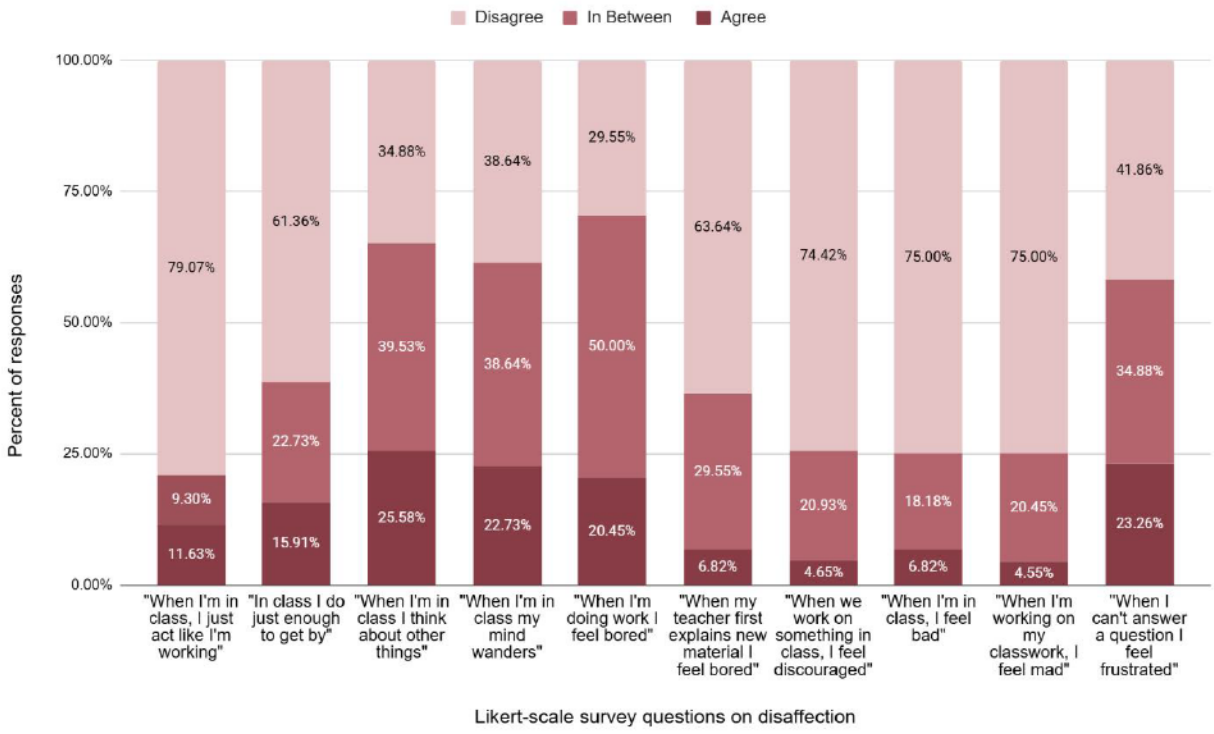

Figure 6. Student disaffection survey responses pre-treatment, (n=44).

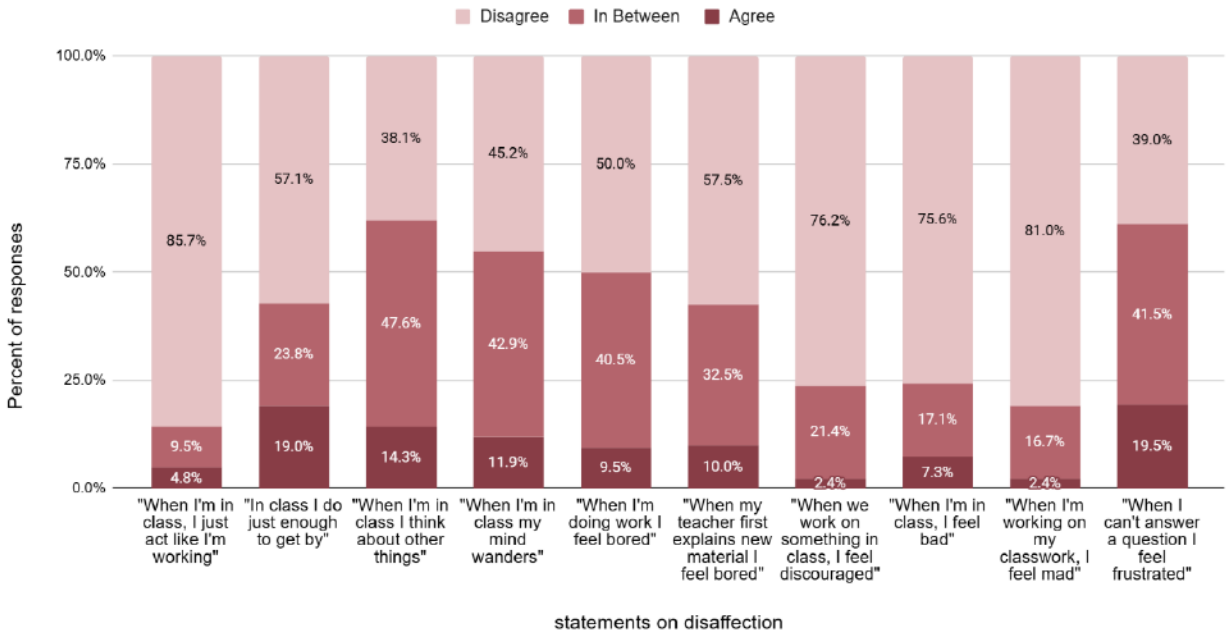

Figure 7. Student disaffection survey responses post-treatment, (n=42).

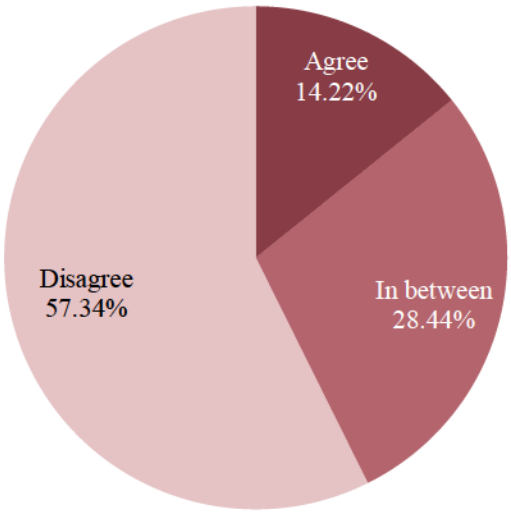

Figure 8. Student disaffection total survey responses pre-treatment, (n=44).

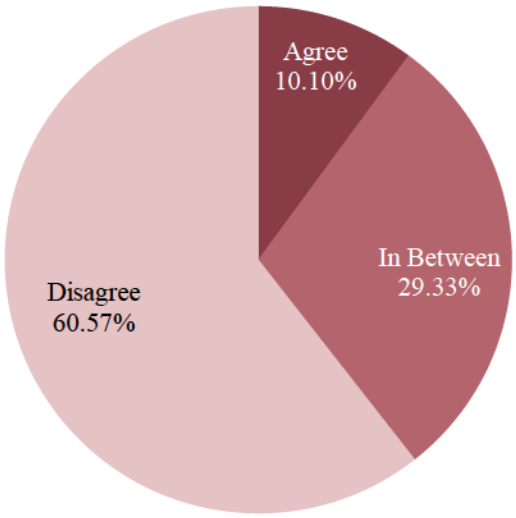

Figure 9. Student disaffection total survey responses post-treatment, (n=42).

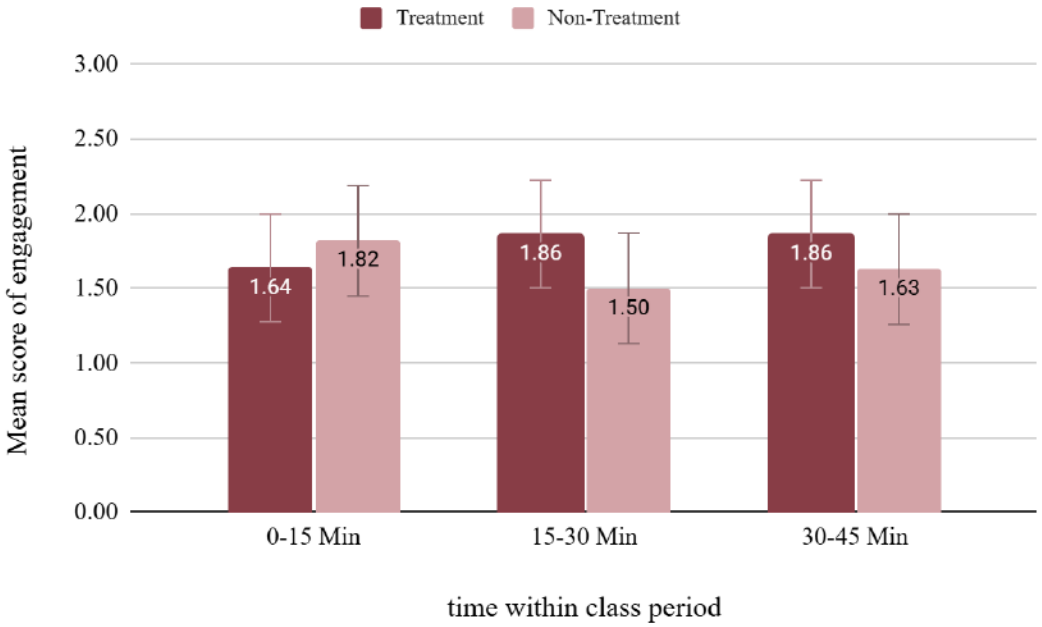

Figure 10. Mean scores of off task behavior with treatment and non-treatment groups, (N =46).

The disaffection statements on the Likert survey were broken down into categories of behavioral and emotional disaffection. The first 4 questions were about behavioral disaffection and the next 6 were about emotional disaffection. These categories of engagement were also analyzed using Chi-squared analysis and found to have no significant change from pre-treatment to post-treatment ($p>0.05$). This indicates that peer instruction did not substantially reduce the students desire to avoid classwork or how they might choose to disengage.

Peer instruction did not substantially improve classroom engagement. In the interviews students explained that peer instruction often had a mix of positive and negative experiences. Students' reports of their own engagement showed very little change in engagement from pre-treatment to post treatment and there was very little change in observational data between treatment and non-treatment groups. This indicates that peer instruction did not meaningfully increase student engagement in the classroom.

CHAPTER FIVE

VALUE: REASONING AND REFLECTION

Claims from the Study

The goal of this study was to determine if reading and discussing with a partner would be a more engaging way of delivering instruction for my fourth-grade science students. Peer instruction caused a small increase in classroom engagement, but did not substantially improve engagement. The data from the Likert-scale survey, observation rubric, and post-treatment interviews all align to support the idea that there was only a minor increase in participation. This suggests that the strategy of reading and discussing with a partner is not inherently more interesting to the majority of 4th grade science students in this study than traditional instruction. It may be that the cognitive load involved in either reading the passages, explaining the reading, or a combination of both, served as a barrier to engagement in this mode of instruction.

Quantitative data from the survey show that a few students had a positive shift in their perception of how involved they are in class during the time of peer instruction. The majority of students, however, exhibited no change in participation. The direct observation scores also show an increase in mean engagement during treatment, but that mean was very similar to the non-treatment engagement mean. Since only a small number of students experienced positive effects from the treatment, it is possible that the format of instruction is not more appealing to the majority of students.

Qualitative data came from student interviews and notes during direct observation. In the interviews, slightly more than half of students reported having a positive experience with peer

instruction, while around a third of students reported having a mix of positive and negative experiences. It was commonly reported that peer instruction did not change students' interest in the topics learned and the topic of learning was more important to students' interest level than the method of instruction. Students also commonly described that their mixed experience with peer instruction was often a result of the differences in the partners that they worked with. The inconsistency in partner interactions may have been due to developmental maturity, or some students expressing a resistance to the cognitive load involved with the reading and discussion. Observationally, there was not a dramatic difference within classes when they were in the treatment period compared to the non-treatment period. Class engagement was typically the highest once instruction had ended and students had begun an activity, regardless of the mode of instruction before the activity began. This indicates that students, especially those with low engagement, had difficulty directing their energy to any type of instruction; however, they were able to better direct their attention towards completion of an activity. Since the method of peer instruction used in this study began with having students read it is possible that the act of reading is not inherently engaging, while completing a hands-on task or activity is more appealing, explaining the increase in engagement in that portion of the class period.

Value of the Study and Consideration for Future Research

Being actively involved in the learning process is an important aspect of understanding content completely. A student's level of participation early in their education can influence their level of participation later on (Skinner et al., 2008). The active learning method used in this study included reading a related text and then discussing it with a partner. This peer instruction is more active than listening to a teacher explain content with breaks for questions from a few students.

Although this use of peer instruction was more active it did not cause a substantial increase in student engagement. This finding does not align with studies by Ozcan et al. (2024), Mathes et al. (2003), or Boothe et al. (2018). This difference suggests that the effectiveness of peer instruction may be dependent on developmental level since those studies did not involve students in this age group. It may be that peer instruction is a greater tool for engagement with students that are older and developmentally able to explain abstract ideas more completely, as well as communicating in a way that is more consistently clear for their audience. Another possibility is that providing additional scaffolding, and modelling at the start of each class what reading and discussing with a partner should look like would help reinforce expectations. Receiving more reminders and seeing examples of the expectations repeated each time may have influenced engagement in this process. The format of peer instruction may have influenced its effectiveness compared the literature cited. In the cited literature students almost always had access to the information prior to when they were expected to communicate the information with peers. This additional time to process the information may have made peer instruction more successful and engaging in those cases. Providing that additional time for reading prior to explaining may have been beneficial to the outcomes of engagement in this study, however, the practical ability to achieve that would have been difficult. The fourth-grade students in the study do not receive homework from science class. Additionally, the format of the schedule means that there can be several days in between science classes, which would increase the load of students trying to remember what they read at the end of one class and being able to use that information to explain to a peer in the next class. Several of these possibilities suggest that the technique used for peer instruction in this study may not have been optimally effective for this age group. Although I

have six years of prior teaching experience, this is my first year teaching elementary age students. A study by Erdem and Akyol (2024) found that teachers with 15 years or more of experience had significantly more engaged students than teachers with less experience. A more experienced teacher may have a better idea of how to fine tune this technique so that it is more effective for this age group of students. Another possibility is that a different method of active instruction may be more effective with this age group of students.

Limitations of the Study

There were several factors that limited the scope of the study carried out. One of which was the implementation of peer instruction treatment. Since this was my first year at Springside Chestnut Hill Academy and my first year teaching this age group, I was still familiarizing myself with and developing the curriculum that I was teaching. In addition to this, it was very time consuming to find and make copies of pairs of readings that were on grade level and relevant to the science content the class was learning about. This proved to be so time consuming and challenging that the study length was reduced. Initially, the study was proposed to be three cycles of treatment per group but was reduced to two cycles per group because of the time demands associated with implementing peer instruction.

Another limitation was the difficulty of collecting nuanced observational data while teaching. I was able to confidently score on-task and off-task behavior during the data collection period. It was more challenging to consistently be attuned to and score students discussing class content and asking questions while assisting with student needs and teaching. This led to a broader view of engagement, since some of the smaller details weren't captured consistently enough to analyze in depth for this paper.

Student interviews had to be chosen at random. Ideally, students would have been chosen based on changes in engagement or being representative of different engagement levels. Unfortunately, the high demand being put on the IRB resulted in slow response time and extra steps in communication, so survey data were made anonymous to simplify the IRB process. As such, individual students could not be tracked for changes in engagement from pre-treatment to post-treatment. Student interviews were chosen at random, and roughly 1/3 of the total sample were interviewed to try and get a representative sample of different groups.

Implications for Future Research

There are several variations that could be made to this study that may bring meaningful insight to the pedagogy. At the beginning of the treatment period, it may be helpful to have teachers or students' model what productive, informative peer instruction looks like. This would act as a guide so that students could more effectively communicate with their partner. Having consistent partners throughout the duration of the peer instruction treatment may have a different impact on engagement than having randomly assigned partners each class. Both of these strategies help address the most common negative feedback about peer instruction, which was partner variability.

Student interviews offered substantial insight into how students viewed peer instruction. Changing or adding questions to the interview list to better understand behavioral engagement may be helpful. Currently, the interview questions primarily focus on emotional engagement, and a shift to include more information on behavioral engagement may be worthwhile.

Further consideration should also be given to whether the method of having students read and discuss with their partner is the most effective way to implement peer instruction, or active

learning with 4th grade students. Over the course of the interviews, there were two ideas worthy of consideration in the design of future studies. The first was the limited time for students to read and discuss. The second was the connection between related readings. Although these comments were raised by only one student each, they may have implications that effect more students. One student mentioned how they felt pressure to finish the reading to discuss with their partner saying, "when someone else is reading with you, or you have to share information with them, you have to discuss what you've read and can't reread. When you have to discuss, you are on more of a time limit." This shows that some students would benefit from additional time to fully absorb the material before explaining to a peer what they've read. Another consideration is that some students, especially those with learning disabilities, may have difficulty understanding how the two texts are connected, even after discussing with a partner. One student with an OAP expressed this sentiment saying, "It is hard to understand what we are working on because we have different topics, so it makes it hard to understand what we are learning." This student also expressed that it was often difficult for them to understand what their partner was trying to communicate. This leads me to believe that this method of active learning may pose challenges to some students including those with learning disabilities due to the possible unclear communication from peers. Investigating other methods of implementing active learning are worth consideration to ensure the process is more equitable and accessible to students of all ability levels. In a study by Rizzo & Taylor (2016) that examined the effectiveness of inquiry in a science classroom for students with disabilities, they found that explicit instruction and guidance is an essential part of success in inquiry for students with disabilities. Finding a way to restructure active learning so that it is more explicit and works more effectively for students with

disabilities is important, so it can be maximally effective to engage students that feel confused or uncertain with traditional and active methods of instruction.

Impact of Action Research on the Author

Carrying out this action research project helped me fully realize the benefits of collecting measurable focused data on classroom outcomes. Taking time to focus my efforts on quantifying and qualitatively measuring engagement helped me recognize patterns in behavior that I hadn't understood from teaching alone. This allowed me to reflect on these behaviors and consider other changes that might be made to continue creating a more engaging instructional experience for students. As I gain experience working with 4th grade students, I will develop a better understanding of their developmental needs, and strategies for classroom management. I hope to use that knowledge, along with increased collaboration with colleagues, to implement new strategies for instruction that can increase engagement, joy, and student learning outcomes. Making a concerted effort to measure the impact of a new strategy and its effect on students will allow a more data-informed and accurate understanding of its effectiveness.

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APPENDICES

APPENDIX A: IRB APPROVAL

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

PI: Houseman, Nicholas

Approval Date: 11/17/2025

Title: Impact of peer instruction on classroom engagement in an elementary science classroom.

Protocol #: 2025-2287-EXEMPT

Review Type: Exemption

Expiration Date: 11/17/2030

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

APPENDIX B: LIKERT SCALE SURVEY ON ENGAGEMENT

Answer in a way that best expresses your feelings on the statement below

	Disagree	In between	Agree
" As a rule I work harder than other students"	○	○	○
"I try hard to do well in school"	○	○	○
"When I'm in class I participate in class discussions"	○	○	○
"I pay attention in class"	○	○	○
"When I'm in class I listen very carefully	○	○	○
"When I'm in class I feel good"	○	○	○
"When we work on something in class, I feel interested"	○	○	○
"Class is fun"	○	○	○
"I enjoy learning new things in class"	○	○	○
"When we work on something in class I get involved"	○	○	○

Answer in a way that best expresses your feelings on the statements below

	Disagree	In between	Agree
"When I'm in class, I just act like I'm working"	○	○	○
"In class I do just enough to get by"	○	○	○
"When I'm in class I think about other things"	○	○	○
"When I'm in class my mind wanders"	○	○	○
"When I'm doing work I feel bored"	○	○	○
"When my teacher first explains new material I feel bored"	○	○	○
"When we work on something in class, I feel discouraged"	○	○	○
"When I'm in class, I feel bad"	○	○	○
"When I'm working on my classwork, I feel mad	○	○	○
"When I can't answer a question I feel frustrated"	○	○	○

Submit

Clear form

APPENDIX C: ENGAGEMENT OBSERVATION RUBRIC

Engagement observation rubric

Date: _____ Observer: _____ Class: _____

Total number of students present: _____

Students engaging in behavior (rated on a 0-3 scale)
0 = None 1 = Few (1-3 students) 2 = several (5-8 students) 3 = Most/All students

Behavior	0-15 mins	15-30 mins	30-45 mins	Notes
On task: Shown by following directions, working on assignment, listening to instructions				
Shows off-task behavior: By daydreaming, talking with peers unrelated to content, or moving out of designated work area.				
Asking questions related to content				
Discussing content with peers or instructor				
Completed assigned task: Shown by finishing written work submitting response, or showing product				

Summary notes

Engagement peaked when: _____

Common distractors: _____

APPENDIX D: SEMI-STRUCTURED INTERVIEW QUESTIONS

Semi-structured interview questions

1. Answers used in this interview are for academic research and will not affect your class standing in any way. Your participation is appreciated but voluntary, you are not required to answer every question and you can chose to end the interview at any time. Do you understand?

2. Did teaching and learning from other students affect your level of interest in the topic?
    a. If yes, how so?
    b. If not, why not?

3. How do you think teaching and learning from other students compares to learning from the teacher?

4. Do you think that teaching and learning from other students was overall a positive or a negative experience?
    a. Why do you think so?

5. Do you think we should continue to teach and learn from other students in this class?
    a. Why or why not?