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How Does Different Level of Questioning Impact Student Performance, Engagement, and Motivation in a 6th Grade Science Classroom?

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A Capstone Project submitted in partial fulfillment of the requirements for the Master of Science Degree in Education at Winona State University

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Winona State University

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CERTIFICATE OF APPROVAL

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CAPSTONE PROJECT

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This is to certify that the Capstone Project of

Mia Bruesewitz

Has been approved by the faculty advisor and REDG 618 – Action Research: Capstone Project Course Instructor in partial fulfillment of the requirements for the

Master of Science Degree in Education

Capstone Project Supervisor: _____

Approval Date: _____

Abstract

This study was designed to determine how different level of questioning in a 6th grade science classroom can impact student performance, engagement, and motivation. During the study, students were taught three different lessons, balance and unbalanced forces, friction, and mass versus weight. Data was collected in a 6th grade science class of 25 participants and focused on surveys, pretests, exit slips, at-task checklist, and a final summative assessment. The results of the data showed that there was no significant difference in performance, engagement, or motivation in relation to different level of questioning. The data also showed that activities that students do during a science class have an impact on their engagement and motivation.

Contents

How Does Different Level of Questioning Impact Student Performance, Engagement, and Motivation in a 6th Grade Science Classroom?

Introduction

There are many factors that affect students in the classroom, and each of those can have a different effect on the different types of students. This paper focuses on a study done to see if the different level of questions asked during a science lesson can impact students' learning. Three factors of student learning, performance, engagement, and motivation, were the main focus of the study. Participants were able to give their own feedback on the three factors, as well as teacher observation.

Rationale

All day teachers are asking many different questions to their students, but are they asking the right questions? While planning a lesson, teachers need to consider if the questions they are going to ask are effective to promote student learning. As a teacher, I am constantly asking students, sometimes without thinking about the type of question being asked. Is it possible that different level of questions can impact student learning? Can different level of questions affect academic performance, engagement, and motivation of students?

Purpose of the Study

It is important to consider if asking lower level questions versus higher level questions have any impact on student learning. Much of the content that is taught in science, is usually something new for most 6th graders. Different students learn in different ways and that is an important fact to consider when planning a study to determine what can impact student learning. Taking into consideration how you are teaching and asking your questions can help you determine if the level of questioning has an impact on student learning.

Research Questions

The three following research were created after spending time teaching a lesson and constantly asking students questions. They aim to answer if the different level of questions asked during different science lessons has any impact on students performance, engagement, or motivation.

1. How can the level of questioning during instruction impact student performance in a 6th grade science classroom?
2. How can the level of questioning during instruction impact student engagement in a 6th grade science classroom?
3. How can the level of questioning during instruction impact student motivation in the 6th grade science classroom?

Definitions

Engagement, motivation, and performance can be defined in different ways based on the context and what is being measured. For this study, engagement is defined by the student's participation during a class period when questions are asked, motivation is defined by the student's want and willingness to answer questions that are asked, and performance was based on how well students scored on a given assignment. Lower level questions are questions that are fact based and have an answer that can be looked up. Higher level questions are questions that students must apply a science concept that is taught to answer the question. It can not simply be searched for on Google. Many studies analyzed in the literature review have found that the questions that are asked during class impacts a student's level of thinking. If students are solely asked lower level questions that are fact based with one direct answer, they will not be promoted

to achieve higher order thinking. Educators and teachers want to promote students to reach that higher order of thinking and apply what they are taught during a lesson to the real world.

Limitations

During the time of the study, many limitations occurred. Time allotted to perform the study and collect data was from April 5th to April 30th, which is not a significant amount of time. During that time, there was also standardized testing that occurred which took up two whole days. The COVID-19 pandemic was one of the biggest limitations during the study. Because of COVID-19, the school where the research was taking place started online and did not come back to in person learning until April 5th, which was the same date the study was to start. This caused the implementation of the study to start about five days later than scheduled. Having to conduct the study with the participants in the class and the participants who choose to stay distance learning simultaneously, was also a limitation faced.

Review of Literature

Level of Questioning

Questioning in science instruction plays an influential role in the classroom. Level of questioning usually varies from lower level to high level type of questions, which can be used to create different level of thinking. Lower level questions and thinking to higher level questions and thinking, are most commonly classified using *The Taxonomy of Educational Objectives* by Bloom, Engelhart, Furst, Hill, and Krathwohl (1956) (as cited in Agarwal, 2019). The original Bloom's taxonomy included six categories of cognitive process, and it was designed as a step by step process (Agarwal, 2019). For students to reach higher level thinking, analysis, synthesis, and evaluation, they must first focus on the lower level thinking, knowledge, comprehension, and application (Agarwal, 2019).

In Pooja Agarwal's 2019 study, she tested to see if students needed to build up to high order thinking with fact based knowledge at the start. Agarwal focused on two groups of college students and one group of 6th grade students to see if different types of quizzes, low level fact quizzes and mixed quizzes, impacted a final high higher order thinking test. In her results, she found out that fact based quizzes do not enhance higher order learning, but mixed quizzes, having both fact and high order questions, enhance higher order learning (Agarwal, 2019).

In a 2017 study conducted by Carrie Kracel and Dena Hasrshbarger, the researchers focused on the use of higher level thinking questions during a read aloud to enhance science instruction. Kracel and Hasrshbarger used the higher level of Bloom's Taxonomy, application, analysis, synthesis, and evaluation constructs to create different level of higher order questions to ask before, during, and after read alouds. They concluded that when what they called low-consensus questions, which do not have a direct answer and students need to apply what they know, were asked, caused students to move into higher-level thinking (Kracel & Hasrshbarger, 2017). They also concluded that using low-consensus questions, whether science teachers use it along with a read aloud or not, engages students in higher order thinking and making stronger connections to science content (Kracel & Hasrshbarger, 2017).

Engagement, Motivation, and Performance

Engagement, motivation, and performance are important terms widely talked about in education and classrooms. All three can be defined and described in different ways based on context and what is being measured or observed, and also have an effect on one another as well.

In Jung-Sook Lee's 2014 study, he defined student engagement into two components, behavioral, which focuses on the behaviors of students in the classroom, and emotional, which focuses on their sense of belonging in the classroom. For this study, the definition of engagement

that was focused on was closely related to Lee's behavioral engagement. This study focused around how much the participants were participating with the questions being asked of them in the classroom. Les's 2014 study also discovered that there was a positive relationship between student engagement and their performance. Understanding that engagement and performance are directly related, will help a teacher know to focus on engagement first before performance. Noting the difference between behavioral and emotional engagement will also help a teacher connect with how different students will show their engagement. If a student has a low emotional engagement, such as they do not feel as though they belong, their behavioral engagement will suffer. In Robinson and Hullinger's 2008 study, they focused on how student engagement differed from online learning and in person learning. Four benchmarks created from the National Survey of Student Engagement (NSSE), level of academic challenge, active and collaborative learning, student interaction with faculty members, and enriching educational experience, were used to measure a student's engagement. In the conclusion of their study, online students reported higher levels of engagement on each of the four benchmarks. Technology is only advancing, and more schools are making it part of their curriculum. Knowing that students' engagement is higher with online learning, will help teachers create more technology focused lessons.

It is also important to consider that a student's engagement can be affected by outside factors. According to Uekawa, Borman, and Lee's 2007 study, classroom organization and activities, such as what students are learning and how that information is presented, will impact student engagement. When students feel more connected to the learning, they will have more engagement in the class. Race and ethnicity, and how it is presented in the classroom social organization, can also have either a positive or negative impact on student engagement.

Motivation can be interpreted in different ways and in different contexts. In this study motivation focused on the drive and the want students had to answer questions during science class. This is supported by Richard M. Ryan and Edward L. Deci 2000's study, where they defined motivation as how much energy and focus students had to complete a task.

It is important to consider that a participant's motivation can be affected by outside factors. Students' motivation can be affected by teaching practices and teachers' own motivation (Ahn, Chiu, & Patrick, 2021). As one of the main figures in the classroom, if the teacher is not wanting to be present in the class; why would the students want to be either? Motivation can also be impacted by the students' interests. According to Santine Cuccio-Schirripa, student interests in science can impact their motivation to answer and create questions during class (Schirripa, 1999). A participant's motivation can also be affected by the instructional practices and context that are happening in the classroom. In Schweinle, Meyer, and Turner's 2006 study, they identified seven instructional contexts that a teacher can do to increase students' motivation in the classroom. They are, providing feedback, building student relationships, providing challenges, support of student autonomy, guided support for competence, focus on task importance, and supporting positivity. By combining all of these factors into the classroom, motivation among all participants will directly improve. As a teacher, it is important to gauge what your students are interested in, because if students are more interested, they will be more motivated to be engaged and participate during class.

A student's performance in the classroom is measured by how well they are able to demonstrate their knowledge of what was learned. Different ways to measure a student's performance is through a test, a presentation, a discussion, or a project. In a perfect classroom, the only thing a student's performance would rely on is the information being taught, but that is

not always the case. Student's performance can be affected by many factors outside of the curricula that are being taught. According to Fredricks, Blumenfeld, & Paris 2004 study, students' test scores and performance increased based on their behavioral engagement. Students' engagement needs to be fostered in the classroom just as much as fostering their learning, because they go hand in hand. A student's motivation also has a relationship with their academic performance. According to Schweinle et. al., a student who has more motivation, will have a higher academic performance. If students are not engaged in the content being taught, they will lack motivation as well, which will also cause students' performance to go down. Teachers need to take these direct relationships into consideration while teaching to better reach all students. How the information is being taught, will affect how well students learn. To create a positive learning experience for all students, engagement motivation, and performance need to be grouped together.

Conclusion

The scope of the literature review is focused on how to improve students' experience in the classroom and the different factors that play a part in that. The different level of questions that are asked during a lesson need to have a mix of low level questions and high level questions. This quartennes that all levels of learning are being meant for all the different students in a class. The direct relationship between a student's engagement, motivation, and performance always need to be focused on and fostered for students to reach maximum learning.

Method

Introduction

The methods used in the study were created to figure out if different level of questions during a 6th grade science lesson had an impact on participants' performance, engagement, and motivation. This study took place over a new science unit on forces that was broken down into three different lessons, balance and unbalanced forces, friction, and gravity. Three data tools, pretest, exit slips, and a final summative assessment, were used to measure performance. Survey, focus group interview questions, and at-task checklist were used to measure engagement. Motivation was measured by a survey, focus group interview questions, and an exit slip. All data tools used, except focus group interview questions, were given to participants over Google Forms to make it equitable for the participants in person and those on distance learning.

Participants and Setting

The research took place in a 6-8th grade middle school in Southeastern Minnesota. Participants in the study were all a part of a 6th grade physical science classroom and were between the ages of 11-12 years old. There were 27 participants in the class, and of those 27, 14 were boys and 13 were girls. During the study, 21 participants attended class in person, and five participants attended class synchronously through a Google Meet. 11 participants were gifted and talented, one English Language Learner, and two participants with an IEP, one for a specific learning disability and one for other health disability. For the interview, five participants were selected to answer the questions. One participant who was gifted and talented, one who was on an IEP, one participant who was an English Language Learner, one who was a distance learner, and one participant who had no special circumstances. As the teacher of the class, I was a participant-observer during the study.

Research Questions

How can the level of questioning during instruction impact student performance in a 6th grade science classroom?

How can the level of questioning during instruction impact student engagement in a 6th grade science classroom?

How can the level of questioning during instruction impact student motivation in the 6th grade science classroom?

Data collection procedures

Table 1

Triangulation Matrix

Research Questions	Data Tool A	Data Tool B	Data Tool C
Q1- How can level of questioning during instruction impact student academic performance in the 6th grade science classroom?	Student pretest	Exit slips/check for understandings	Final summative assessment
Q2- How can level of questioning during instruction impact student engagement in the 6th grade science classroom?	Student survey	Focus group interview questions	At-task checklist
Q3-How can level of questioning during instruction impact student motivation in the 6th grade science classroom?	Student survey	Focus group interview questions	Exit slips

Data for the study was collected over a three-week period and focused on a 6th science unit about forces and motion.

To measure participants' academic performance based on different level of questioning, three different data tools will be used; student pretest, exit slips to check for understanding, and a final summative assessment.

To create the pretest, example question in Appendix A, questions were created that focused on the new unit being taught, forces and motion. 20 questions were asked on a Google Form; that were either true or false questions or multiple choice. Out of the 20 questions, 10 were lower level questions and 10 were higher level type questions. The 10 lower level type questions focused on recalling basic facts, related to forces and motions, that could be found in the textbook. The 10 higher level type questions focused on applying and analyzing information related to forces and motion. Having an even number of both types of questions, did not show a preference towards lower level or higher-level type questions, and made the data collected as fair as possible. This tool helped show if participants' performance would be impacted based on the type of question asked.

Google Forms were also used to create exit slips to check for understanding of the new science content that was taught during a lesson. The first exit slip, Appendix B, had two lower level questions, questions that focused on recalling or remembering a term taught during the lesson. The second exit slip had two higher level questions, Appendix C, questions that focused on applying or analyzing a term that was taught. Having both types of questions for the exit slips helped show if participants' knowledge of what was taught can be impacted based on the type of question. These exit slips also showed if participants need to have a basic understanding of science content before it can be applied to a higher-level question.

For the final summative assessment, example questions in Appendix D, participants were asked a mix of both types of questions, and the level of questions were spread out through the

test and not grouped next to each other. It was completed on a Google form and consisted of a total of 26 questions, seven from each of the three lessons that were taught. There were a total of 13 lower level questions, that were fact based with a direct answer, and 13 higher level questions, where participants had to apply a science concept that was taught.

To measure participants' engagement based on different level of questioning, three different data tools were used; student surveys, focus group interview questions, and an at-task checklist.

Participants engagement survey, Appendix E, was completed on a Google form. The survey contained four questions. The first question, participants were asked how they show engagement or participation in science class. The second question asked students to rate how much they participate during class on a scale of one, I never participate, to four, I am participating the whole class period. The third question was a free response question, and asked when they feel they participate the most in class. The fourth question was a free response, and asked students if they do not participate sometimes during class because they do not understand the content.

Focus group interview questions will be asked face-to-face, one at a time, with the five chosen participants. The participants will be asked six questions that have to do with engagement in the classroom and their feelings toward different level of questions. Two of the questions asked will be about how a participant shows they are engaged and what factors help or not help them focus and participate. The other four questions asked will be focused on the different level of questions and what type of level participants have an easier time participating and focusing on. Participants will also be asked to explain why they focus and participate better on the level of question that they choose.

An at-task checklist will also be used to measure participants' engagement during class. The checklist will measure how each participant participated during class when different questions were asked. The different types of questions will either be asked out loud, on a discussion board such as Nearpod or Jamboard, or on a poll. On the checklist, each participant will be marked how they participated for each question that was asked, either out loud (OT), on the discussion board, (DB), or for the poll question (P). Participants can also be marked if they raised their hand but did not answer (RH), if we did a turn and talk (TT) and they participated, or if participants attending class through the Google Meet participated in the chat (C). Giving participants many ways to respond, will provide opportunities for all to participate and engage with how they feel comfortable.

To measure participants' motivation based on different level of questioning, three different data tools will be used; participant surveys, focus group interview questions, and exit slips.

Participant motivation survey, Appendix F, was completed on a Google form. The survey contained four questions. The first question, participants were asked how they show motivation in science class. The second question asked participants to rate how much they want to participate during class on a scale of one, I never want to participate, to four, I always want to participate. The third question was a free response question, and asked when they feel the most motivated during a class period. The fourth question was a free response, and asked participants if they do not want to participate sometimes during class because they do not understand the content.

Focus group interview questions were asked face-to-face, one at a time, with the five chosen participants. The participants were asked six questions that have to do with their

motivation in the classroom and their feelings toward different level of questions. Two of the questions asked were about what keeps a student wanting to be a part of the class and how participants stay motivated during class. The other four questions asked were focused on the different level of questions and what type of level participants have an easier time wanting to answer. Participants were also asked to explain why they want to answer on the level of question that they choose.

Participant motivation exit slip, Appendix G, was completed on a Google form. The exit slip contained two questions; both questions were answered on a linear scale with one (did not want to answer the question at all) through four (strongly wanted to answer the question). One liner question was them rating how much they wanted to answer when a lower-level type of question was asked during a lesson. The second question was a linear rating question asking how much they wanted to answer during the lesson when a higher-level type of question was asked.

Instruction

The unit of study was broken up into three main concepts: balance and unbalanced forces, friction, and gravity (mass versus weight). One lesson was spent on each concept. Before the start of the study, participants were given two different surveys to complete: one on their engagement and one on their motivation level. Participants were also given a pretest on all the content that was going to be taught before any lesson was given to gauge where they are at. Each lesson of each concept started out with an activity or demonstration that showed the concept that was going to be taught. Participants would not be told what concept was being shown, but would be given questions to help guide their thinking. After participants had identified what was going to be focused on, the lesson would start. Each lesson was broken up into two parts. The first part of each lesson, focused on participants being asked a majority of

lower level questions. The second part of each lesson, focused on participants being asked a majority of higher-level questions. Once all lessons had been taught, participants were given a final summative assessment.

The first part of the lesson on forces started out with a game of tug of war outside. The participants were first broken up into girls and boys for three games of tug of war. After each game, I proposed the question, what is going on? Participants were then put into different pairs of two, and different pairs played different pairs. After each round was complete, two questions were proposed: what is different in these rounds than others and what has changed this round? After spending 25 minutes outside, the class came back into the room. Once back in the room, participants were asked to write down for five minutes what they experienced outside. After five minutes, participants were asked to share what they wrote down.

Participants were then instructed to log onto a Nearpod that focused on balanced and unbalanced forces. The first question asked on the Nearpod was, what is a force? Participants submitted their answers to the collaborative board, and then a definition of a force was given: a push or pull of an object. Participants were then asked to draw a picture of a force being put on an object or a person. Participants were then asked, what are some forces acting on you right not that maybe you cannot see? Participants wrote their answers on the Nearpod slide, but were also asked to give more information verbally if they wished. The last things participants were taught for the first part of the lesson, was that force is measured in Newtons (N).

The second part of the lesson started with the question, how many Newtons do you think it took to win in tug of war. They were also asked to defend why they put the answer they did. Participants were then taught how to label a force. To label a force, participants need to know the number of Newtons and what direction the force is going. A picture of people doing tug of war

was shown with person A and person B. A red arrow was pointed towards person A with 500 N and an arrow was pointed towards person B with 100 N. I asked the participants who is going to win the game and how you can tell. I then asked the participants, what would happen if both people in tug of war were pulling with a force of 300 N, and why do you think that is?

Participants were then given a brief definition of a balanced force, equal in strength and does not change an object's motion, and a brief definition of an unbalanced force, not equal in strength and causes a change in the object's motion. Participants were then asked to find their own examples of a balanced force and an unbalanced force. Participants were then asked; what is going to happen if someone is pulling a box and someone is helping push it along? They were also asked, is that an example of a balanced for or unbalanced force and why? Participants were then asked; how can I calculate how much force it takes those two people to move the box? After participants shared their responses, they were told that if forces are being applied in the same direction, you need to add all the forces together to find how much total force it takes to move the box.

The next lesson presented in the study focused on friction. To start out the lesson, participants were given a smooth playing card with a piece of string taped to the back and a penny. Participants were instructed to place the playing card on their pointed finger and balance the penny on top of the playing card. Once the penny was balanced, participants had to pull the card out from under the penny, but the goal was to make the penny stay on your finger. After about eight to ten minutes, participants were then given a piece of sandpaper that had a string attached. Participants then had to do the same thing with the penny, but now with a piece of sandpaper. After about eight to ten minutes of participants trying with the sandpaper, they were asked if anyone was able to get the penny to stay. Participants then had to go onto a Padlet to

answer the question, why do you think the penny would not stay on your finger with the sandpaper? Participants were then given a basic definition of friction, a force that tries to stop motion between two objects touching each other. Participants were then tasked with finding an image that showed a lot of friction and an image that showed little friction. Participants posted their images on a Jamboard and stated why each image had lots or little friction.

To start off the second part of the lesson, participants were told to rub their hands together. Participants were asked to explain what is going on when you rub your hands together. Participants then had to form the connection that when increasing friction, heat gets created. Participants were asked, why do they think this phenomenon occurs, increasing friction causes heat, and can they think of any other examples in the world. Participants were then asked; how can you decrease friction and why might that be useful in the world? Participants were taught that you need a type of lubricant to decrease friction, such as oil, grease, or soap.

The last lesson taught in this study focused on gravitational force and the difference between mass and weight. To start the first part of the lesson, participants were asked if I drop these two balls, one tennis ball and one foam ball, from the same height; what will happen and why? Participants posted their response onto a collaborative board in Nearpod. Participants also had to defend why they thought what was going to happen when I dropped the balls. After I dropped the balls, they hit the ground at the same time. Participants then had to post what they thought caused them to hit the ground at the same time. Participants were then asked; what do you already know about gravity, mass, and weight? They were then asked; what factor do you think played the biggest role in the ball drop demonstration? A brief definition of gravity was then given on the Nearpod, a force of attraction acting between all matter.

The second part of the lesson started with the question, do you think mass and weight are the same thing? Why or why not? Participants were then given a brief definition of mass, how much stuff is in an object, and weight, the effect of gravity on an object. The next question participants were asked was why do astronauts seem to float on the moon? Participants were taught that there is less gravity on the moon, about 1/6 the amount than there is on Earth. Based on this piece of information, participants were asked would an astronaut be heavier or lighter on the moon than on Earth? Participants were then provided a link to a website where they put in their weight on Earth and it calculated what their weight would be on different plants.

Participants were then asked, why do they have different weights and how is gravity different based on the plants? Participants were then asked; if my mass on Earth is 50 grams, then what is my mass on Jupiter? Participants were also asked to defend or further explain their answer. They were then taught that mass is not affected by gravity and will stay consistent. At the end of the lesson, participants had to create a short paragraph explaining how mass, weight, and gravity are all connected and different.

Results

Introduction

Data were collected to determine if different level of questioning affected participants in the classroom. Several data collection tools were used to assess participants' performance, engagement, and motivation. The tools used to collect data on these areas were: a pretest, an exit slip, a final summative assessment, a motivation and engagement survey, and at-task observations. The results section answers the three sub-questions posed by this study: do different level of questions impact participant performance, engagement, and motivation? For the results, performance was defined as a participant's score on an assignment; engagement was

defined as participants' focus and participation on questions; and motivation was defined as a participant's want to answer a question.

Research Question #1

How can the level of questioning during instruction impact student performance in the 6th grade science classroom?

Data Tool 1: Pretest

Tabel 2

Participants	Lower-Level Questions	Higher-Level Questions
1	5/10	4/10
2	6/10	5/10
3	7/10	5/10
4	8/10	8/10
5	5/10	7/10
6	7/10	8/10
7	6/10	6/10
8	7/10	7/10
9	7/10	6/10
10	6/10	5/10
11	4/10	4/10
12	7/10	5/10
13	6/10	5/10
14	5/10	6/10
15	6/10	7/10
16	4/10	4/10

17	6/10	5/10
18	5/10	5/10
19	4/10	3/10
20	3/10	3/10
21	5/10	3/10
22	3/10	5/10
23	6/10	6/10
24	6/10	4/10
25	5/10	6/10
Average	5.56/10	5.28/10

The data presented showed participants' scores on a pretest, which consisted of a mix of lower level questions and higher level questions. The participant average showed a slightly higher score of lower level questions than higher level questions. Six out of 25 participants scored higher on the higher level questions than lower level questions. Out of those six, four participants scored one point higher and the other two scored two points higher. 11 participants scored higher on lower level questions than higher level questions. Out of those 11, seven participants scored one point higher on lower level questions and the other five scored two points higher. Eight participants had no change in the score on lower level to higher level questions.

Data Tool #2: Two Exit Slips

Table 3

Participants	Exit Slip 1 Lower Level Questions	Exit Slip 2 Higher Level Questions
1	1/2	1/2

2	1/2	0/2
3	2/2	1/2
4	0/2	1/2
5	2/2	1/2
6	2/2	1/2
7	1/2	2/2
8	1/2	1/2
9	2/2	2/2
10	2/2	1/2
11	2/2	1/2
12	1/2	2/2
13	1/2	0/2
14	1/2	1/2
15	2/2	2/2
16	2/2	2/2
17	1/2	1/2
18	0/2	1/2
19	2/2	1/2
20	1/2	2/2
21	1/2	1/2
22	2/2	1/2
23	2/2	1/2
24	1/2	0/2
25	1/2	1/2
Average	1.32/2	1.16/2

Table 3 is created from data collected from two different exit slips on participants performance. The first exit slip had two lower level questions and the second exit slip had two higher level questions. There was a slight higher average score, 0.16 difference, on lower level questions correct than higher level questions. The majority of participants, 11 out of 25, scored one point higher on lower level questions than higher level questions. Nine out of 25 participants scored the same on both exit slips. The other five out of 25 participants scored one point higher on higher level questions than lower level questions.

Data Tool C: Final Summative Assessment

Tabel 4

Participants	Lower Level Questions	Higher Level Questions
1	12/13	12/13
2	11/13	13/13
3	11/13	10/13
4	13/13	12/13
5	11/13	10/13
6	9/13	10/13
7	10/13	11/13
8	13/13	13/13
9	8/13	8/13
10	12/13	10/13
11	7/13	8/13
12	11/13	11/13
13	10/13	12/13
14	12/13	9/13

15	10/13	11/13
16	13/13	13/13
17	12/13	10/13
18	7/13	8/13
19	9/13	12/13
20	12/13	11/13
21	10/13	9/13
22	6/13	6/13
23	13/13	11/13
24	12/13	13/13
25	11/13	13/13
Average	10.6/13	9.24/13

The data presented showed participants' scores on a final summative assessment, which consisted of a mix of lower level questions and higher level questions. The participant average showed a slightly higher score on lower level questions than higher level questions. 10 out of 25 participants scored higher on higher level questions than on lower level questions. Six out of those 10 participants scored one point higher, three scored two points higher, and one participant scored three points higher. Nine out of 25 participants scored higher on lower level questions than on higher level questions. Out of those nine participants, five participants scored one point higher, three scored two points higher, and one participant scored three points higher. Six out of 25 participants had no change in score between lower and higher level questions.

Research Question #2

How can the level of questioning during instruction impact student engagement in the 6th grade science classroom?

Data Tool 1: Participant Engagement Survey

Question 1: Rate how much you participate during class on a scale of 1-4.

Chart 1

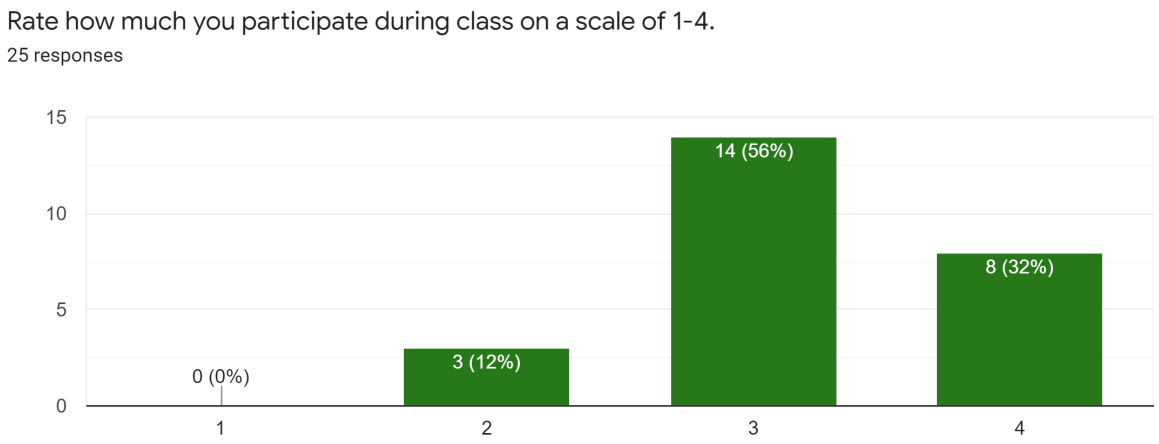


Chart 1 is from the first question on a participant engagement survey. The y-axis is the number of people that selected a certain number. Participants were asked to rate on a scale from one, I never participate, to four, I am participating every class the whole hour, which is the x-axis. Zero participants selected one, three selected two, and eight selected four as their response. The most popular number selected, by 14 participants, was number three.

Question 2: How do you show engagement or participation in science class?

Chart 2:

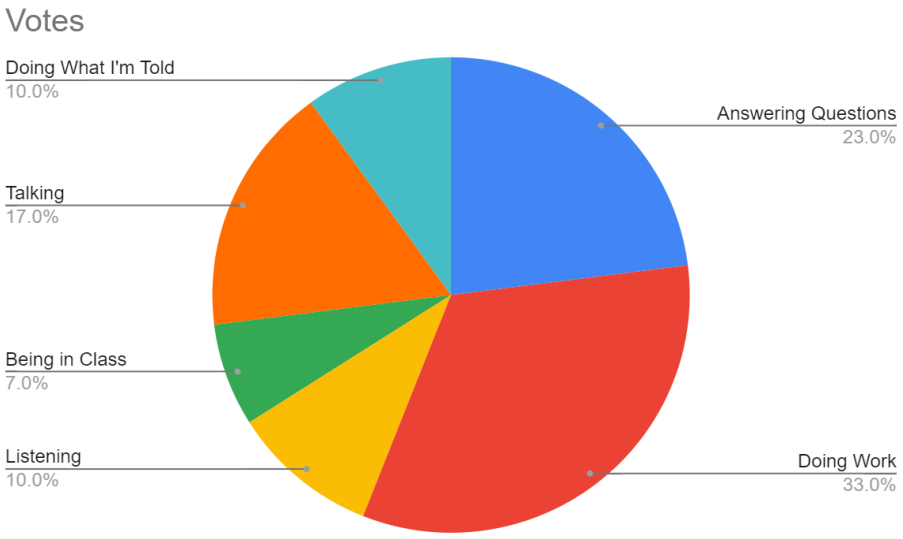
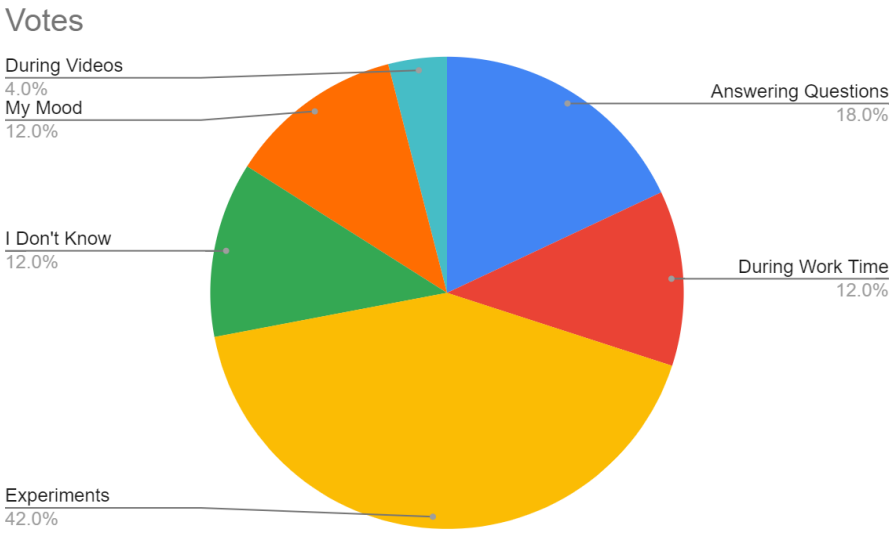


Chart 2 is made from data from the second question on the participants engagement survey, and focused on how participants show they are engaged in the classroom. This free response question generated six major themes from 30 participant responses. The most popular response, doing work, was stated by 10 participants out of the 30. The next highest theme, answering questions, was stated by seven out of the 30 participants. Talking was stated by five participants, and listening and doing what I'm told were both stated by three participants. The least theme stated, being in class, was given by two participants.

Question 3: When do you feel you participate the most in class?

Chart 3:



Data presented in was collected from the third question on the participant engagement survey and focused on when participants participate the most in class. This free response question generated six major themes from 26 participant responses. The most popular response, experiments, was stated 11 times out of the 26 total responses. Answering questions was stated five times, and my mood, during work time, and I don't know were each stated three times. The least given response, during videos, was given one time.

Question 4: If you do not understand the content, does that make you not participate in class?

Chart 4

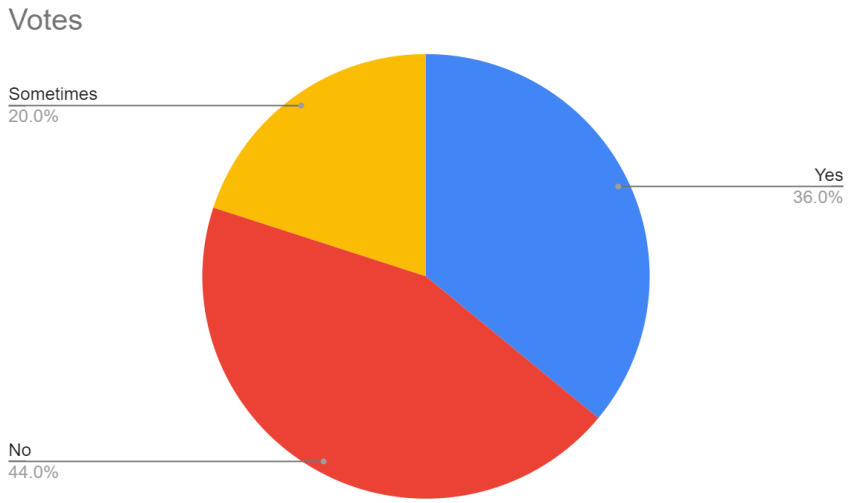


Chart 4 represents data collected on question four from the participant engagement survey. Participants were given three choices, yes, no, or sometimes to answer the question. The majority of participants, 11 out of 25, selected no. Nine participants selected yes, and the other five participants selected sometimes.

Research Question #3

How can the level of questioning during instruction impact student motivation in the 6th grade science classroom?

Data Tool 1: Participant Motivation Survey

Question 1: Rate how much you want to participate during class on a scale of 1-4.

Chart 5:

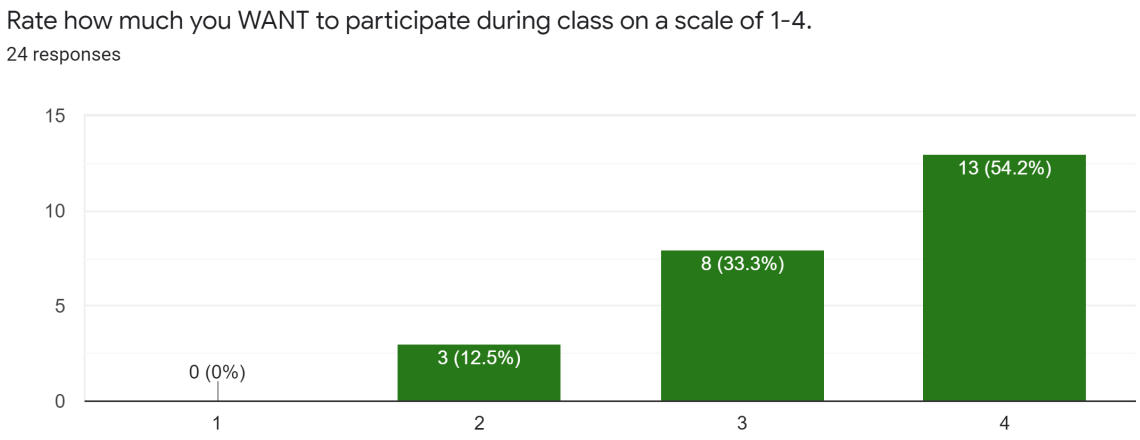
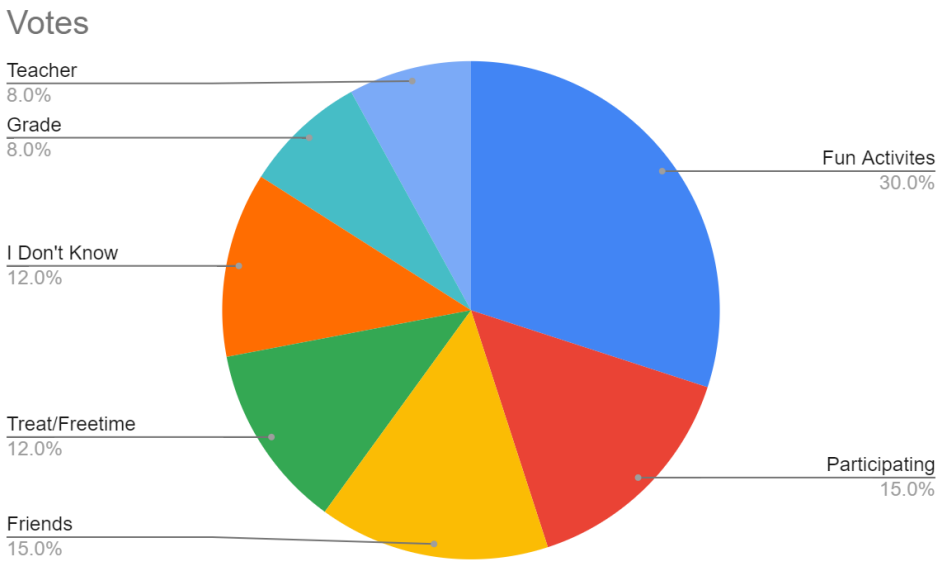


Chart 5 is from the first question on a participant motivation survey. The y-axis is the number of people that selected a certain number. Participants were asked to rate on a scale from one, I never want to participate, to four, I always want to participate, which is the x-axis. Zero participants selected one, three selected two, and eight selected three as their response. The most popular number selected, by 13 participants, was number four.

Question 2: How do you stay motivated in science class?

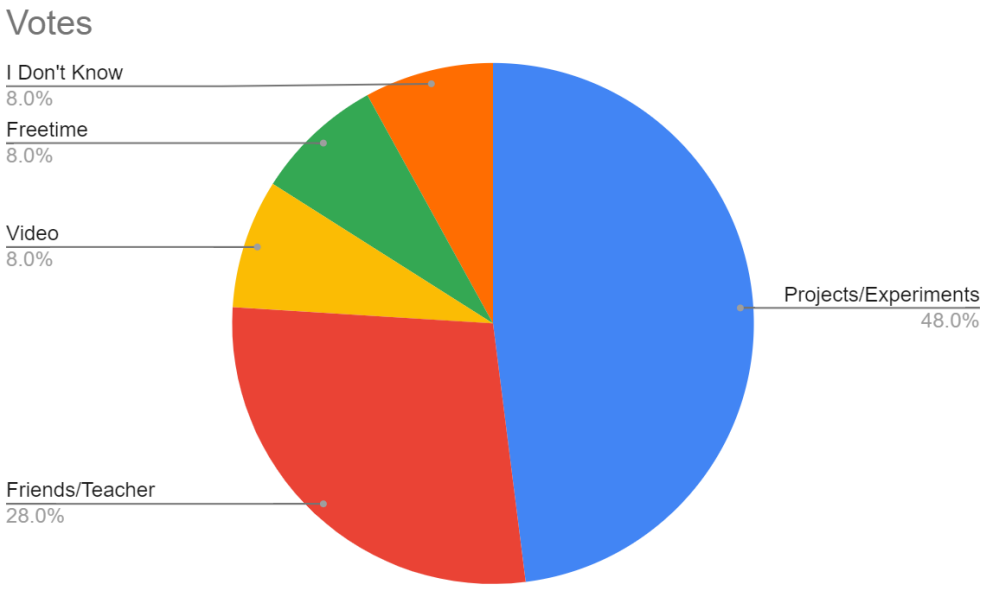
Chart 6:



Data presented in Chart 6 was collected from the second question on the participant motivation survey, and asked participants to state how they stay motivated in science class. This free response question generated seven major themes from 26 participant responses. The most popular response, fun activities, was stated eight times out of the 26 total responses. Participating and friends were each stated four times. I don't know and treat/freetime were each give three times. The least popular themes, grades and teacher, were each given twice.

Question 3: What makes you feel most motivated in science class?

Chart 7



Data represented in Chart 7 was collected from the third question on the participant motivation survey and asked participants to state what makes them feel most motivated in science class. This free response question generated five major themes from 25 participant responses. The most popular theme, projects/experiments, was stated 12 times out of the 25 total answers given. Friends/teacher was the second most popular theme with seven responses. Video, freetime, and I don't know were the least popular, and all were given twice.

Question 4: If you do not understand the content, does that make you not want to participate in class?

Chart 8

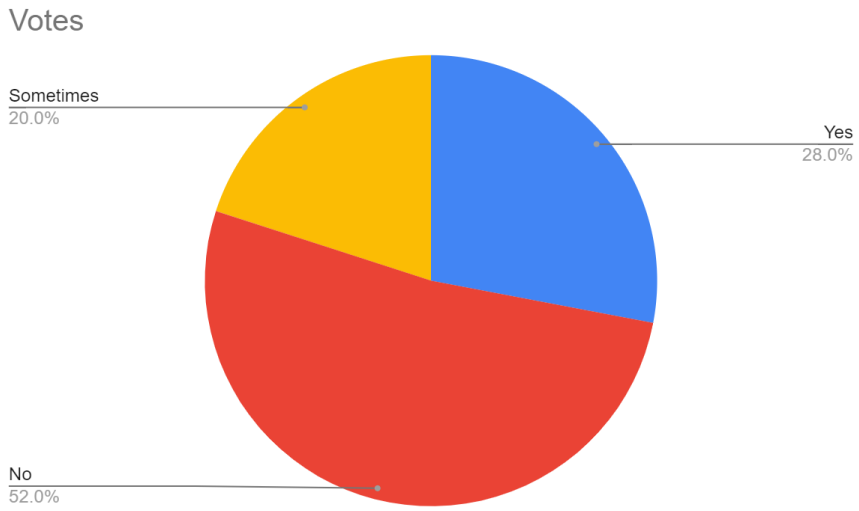


Chart 8 is created from data collected on question four from the participant motivation survey. Participants were given three choices, yes, no, or sometimes to answer the question. The majority of participants, 13 out of 25, selected no. Seven participants selected yes, and the other five participants selected sometimes.

Data Tool 2: Motivation Exit Slip

Question 1: On a scale of 1-4, how much did you want to answer the question, What is a force?

Chart 9

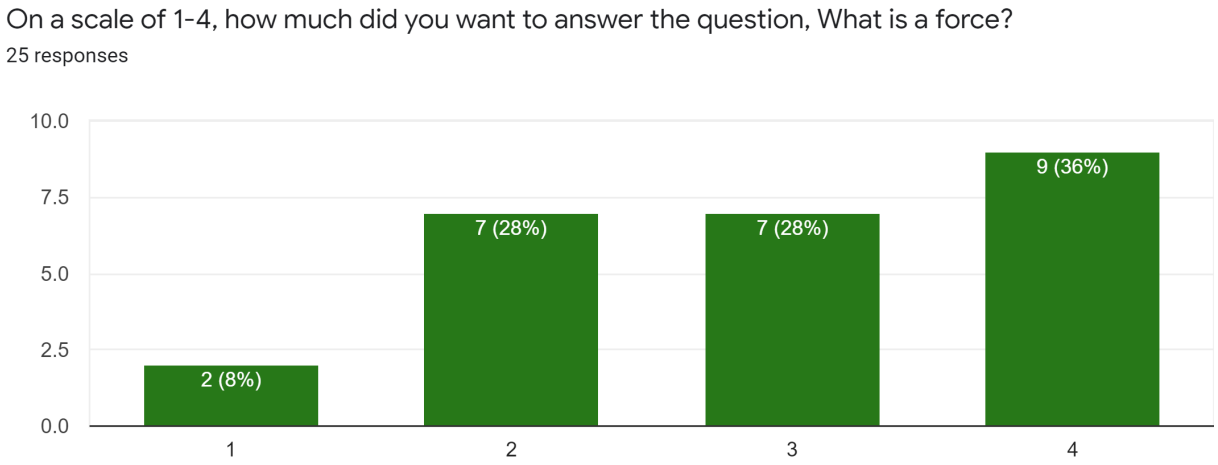


Chart 9 is from the first question on a participant motivation exit slip. It asked the participants to gauge their level of motivation for a lower level question. The y-axis is the number of people that selected a certain number. Participants were asked to rate on a scale from one, did not want to answer the question at all, to four, strongly wanted to answer the question, which is the x-axis. Two participants selected number one, seven selected number two, and seven selected number three as their response. The most popular number selected, by nine participants, was number four.

Question 2: How much did you want to answer the question, Why are some forces balanced and some unbalanced?

Chart 10

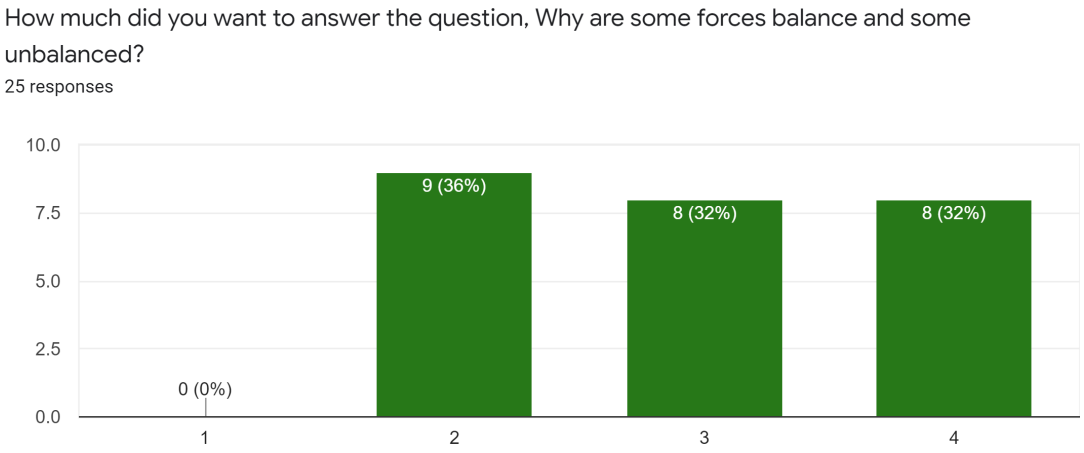


Chart 10 is from the second question on a participant motivation exit slip. It asked the participants to gauge their level of motivation for a higher level question. The y-axis is the number of people that selected a certain number. Participants were asked to rate on a scale from one, did not want to answer the question at all, to four, strongly wanted to answer the question, which is the x-axis. Zero participants selected number one, eight selected number three, and eighth elected number four as their response. The most popular number selected, by nine participants, was number two.

Discussion

Summary

The results provided from my data showed a mix of what I expected them to be and some surprising results. There did not seem to be a big significance in student performance in relation to different level of questions. When looking at the averages for each data tool used for student performance, there was a slight higher average for lower level questions. Majority of participants had higher scores on lower level questions for all data tools used for performance. This shows that participants seem more confident and have a better understanding of lower level

questions than higher level questions. The data also shows the pattern that students participate and show engagement equally among lower and higher level questions. The data also shows that the participants in the study do not have any more motivation for one type of question over the other. The data also shows that the participants feel more motivation and show more engagement when they are doing hands-on activities, such as experiments. The most surprising data was that even if participants do not completely understand the content being presented, they are still motivated to participate. They are not scared to get the answer wrong and will still try to answer to the best of their ability.

Limitation

The biggest, and most impactful, limitation to this study was the amount of time spent on collecting data. Data was to be collected from April 5th through April 30th, a four week period. Due to the COVID-19 pandemic, April 5th was the date that the school where the study takes place was returning to in-person learning for the first time this year. The participants in this study had been out of school since March 2020 and would be their first time entering the middle school building. Because April 5th was the first time in person, time was spent on getting to know the students, learning how to do in person school, and learning how a new school runs. This pushed the start date of the collection of data five days later than it was supposed to start. Also during this four week period, two whole days were spent on standardized testing. This left only two and half weeks of time to collect data. Because of the storage of time, two data tools could not be completed, group interviews and at-task checklist.

Conclusion

The data that has been collected can help teachers plan future lesson activities and questions to ask. As stated in the literature review, students feel more motivated and willing to

participate when meaningful content is being presented in a meaningful way. The data shows that students in a science classroom feel more motivated and engaged when they can do experiments and hands-on activities. While taking that into consideration, teachers can design a science lesson to include experiments. While focusing on level of questioning, it is important to consider that students seemed to slightly favor lower level type questions. This might be because they have a better understanding and feel more confident with fact based type questions. It is important to note that, based on literature review done, that to develop a deeper understanding of science content, there needs to be higher level questions. This will help ensure that students are able to apply the science concept to the real world and make stronger connections. But in order to grasp higher level questions, students first need to have a basic understanding of the science concepts being taught. This is why building a strong foundation around lower level questions is important for students.

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Appendix A: Pretest

To increase friction (make more of it) you could... *

- use sand
- use motor oil
- use wax
- use grease

Motor oil, grease, and wax are examples of this substance. *

- lubricant
- sand
- glue
- non lubricant

Trying to push heavy furniture, but not being able to move it *

- kinetic friction

Appendix B: Exit Slip

When all of the forces acting on an object are added together you determine the _____ of an object.

- ○ add
- ○ Net force
- ○ Newton
- ○ Unbalanced force

When the forces on an object produce a net force of 0 newtons, a _____ is produced.

- ○ Balance Force
- ○ add
- ○ subtract
- ○ Unbalance Force

Appendix C: Exit Slip

Joe Mauer, of the Minnesota Twins, hitting a home run, is an example of an unbalanced force. *

- true
- false

A light hanging from a ceiling is an example of a balance force. *

- true
- false

Appendix D: Final Summative Assessment Example Questions

When forces are going against each other should be *

- subtracted
- added
- multiplied
- divided

Moving friction - A skateboarder riding down a hill. *

- Kinetic friction
- static friction

All of the forces acting on an object is called the _____ *

- opposite force
- net force
- dark force

An example of static friction would be *

- Trying to push a car, but not moving it.
- Skiing down a hill
- sanding wood

You would weigh _____ on Jupiter than on the Earth because Jupiter is _____ *

- less, smaller
- more, smaller
- more, bigger
- less, bigger

Sanding would be a way to _____ friction *

- decrease friction
- increase friction

Appendix E: Engagement Survey

Rate how much you participate during class on a scale of 1-4. *

	1	2	3	4	
I never participate	○	○	○	○	I am participating every class the whole hour

How do you show engagement or participation in science class? *

Long answer text

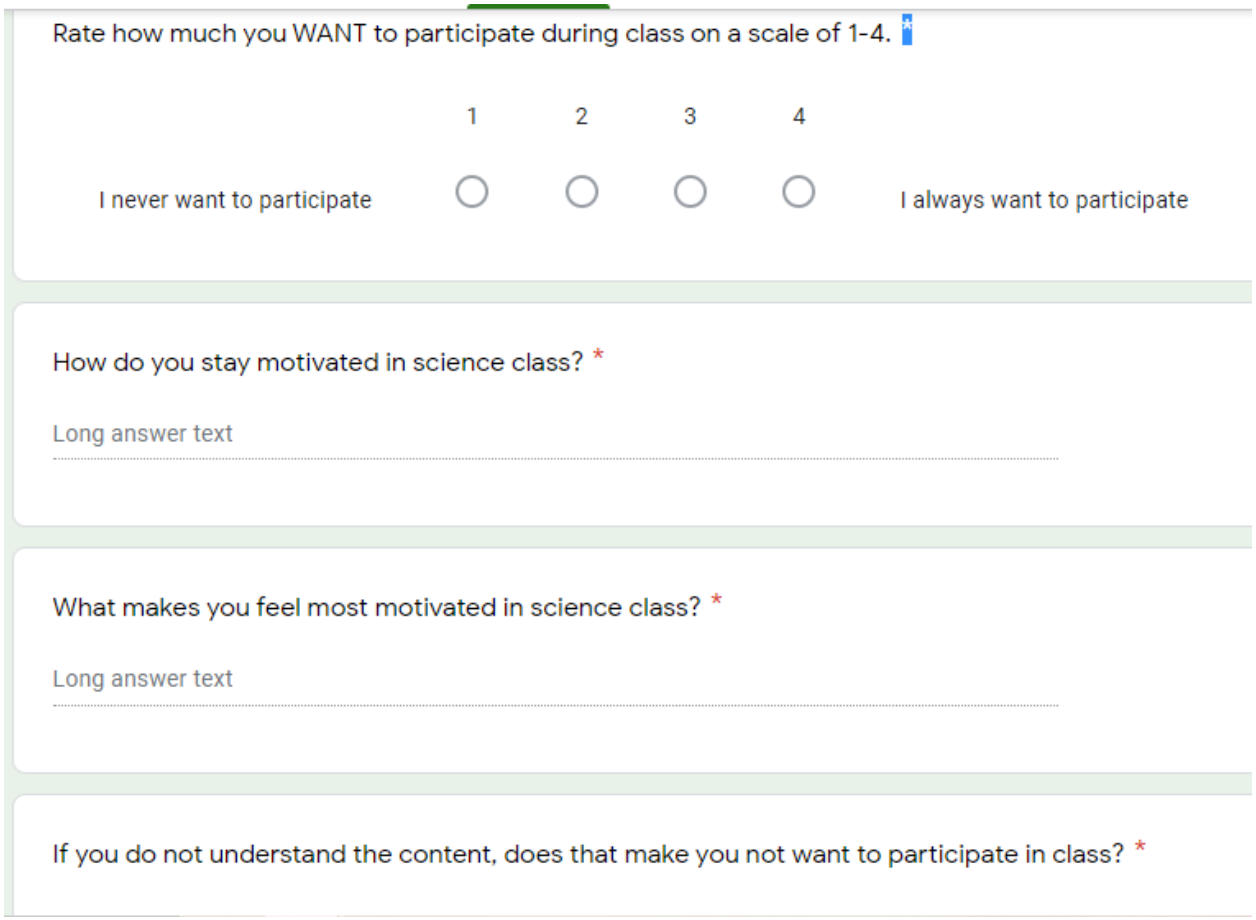
When do you feel you participate the most in class? *

Long answer text

If you do not understand the content, does that make you not participate in class? *

Short answer text

Appendix F: Motivation Survey



Appendix G: Motivation Exit Slip

On a scale of 1-4, how much did you want to answer the question, What is a force? *

	1	2	3	4	
Did not want to answer the question at all	○	○	○	○	Strongly wanted to answer the question

How much did you want to answer the question, Why are some forces balance and some unbalanced? *

	1	2	3	4	
Did not want to answer the question at all	○	○	○	○	Strongly wanted to answer the question