SOCRATIC SEMINARS IN A MIDDLE SCHOOL SCIENCE CLASSROOM

by

Elizabeth Dorene Davidson

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

of

Master of Science

in

Science Education

MONTANA STATE UNIVERSITY
Bozeman, Montana

July 2022

DEDICATION

To my mother, for leading me to the path of education

ACKNOWLEDGEMENTS

I would like to acknowledge my family, friends, and students for their patience through my completion of this degree. Thank you to Walt Woolbaugh for being the most encouraging advisor through the entire process. Lastly, thank you to my MSSE classmates, both virtually and in person, for the support, laughs, and adventures. Never knew riding long hours in vans with strangers could be so much fun.

TABLE OF CONTENTS

TABLE OF CONTENTS CONTINUED

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

ABSTRACT

The purpose of this action research was to examine the effects of incorporating Socratic Seminars in a middle school science classroom. Often in middle school science classrooms, whole class discussion turns into a question-and-answer session with the teacher, whereas the goal is for the discussion to be student-centered. Over the course of seven months, four Socratic Seminars were completed in two different 7th grade class settings, general and honors science. Students completed a pre-treatment and post-treatment survey using a Likert scale with open response explanations. During each seminar, students kept a note sheet and tracked the actions of their partner in the discussion, while the teacher recorded student participation and rated each seminar in terms of level of discussion and participation. In addition, other secondary teachers in the district that utilized Socratic Seminars were interviewed to compare experience and refine facilitating techniques. Majority of students in each treatment group agreed that Socratic Seminars were a valuable use of class time in science. Participation in the honors class was consistently high (above 70%), while participation in the general class grew from below 50% to 73% in the final seminar. Honors classes were more adaptable and reached greater participation level and depth of discussion. However, with proper scaffolding and practice, general classes were able to improve their participation rate. These seminars put a rigorous demand on students to contribute to class discussion. Overall, Socratic Seminars allow an opportunity for the teacher to conduct whole class conversations that are student driven.

CHAPTER ONE

INTRODUCTION AND BACKGROUND

Context of Study

Clark Intermediate School is a 7th through 8th grade public school in Clovis Unified School District in Clovis, California. For the 2021-2022 school year, 1500 total students enrolled at the school. In 2021, 66.9% of students were classified as socioeconomically disadvantaged, 8.3% were students with disabilities, and 3.8% were classified as English Learners. Our student population includes Hispanic or Latino (47%), White (35.6%), Asian (9.8%), Two or More Races (2.8%), African American (2.4%), Filipino (1.4%), American Indian (0.7%), and Pacific Islander (0.3%) students. My 7th grade class teaching schedule consists of two General/AVID (Advancement Via Individual Determination) Pathway Science Classes and three Honors Science classes.

Over the course of my teaching career, I have been interested in encouraging and supporting whole class conversations in a middle school science classroom. At the beginning of this action research project, whole class conversations were teacher driven, with students speaking primarily to the teacher instead of listening and speaking to each other. This led me to inquire about how I could improve whole class conversations to be more student centered rather than teacher driven.

My 7th grade science classroom is centered around working in groups. Every day students work in a variety of group sizes: from partners, to tables (3-4 students), to groups of tables (5-9 students), and as a whole class (30-40 students). During Spring 2021, our site science administrator helped me make initial observations in my classroom. This administrator made

observations of student discussions during a lab activity in two different class periods. Due to COVID social distancing protocols at the time, students were working in pairs during the lab activity. The administrator observed that all students were engaged in high levels of questioning and discussion while working through the labs.

Student discussion is essential in creating an engaging classroom where students feel supported in tackling rigorous content. After the observing administrator collected the initial data, I realized that my students did a great job of discussion when in smaller groups. However, I struggled to run an effective whole class conversation. Most of the time whole class conversations turned into more of a question and answer session between student and teacher. While attending an AVID teacher training in Summer 2021, I was introduced to the Socratic Seminar method for whole class discussion. This method seemed to provide support for whole class, student centered discussions. Socratic Seminars have the potential to help bridge the gap between deep small group conversations and whole class conversations. My hope is that my findings can also help other middle school science teachers, both at my school site and beyond, promote whole class discussions in their own classrooms.

Focus Questions

My primary action research question is, What are the effects of whole class discussion in the middle school classroom?

My sub-questions include the following:

1. Do Socratic Seminars provide an environment that fosters productive student dialogue?
2. How does incorporating regular Socratic Seminars affect the student?

3. How does incorporating regular Socratic Seminars affect the teacher?

CHAPTER TWO

CONCEPTUAL FRAMEWORK

Theoretical Framework

Next Generation Science Standards (NGSS)

Beginning in 2013, the Next Generation Science Standards updated K-12 science education by emphasizing three dimensions in performance expectations. These dimensions are crosscutting concepts, science and engineering practices, and disciplinary core ideas. When a teacher follows NGSS performance expectations, there is a natural progression to go from less rigorous, memorizing science activities to more rigorous, student-centered science investigations. As in any classroom, putting more expectations on the students can offer learning opportunities and challenges, especially to traditionally underserved student groups. Therefore, teachers need to intentionally employ strategies to help guide students through student centered scientific discovery (NGSS Lead States, 2013).

Focusing in on student discussion, there is an opportunity to utilize classroom discourse to help support the science and engineering practices (SEPs). In addition to science sense-making, SEPs also include language use. SEPs help transition students from "naïve conceptions of the world to more scientifically-based conceptions" (NGSS Lead States, 2013, p. 5). A key to this transition is supporting the incorporation of scientific language, which requires students to participate in science discourse. Besides reading, writing, and modeling, it is also important for students to be able to verbally present ideas and engage in argumentation with other students. With these intentions set by NGSS, teachers need to adapt to shifting the main voice of the classroom over to the students, while also helping support students in this transition.

Talk Strategies in a Science Classroom

In wanting to elicit more student conversation in a classroom, the teacher needs to provide structure to support students' sharing ideas and responding to peers. Before starting a class conversation, the goals for the conversation should be identified. For whole class discussion, this could be eliciting initial thoughts and ideas about a phenomenon or connecting classroom activities to big scientific ideas. Within this conversation, a teacher needs to consider the cognitive demands of the questions and tasks. Lower cognitive demand questions include recall of concepts/vocabulary definitions or procedural tasks. Higher cognitive demand questions require students to do something with ideas, and don't always have discrete answers (Windschitl et al., 2018). For example, students considering and arguing various viewpoints in a debate over whether natural diamond mining should be stopped now that we can make diamonds in a lab. While there is a place for lower cognitive demand questions in classroom discussion, a teacher should aim to have student discussion reach higher cognitive demand.

Ambitious Science Teaching (Windschitl et al., 2018) examines many discourse moves that can be utilized by the teacher to prompt higher cognitive demand in student conversations. The two applicable for this study are teacher follow-ups and opening up to cross-talk.

As the name suggests, a follow-up is when the teacher requests something more from a student who has made a comment. This could include asking the student to tell the teacher more about their thinking or describe it in a different way. This follow up shows students their voice is valued, and the teacher genuinely wants to hear more about their thinking (Windschitl et al., 2018).

Opening up cross-talk, or peer-to-peer talk, allows students to respond to each other with the support of a teacher providing probing questions to encourage the academic discussion. In

order to have cross-talk work effectively, a teacher must create special norms and routines in the classroom (Windschitl et al., 2018). Students must be willing to participate, listen to other students, and respect everyone's voice in the classroom. By setting the foundation of peer-to-peer talk, over time the teacher can step back from the leader role and allow the academic conversation to be student driven.

Windschitl et al. (2018) advises that for any talk strategy to be effective, there is a need for strong norms, predictable routines, and strategic scaffolding within a classroom. In addition to setting strong norms (respect for others, equitable participation, etc.), the teacher can also put in place a reflection on the class discussion at the end of class. This can include student reflections on how well the norms were followed, what went well, and what might need to be improved next time. This helps reinforce the norms set for student discussion. By putting in place predictable routines, students understand what their roles are during the discussion and are more prepared to participate.

Lastly, the teacher needs to remember that students will need extra support when learning how to participate in a whole class discussion. This could include sentence starters aimed around adding to a peer's comment, asking for evidence or reasoning behind a claim, asking for clarification, or respectfully disagreeing with an idea. By providing sentence starters, students get support and ideas on how to appropriately add into the classroom discussion (Windschitl et al., 2018).

Another helpful scaffold strategy is adding a written component to the whole class discussion. Lower rigor questions, such as retention of facts and simple concepts, can be obtained through pure class discussion, but for retention of higher rigor material, like integrated

knowledge, writing can help students organize and remember key points from the discussion later (Rivard & Straw, 2000).

With the many different strategies available, the best whole class discussion appears to happen when multiple strategies are applied. Colley and Windschitl (2016) saw that when only one strategy was applied by the teacher in 4th and 5th grade classrooms, only 4% of class discussions had examples of rigorous whole-class talk. Meanwhile, in 65% of the class discussions that contained higher rigor responses, multiple talk strategies were employed by the teacher. In this study, the most impactful set of strategy combinations was use of open-ended questions, follow up prompts, and direct reference to a recent activity. In addition, two other strategies, though used less often, had a strong association with the higher rigor conversations: think-pair-shares and prompting students to comment on another peer's idea.

Challenges in Implementation of Talk Strategies. When implementing new strategies into the classroom, there are many challenges to overcome. Challenges from students are to be expected, but many studies have shown challenges from teacher implementation as well.

Teachers bring engrained strategies from their own schooling and previous years as an educator that limited student involvement. Even when teacher intend to shift the learning responsibility into the hands of students, a lack of skills to succeed can result in a teacher not giving students enough time to respond, providing answers before the students, or posing questions that only have one right answer (Jiménez-Aleixandre et al., 2000). In other instances, when students did participate in discussions, the teacher had tendencies to position themselves as the main directors, evaluators, or feedback providers. In this position, almost all discussion is between student and teacher, with few instances of students interacting directly with each other (Pimentel & McNeill, 2013).

While difficult to accurately collect data in a small study, Ryu and Sikorski (2019) emphasizes in their conclusions that a student's verbal participation extends beyond the verbalized language and also includes paralinguistic features, body gestures and postures, and spatial arrangement of participants and artifacts. Their study urges teachers to think of how their whole-class discussion practices, such as gaze, speech, and interactions with students, may heighten inequitable dynamics among students. Race, gender, English proficiency, and other institutionalized labels could discourage students from recognizing certain peer's scientific ideas. This is something for a teacher to critically reflect on when attempting to create a more equitable learning environment through student discussion.

Direction of Work

Socratic Seminars

After considering many different types of talk strategy structures to incorporate, I decided to focus on running Socratic Seminars in my classroom. Socratic Seminars, named after the classical Greek philosopher Socrates (470-399 BC), place emphasis on empowering students to build their own understanding and think analytically through dialogue and questioning. Key elements of a Socratic Seminar include the text, classroom environment, questions, and seminar structure (Chowning, 2009)

The text can be any type of artifact that has value that can relate back to core ideas in the subject area. It is important to choose text that is grade-level appropriate in terms of complexity and concepts being studied. The teacher should also strive to choose a text that allows for different interpretations (Chowning, 2009).

During a Socratic Seminar, the classroom is rearranged so all students are facing each other. This promotes a dialogue between the students, instead of between the students and

teacher. If the teacher chooses to join the circle, they need to sit at the same level as the students (Chowning, 2009). One way to accommodate larger class sizes is utilizing the fishbowl method. With this method, students would sit in two concentric circles. The inner circle are the speakers in the discussion while the outer circle are the silent support partners (Griswold et al, 2017).

Questions are the cornerstone of the Socratic Seminar. The teacher should have several questions prepared in advance (Chowning, 2009). These questions can range from literal questions ("What does the data show?), interpretive questions ("What does the data mean?"), to evaluative questions ("How might this apply to you?") (Griswold et al., 2017).

Finally, the teacher must think of the structure of the seminar. This includes providing time for students to examine and think about the artifact prior to the seminar, refocus off task conversation during the seminar, help summarize main points being presented, and guide students through a reflection of how the seminar went at the conclusion (Chowning, 2009). In providing structure, unique classroom norms should be set up that apply to the Socratic Seminar. For example, while hand raising might be more appropriate during "normal" classroom routine, in a Socratic Seminars students are encouraged to listen to each other and build off what others are saying, like during a respectful conversation around a dinner table (Griswold et al, 2009).

Chowning (2009) addresses the fears that teachers might have when beginning to implement Socratic Seminars, such as giving up control to students for the discussion. However, if students are properly prepared and supported in the Socratic Seminar, they often rise up to the more mature discussion. Cohesion among students is also observed as students work together to think through challenging concepts. While it might be challenging to begin the process, many rewards in student centered discourse can be achieved through the implementation of Socratic Seminars.

Data Collection

To bring a quantitative approach to analyzing whole-class discussions, Ryu and Sikorksi (2019) collect a number of learners, time allotted for whole group discussion, total learner turns of talk (turns/min), and a specific student's total turns of talk (percent of total learner turns and percent of whole group discussion) for each day they collected classroom discussion data. In order to examine different student groups, beyond collecting total time of whole group discussions and amount of time each student talked, a few students can be chosen to complete detailed quantitative analysis on.

While most of the data collection and analysis is focused on teacher strategies, student artifacts can also help tell the students' perspective and takeaways from the whole class discussion. Beyond collected audio recordings of the classroom discussions, Short et al. (2020) collected students' written claim, evidence, and reasoning (CER) responses and reflections on classroom discussions. There was a baseline CER assignment given to students before the treatment in order to compare to post-treatment CER responses. In addition, student reflections can show student attitudes towards whole-class discussion and any insights on how to better provide scaffolds and other teacher strategies to support the students in whole-class discussion.

CHAPTER THREE

METHODOLOGY

Demographics

All five of my class sections, including two General/AVID sections and three honors sections, received the treatment during the regular school year. However, to account for student absences, relocations, or new students, only students that met the following criteria were considered as part of the treatment groups: 1) completed pre-treatment survey, 2) completed post-treatment survey, and 3) participated in all four Socratic Seminars. With my two levels of class sections, one treatment group consists of 23 students from my General/AVID classes and the other treatment group consists of 64 students from my Honors classes. The research methodology for this project received an exemption by the Montana State University's Institutional Review Board and compliance for work with human subjects was maintained (Appendix A).

The general class sample contains 23 students, 16 males and 7 females. Eleven students are in the AVID pathway, 3 students are classified as English Language Learners (two moderately developed, one somewhat developed), 2 students have a 504 plan, 1 student is in foster care, and 1 student is in our district's transitions program (additional support to improve students academically, emotionally, and socially). Student ethnicities, as reported in the school's student information system, is shown in Figure 1.

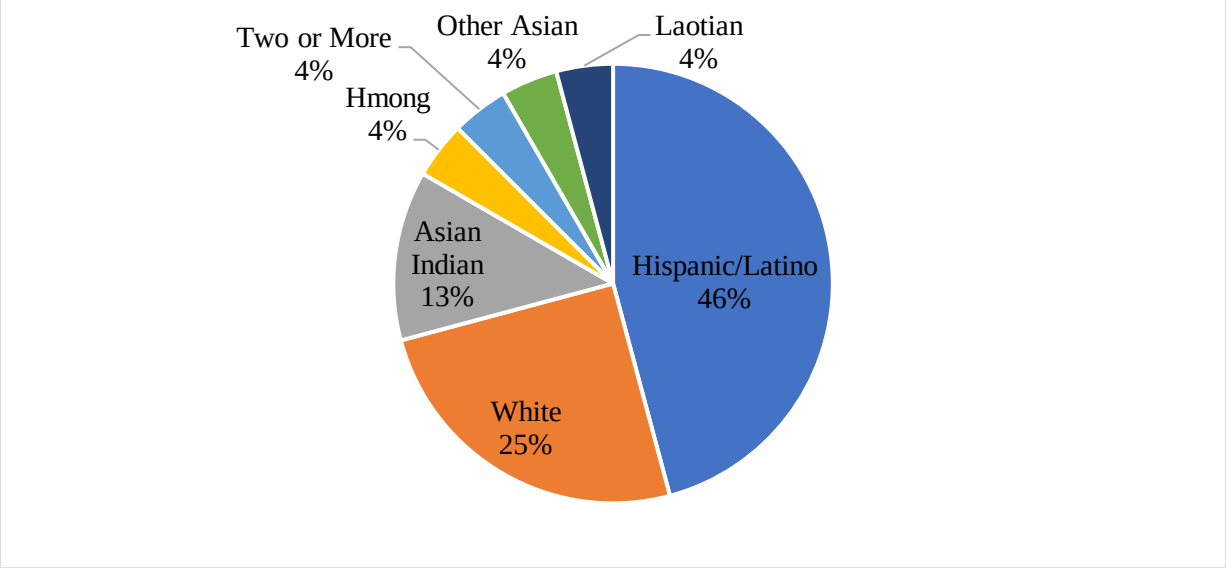


Figure 1. General class sample student ethnicities, (*n*=23).

The honors class sample contains 64 students, 30 males and 34 females. Eighteen students are in the GATE (Gifted and Talented Education) program, 11 students are reclassified fluent English proficient, 4 students are on the AVID pathway, and 2 students have a 504 plan. Student ethnicities, as reported in the school's student information system, is shown in Figure 2.

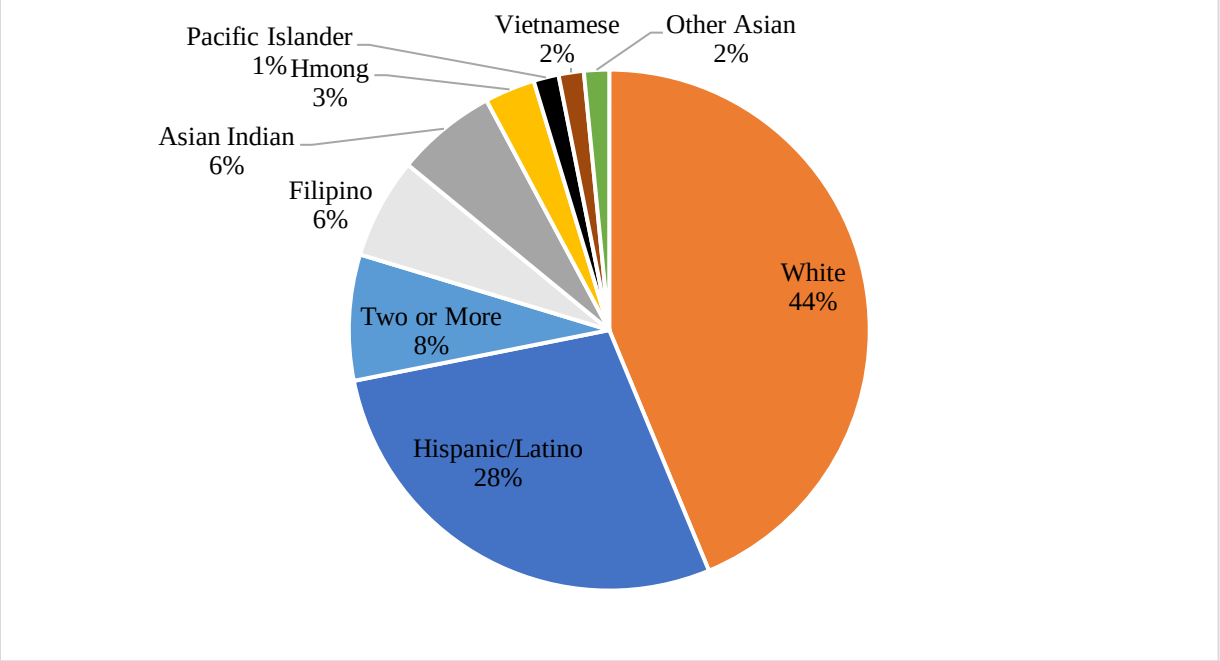


Figure 2. Honors class sample student ethnicities, (*n*=64).

Treatment

Socratic Seminars are the treatment method being used to improve whole class discussions in my action research project. The majority of support materials for implementing Socratic Seminars are taken from AVID program materials that I have access to through my district's subscription. The remaining materials I have created myself.

The goal of Socratic Seminars is for students to think for themselves rather than the teacher providing all the "right" answers. Students gain a deeper understanding of complex ideas through rigorous and thoughtful dialogue. AVID breaks down a Socratic Seminar into four elements: the text, the question, the leader, and the participants.

The Socratic Seminar focuses around a text. A text can be a traditional reading, but can also extend to items such as videos, graphs, diagrams, pictures, songs, or any medium that can be examined and questioned. It is important for the text to be rich and provide an opportunity for

students to respond with thoughtful dialogue. In my treatment, each Socratic Seminar utilized a different type of text: classroom posters/materials, a news article, a photo, and YouTube videos.

Once the text is selected, the leader chooses a question to begin the Socratic Seminar. This leading question should be open-ended and have no right answer. The leading questions used for the four Socratic Seminars in my treatment are as follows: 1) Why do we study science? 2) Should hunting be used for population control? 3) How can you walk on fire/hot coals without burning your feet? and 4) What makes a good scientist? A good practice is to also have the opening question include references to the text to remind participants to utilize the given resource. After the opening question, other questions might also be introduced by the leader or participants. It is best for these questions to come up organically rather than be pre-determined by the leader.

The leader's role is to facilitate the discussion. How the leader goes about doing this depends on the question of the Socratic Seminar and also the level of involvement of the participants. Each group will be different in their approach and involvement in a Socratic Seminar. Overall, the leader should make sure the participants keep the discussion centered around the text, ask follow-up questions when needed, help participants clarify statements when arguments become confusing, and make sure participants are including all peers in the conversation.

The participants are the main players in the Socratic Seminar. A good participant is one that studies the provided text closely, listens to others, responds to others with their own ideas and questions, and continually searches the text for more evidence during the discussion.

An important feature of a Socratic Seminar is that the discussion is meant to be a dialogue instead of a debate. There is no "winner" of a Socratic Seminar. Instead, the participants work together to discuss and question different perspectives about the text.

Because of my large class sizes ranging from 30-40 students, I use the concentric circle model for the Socratic Seminar. In this model, the class is divided into "pilots" (inner circle) and "co-pilots" (outer circle). Pilots are the students that are actively speaking. Co-pilots sit behind their pilot partners. The co-pilot's job is to listen and be ready to provide support to the pilot through short, partner discussions when the leader enforces a break from the class discussion. In most of the Socratic Seminars in my treatment, there is a prompted opportunity for the pilot and co-pilot to switch positions.

Students receive a Socratic Seminar notes sheet (Appendix B) to use as they participate in the Socratic Seminar. This notes sheet varies based on the question and text of the seminar, but overall provides a place for students to write down ideas before, during, and after the seminar discussion. The end of the notes includes a minute paper question for students to record their final answer to the seminar question. There is also goal setting in student's own participation in the seminar with a reflection question on the success of meeting that goal. The notes sheet is submitted after the seminar as an exit ticket.

While the Socratic Seminar is occurring, I use the Socratic Seminar tracking form (Appendix C) provided by AVID. This form helps track the conversation to see the flow of student dialogue. This includes seeing if all students spoke in the conversation as well as tracking if any students dominated the conversation. To go along with teacher tracking, co-pilot students fill out the student observation check list (Appendix D) from AVID. This guides co-pilots to pay attention to the conversation and gather evidence to see if their co-pilot is participating in the

conversation. In addition, this data can help me as the teacher track the participation of an individual or group of students.

AVID provides a Socratic Seminar assessment for leaders of the seminars (Appendix E). After completing a seminar in each class period, I, as the leader, fill this form out to gather immediate thoughts and feelings towards the success of each given seminar.

A student survey (Appendix F and G) regarding classroom discussions is given to students before the first Socratic seminar and at the conclusion of the last Socratic Seminar in the action research data collection period. This survey sees possible changes in students' attitudes and confidence throughout the implementation of Socratic Seminars.

Lastly, I keep a teacher journal in Google Docs to record my thoughts and observations after each Socratic Seminar that I run with my students. I also survey (Appendix H) other secondary teachers in my district who have tried out Socratic Seminars in either current or previous school years to see if their experiences and observations parallel my own.

The treatment began the first week of school in August 2021 with the pre-treatment student surveys and the first Socratic Seminar. The second Socratic Seminar was in October 2021, the third in December 2021, and the last Socratic Seminar was in March 2022. Students completed the post-treatment student survey in March 2022.

Data Collection and Analysis Strategies

Data collection instruments are divided into three parts: pre-treatment and post-treatment student surveys, instruments used during the Socratic Seminars, and teacher journal and surveys. A complete matrix showing which instruments are being used for each question can be seen in Table 1.

Table 1. Research design matrix. Asterix next to instrument means it was made by the AVID organization.

Research Sub Questions	Student Observation Check List*	Socratic Seminar Tracking Form*	Student Survey	Student Socratic Seminar Notes/Exit Ticket	Teacher Socratic Seminar Assessment*	Teacher Journal	AVID Teacher Survey
1) Do Socratic seminars provide an environment that fosters productive student dialogue?	X	X	X				
2) How does incorporating regular Socratic seminars affect the student?		X	X	X			
3) How does incorporating regular Socratic seminars affect the teacher?					X	X	X

The student pre-survey (Appendix F) and post-survey (Appendix G) were given to the students on paper before the first Socratic Seminar and immediately after the conclusion of the last Socratic Seminar. The two surveys contain the same five Likert scale survey questions. The aim of these surveys is to capture each treatment groups overall attitude towards Socratic Seminars and whole class discussions before and after implementing the treatment. By graphing this data, the median and average response for each group can be captured, as well as any outliers. Comparison can be made between the two treatment groups as well as before and after the implementation of the Socratic Seminars. The surveys were examined and revised during MSSE 509 – Implementing Action Research in Science by Walt Woolbaugh and peers in the class. This helped me insure validity of the survey questions in answering my focus questions.

For each Likert scale questions on the survey, students have a space below to explain why they circled their answer. This allows open ended feedback to see what common thoughts among students were or if a student might not have understood the statement being evaluated. These responses help my understanding of the quantitative Likert scale responses.

At the end of the pre-treatment survey and post-treatment survey, there are one to two open ended questions for students to respond to in order to gain insight. For the pre-treatment survey, students are asked about their prior experience speaking in front of others. Looking through responses shows where students are with comfort levels of speaking as they enter my class for the school year. For the post-treatment survey, students are asked which of the Socratic Seminars were their favorite, why it was their favorite, along with a yes/no response to use of Socratic Seminars in other classes. Seeing which Socratic Seminar is enjoyed by my students allows me to make decisions on either source material or questions that students responded positively to. Also, knowing whether students are going through this practice in other classes helps me to see if students are getting whole class discussion experience in other classes besides science.

During each of the four Socratic Seminars, four instruments are in use to capture the class discussion as much as possible on paper. First, students have a note sheet (Appendix B) that captures their initial and final thoughts about the question, their goal for the Socratic Seminar, and their reflection if they achieve their goal. This note sheet is turned in at the end of the Socratic Seminar. The note sheet showed to be reliable as throughout all four Socratic Seminars and multiple treatment groups, students were able to follow directions and fill out the note sheet during the Socratic Seminar process.

For analysis, I focused on the goal setting portion, as I didn't want to critique verbal discussion based on writing skills in looking at the final thoughts. For each Socratic Seminar, students are asked to write a measurable goal from four given categories: 1) Respectful conversation 2) Participation 3) Restate the ideas of others and 4) Refer to evidence to support ideas. In analysis, I categorize each student's written goal to graph and see which categories are the most common and how that might change over the four Socratic Seminars. I also look at student's goal reflection to see whether they achieved their goal. This data is shown by comparing percentage of students who achieve their goal in each seminar and then looking at this data in a series across all seminars.

The other instrument students have with them during each Socratic Seminar is the observation checklist (Appendix D). This checklist is from the AVID organization provided to AVID school subscribers. The intention for this sheet is to have students in the co-pilot role track how their pilot is engaging in the discussion. The analysis of this instrument includes looking at how many students were utilizing this checklist correctly to see if it is a useful tool to include in a Socratic Seminar. This also connects to a question on the student survey on if tracking their pilot during the Socratic Seminar helps them be a better participant.

During each Socratic Seminar, there are two instruments utilized by the teacher. First, during the discussion portion of the Socratic Seminar, I take notes on the Socratic Seminar Tracking Form (Appendix C). The tracking form is from the AVID organization provided to AVID school subscribers. On this form, I record the flow of conversation that allows me to calculate the percentage of students who spoke during each Socratic Seminar. I also keep time notes to see how long each Socratic Seminar takes overall as well as how the time during the seminar is divided (for example, when the pilots and co-pilots switch roles). At the end of each

Socratic Seminar for each group, I fill out the Socratic Seminar Assessment for Teachers (Appendix E). This form is from the AVID organization provided to AVID school subscribers. This allows me to give a quantitative ranking in the moment on how the Socratic Seminar went with each group of students. It also gives me an opportunity in the moment to put down thoughts for improvement. Both the quantitative and qualitive data from these forms helps me see how Socratic Seminars might evolve over the course of the treatment.

The final pieces of my data collection and analysis are the teacher journal and the teacher survey. For the teacher journal, I keep a Google Doc on my work computer that I can access anytime during the school day. I make a point of journaling after every Socratic Seminar, but also add an entry whenever a thought comes up between Socratic Seminars or while prepping for the next one. This qualitative data helps look for common themes and reminds me of any breakthroughs or struggles I have along the way. The teacher journal validity is obtained through triangulation with the Socratic Seminar Tracking Forms (Appendix C), the Socratic Seminar Assessment for Teachers (Appendix D), and Student Post-Treatment Surveys (Appendix G).

This teacher journal pairs with the teacher survey (Appendix H) I sent out via Google Form to other AVID teachers in my district. I chose to email AVID teachers because they are most likely to use Socratic Seminars in their classrooms. With the responses to these questions, I hope to compare my own experience in implementing Socratic Seminars to other teachers' experiences. The teacher survey was vetted in MSSE 509 - Implementing Action Research in Science by my peers and professor Walt Woolbaugh to help insure validity in connection to my research question and sub questions.

CHAPTER FOUR

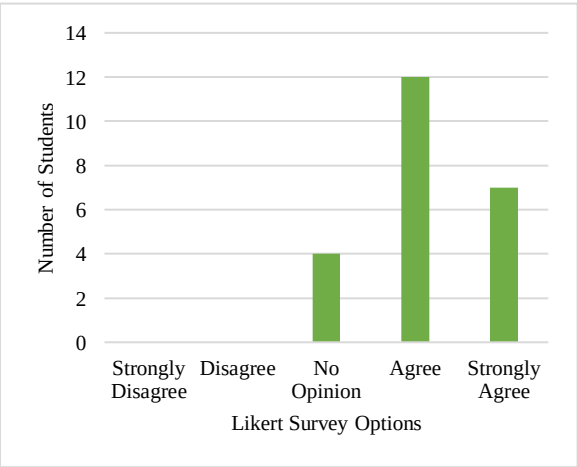
DATA ANALYSIS

Results

Sub Question 1

The first sub question asks if Socratic Seminars provide an environment that fosters productive student dialogue. Three instruments are used to provide evidence for this question: student pre-treatment and post-treatment survey (Appendix F and G), student observation check list (Appendix D), and the Socratic Seminar tracking form (Appendix C).

On the student pre-treatment and post-treatment survey, students responded to the following statement on a Likert scale: "I see class discussion (Socratic Seminars) as a valuable use of class time in science". For both treatment groups, few students knew what a Socratic Seminar was before taking the pre-survey. These students were directed to circle "No Opinion" and explain this in the open response area below the question. The general and honor sections pre-survey and post-survey responses are graphed in Figures 3 and 4.



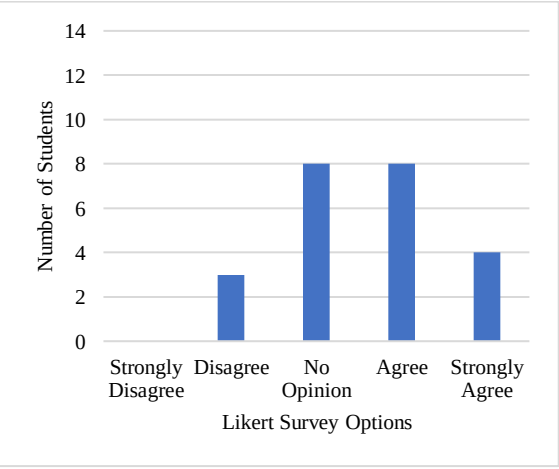


Figure 3. General science responses to "I see class discussion (Socratic Seminars) as a valuable use of class time in science," (*n*=23). Pre-treatment survey responses on the right and post-treatment survey responses on the left.

For the general science treatment group, no students selected "strongly disagree" in either the pre-treatment or post-treatment survey. The median response in both surveys were "Agree." In the post-survey, eight students who "agreed" or "strongly agreed" with this statement said they learned from others in Socratic Seminars and expressed this was helpful to them. Student 121 who choose "Agree" in the post-survey explained, "I think it's a good way to get out ideas and thoughts and help students feel more comfortable with public speaking." The three students who chose "disagree" in the post-treatment survey explained they disagreed because no one talks during the Socratic Seminars.

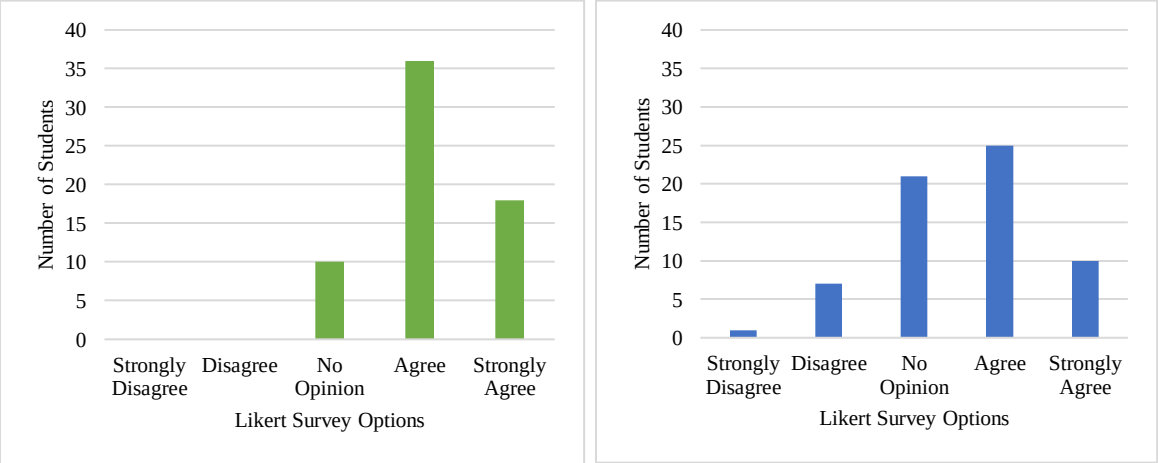


Figure 4. Honors science responses to "I see class discussion (Socratic Seminars) as a valuable use of class time in science", (*n*=64). Pre-treatment survey responses on the right and post-treatment survey responses on the left.

In the Honors science treatment group, the median response for both surveys was "Agree". While no students selected "strongly disagree" or "disagree" in the pre-treatment survey, eight students choose these responses in the post-treatment survey. Three students who chose "disagree" or "strongly disagree" mentioned not focusing during the Socratic Seminars. Among the 21 students who selected "No Opinion" in the post-treatment survey, these students

expressed they could see where Socratic Seminars could be beneficial but were facing a challenge or interruption. For example, student 205 said, “I think they can be very beneficial but when it is dominated by one person it loses purpose.” In addition, student 427 said, “Many people giggle or laugh or don’t speak, but some people do speak. I feel this makes it more valuable to some people than others.” Interestingly, student 402 who choose “Strongly Agree” to this statement stated, “While I’m not good at speaking in them, I believe that Socratic Seminars help build class unity and help to aid in collaborative knowledge.”

On the pre-treatment and post-treatment surveys, students responded to the statement, “Tracking my co-pilot’s participation helps me become a better participant in science class discussion.” In the pre-treatment survey for both treatment groups, most students chose “No Opinion” and stated they did not understand what the statement meant. This is to be expected because this was before the first Socratic Seminar and before introducing the pilot and co-pilot set up. The post-survey responses for both treatment groups are in Figure 5.

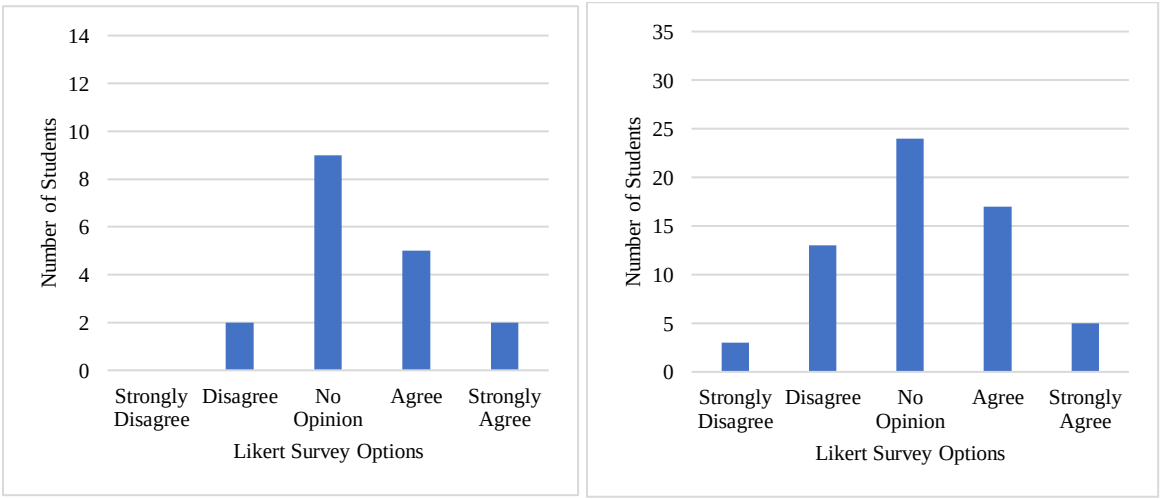


Figure 5. Post-treatment survey responses for “Tracking my co-pilot’s participation helps me become a better participant in science class discussions (Socratic Seminars)” for general treatment group, (*n*=23), and honors treatment group, (*n*=64).

In Figure 5, the median response for both treatment groups was “Agree”. Student 111 from the general treatment group stated, “When I talk to my co-pilot they give me add-ons to my idea before I say it to everybody so it connects more.” Students 204 and 206 from the honors treatment group said that having a co-pilot gave them courage to speak during the seminar. In both treatment groups, most students chose the “No Opinion” option. Many students in the honors treatment group who chose this option expressed that usually their partners don’t talk at all or that it wouldn’t make a difference to them if they had a co-pilot. In addition, two students in the general student group chose “Disagree” because their partners didn’t talk in the seminar. Lastly, Student 209 in the honors treatment group who chose “Disagree” explained, “I forgot to listen to the conversation while I am writing down what my partner is doing.”

To help co-pilots track their pilot partners, the student observation checklist was handed out to each student for the second, third, and fourth Socratic Seminars. The intention for this instrument was to help the co-pilot observe their pilot and recognize key components of the conversation and keep a record. Unfortunately, this turned out to be a tool that was not well utilized and might have been too much for the students to handle during the conversations. The completion rates of the student observation checklist in each seminar for each treatment group can be seen in Figure 6 and Figure 7.

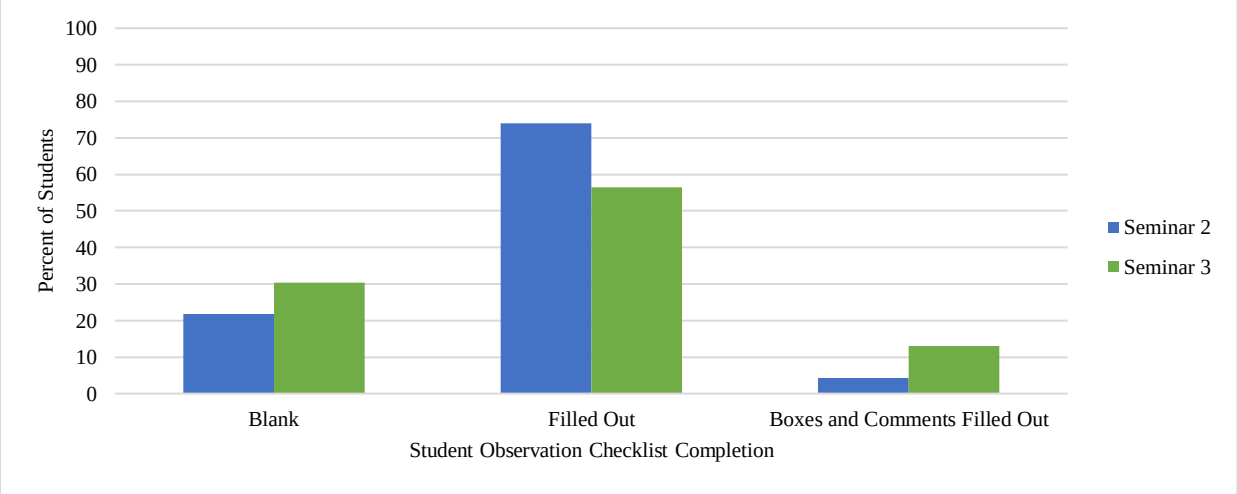


Figure 6. General science student observation checklist completion, (*n*=23). The general treatment group did not get the tracking form for the fourth Socratic Seminar as an attempt to see if eliminating this paper would allow for more participation in the discussion.

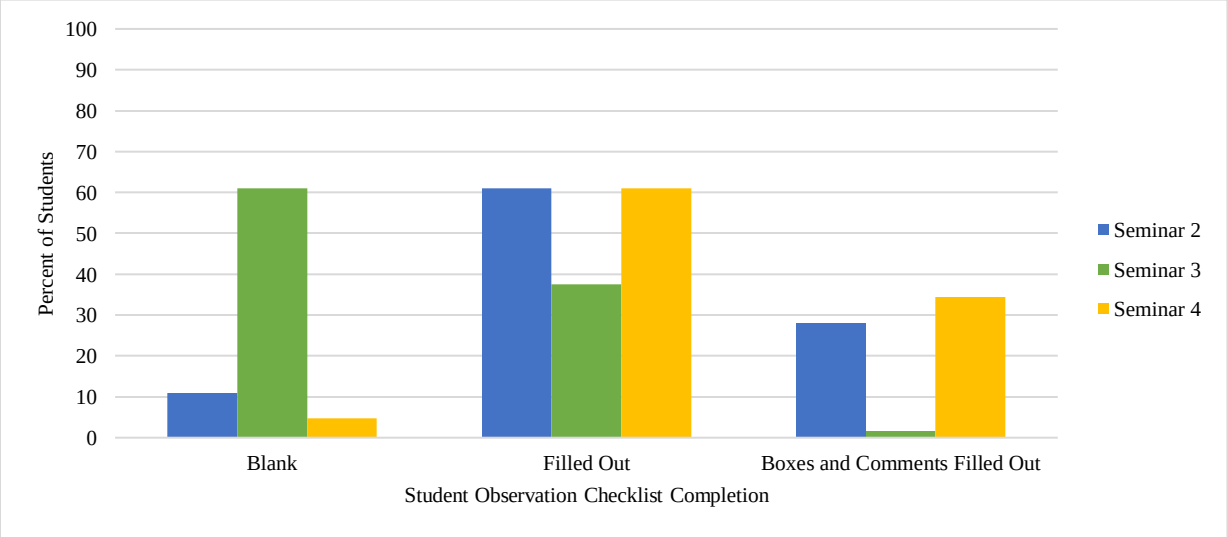


Figure 7. Honors science student observation checklist completion, (*n*=64). In Seminar 2, time for the seminar was cut short and did not allow for pilots and copilots to switch roles. Therefore, more papers were left blank because half the students didn't get to be a co-pilot.

Majority of students in both treatment groups would fill out the top part of the paper by checking a few boxes. However, I do not believe that the check marks were accurate on the boxes. First, most of the check marks among students were in the first two rows. These two rows represented "speaks in discussion" and "makes eye contact with other speakers as she/he

speaks." The other boxes down the list, such as "refers to the text", "responds to another speaker", or "engages in science conversation" were rarely checked by the students, even though these things happened more regularly than this instrument would suggest. For both treatment groups, this paper was too overwhelming for students to utilizing in the moment. In the future, I would combine the observation checklist and note sheet as well as simplify the key points I am looking for.

The last instrument for this sub question was using the Socratic Seminar Tracking Form to track the presence of dominant speakers during Socratic Seminars. A dominate speaker is when the discussion goes to a pilot/co-pilot pair five or more times during a Socratic Seminar. In the general treatment group, there was only one pair speak more than five times in an individual Socratic Seminar. However, in three out of the four general treatment group Socratic Seminars, the teacher was a dominant speaker. This shows an attempt of the teacher to continue the conversation when the general group as a whole was quiet and didn't want to talk.

For the honors treatment group, there were more dominate pairs and the teacher never dominated the discussion. In the first Socratic Seminar, 2-8 pairs in each class were categorized as dominate speakers. In the second Socratic Seminar 2-7 pairs in each class were categorized as dominant speakers. In the third Socratic Seminar, 0-3 pairs were categorized as dominant speakers. In the last Socratic Seminar, 1-5 pairs were categorized as dominant speakers. One class period in the honors treatment group continually had the highest number of dominant speakers. While dominant speakers can be great for continuing the class discussion, there becomes a point where this can lead to less whole class discussion involving all pairs.

<u>Sub Question 2</u>

The second sub question asks how incorporating regular Socratic Seminars affect the students. Three instruments are used to provide evidence for this question: student pre-treatment and post-treatment survey (Appendix F and G), the Socratic Seminar tracking form (Appendix C), and the Student Socratic Seminar Notes (Appendix B).

On the student pre-treatment and post-treatment survey, students were asked to examine the following statement on a Likert scale: "I feel comfortable during science whole class discussions (Socratic Seminars)." The results for the general treatment group and honors treatment group are in Figures 8 and 9.

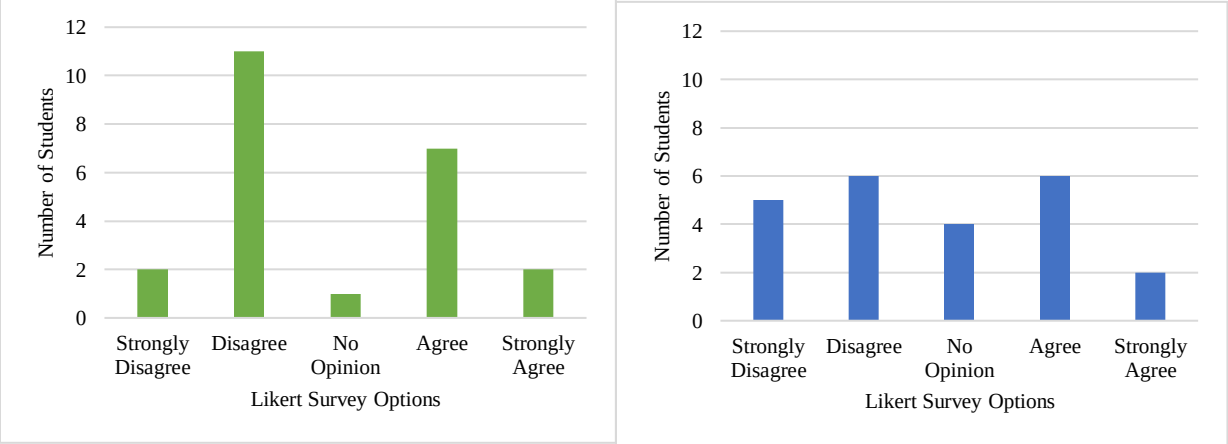


Figure 8. General science response to "I feel comfortable speaking during whole class discussions (Socratic Seminars)," (*n*=23). Pre-treatment survey responses on the right and post-treatment survey responses on the left.

The general treatment group median response to the pre-treatment survey was "Disagree" and the median for the post-treatment survey was "No Opinion". In the pre-treatment survey, 13 of 23 students mentioned the following words in explaining their choice for this question: nervous, uncomfortable, not good at/don't like public speaking, and stressed. In the post-treatment survey, 16 of 23 students included the following words in their explanation: shy, awkward, weird, nervous, don't like public speaking, afraid how others will react, and scared. In the post-treatment, students seemed more concerned with how others thought of them than in the

pre-treatment. While I wouldn't consider this all to be caused by class discussion alone, and more to do with navigating their first year in middle school, it is interesting to note the shift to include how others would perceive them in the discussions.

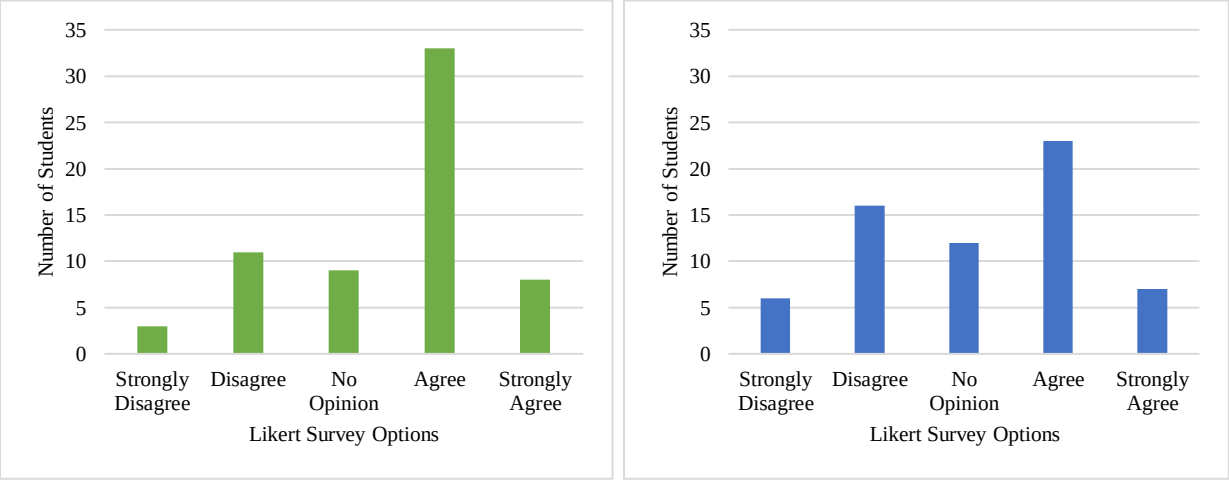


Figure 9. Honors science response to "I feel comfortable speaking during whole class discussions (Socratic Seminars)", (*n*=64). Pre-treatment survey responses on the right and post-treatment survey responses on the left.

The honors treatment group had a pre-treatment median score of "Agree" and a post-treatment score of "No Opinion". There is a shift seen in the post-treatment survey towards the "Disagree" side of the graph. There was a similar shift seen in the general science group where many responded that they were being worried about judgement from others in the post-treatment survey that was not present in the pre-treatment survey.

Another question on the pre-treatment and post-treatment survey was, "I am more comfortable speaking in small groups than in front of the whole class in science." The results from the general treatment group and honors treatment group are in Figures 10 and 11.

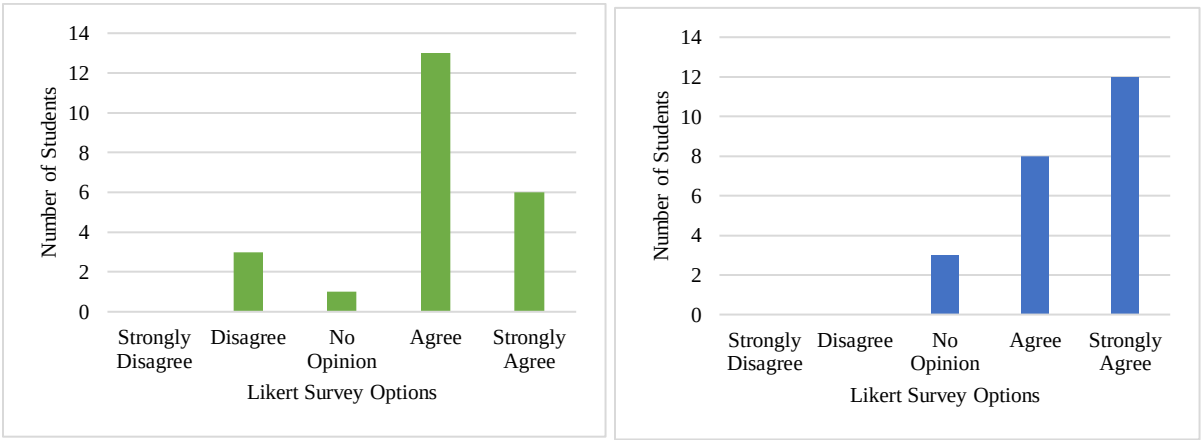


Figure 10. General science response to "I am more comfortable speaking in small groups than in front of the whole class in science," (*n*=23). Pre-treatment survey responses on the right and post-treatment survey responses on the left.

For the general treatment group, neither the pre-treatment or post-treatment surveys had any student select "Strongly Disagree". The median response for the pre-treatment survey was "Agree" and the median response for the post-treatment survey was "Strongly Agree". In the post-treatment survey, no students disagreed with the statement and only three students chose "No Opinion". Even with the added structure of Socratic Seminars, students as a whole in this treatment group still prefer smaller group discussions.

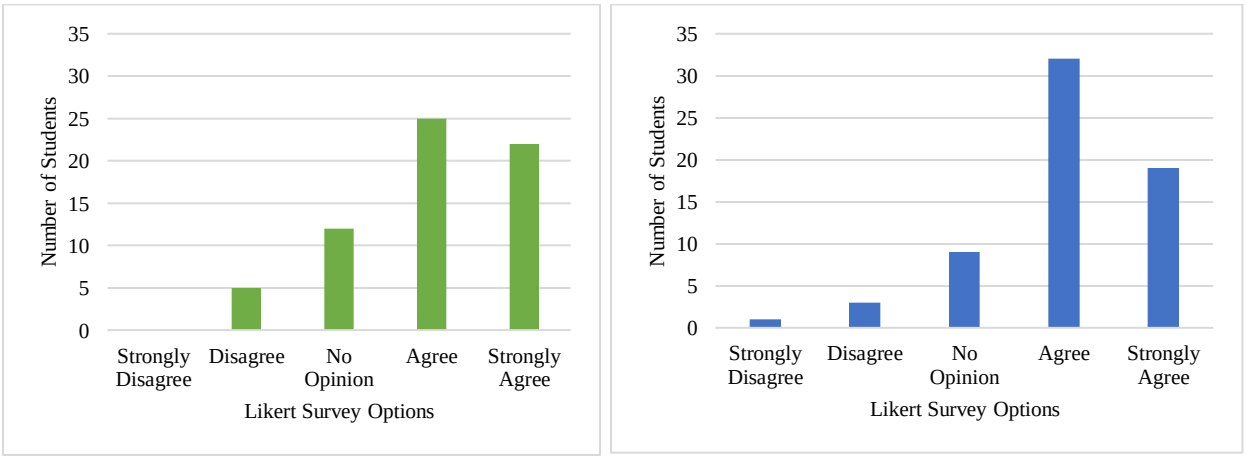


Figure 11. Honors science response to "I am more comfortable speaking in small groups than in front of the whole class in science," (*n*=64). Pre-treatment survey responses on the right and post-treatment survey responses on the left.

For the honors science treatment group, the pre-treatment survey had no student selecting "Strongly Disagree" and a median response of "Agree". In the post-treatment survey, the median response was still "Agree". Four students did select either "Strongly Disagree" or "Disagree" in the post-treatment survey. As a whole, the honors group seems to favor smaller group discussions, however, there are a few individuals that are comfortable in the whole class discussions.

The final Likert scale survey question on the pre-treatment and post-treatment survey was, "I am more likely to speak during science class discussions (Socratic Seminars) than in my other subjects' class discussions." The results for the general and honors treatment group are in Figures 12 and 13.

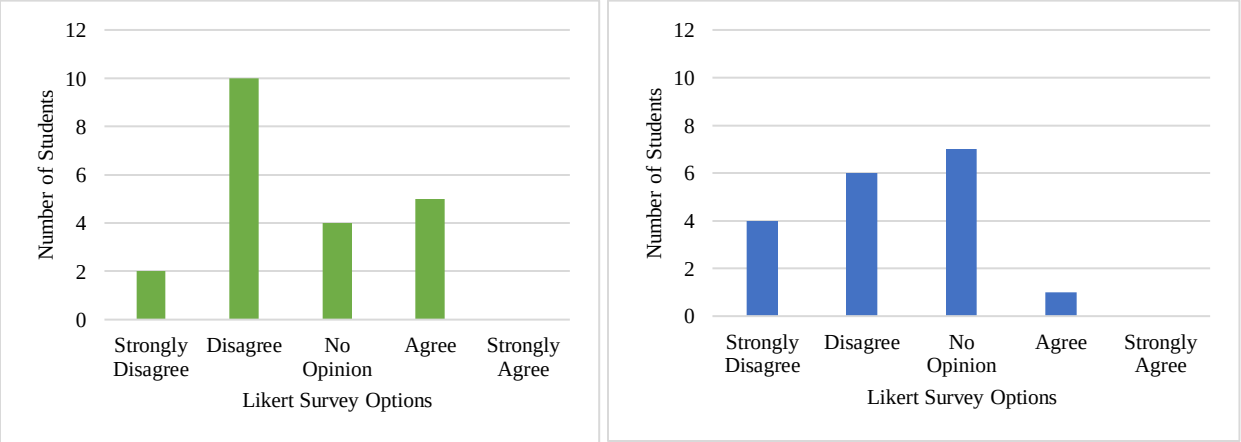


Figure 12. General science response to "I am more likely to speak during class discussions (Socratic Seminars) than in my other subjects' class discussions," (*n*=23). Pre-treatment survey responses on the right and post-treatment survey responses on the left.

In both the pre-treatment and post-treatment survey, the median response for the general treatment group was "Disagree". No students answered "Strongly Agreed" on either survey. Students in this group as a whole are expressing they are more likely to participate in other subjects' class discussions than in science class discussions.

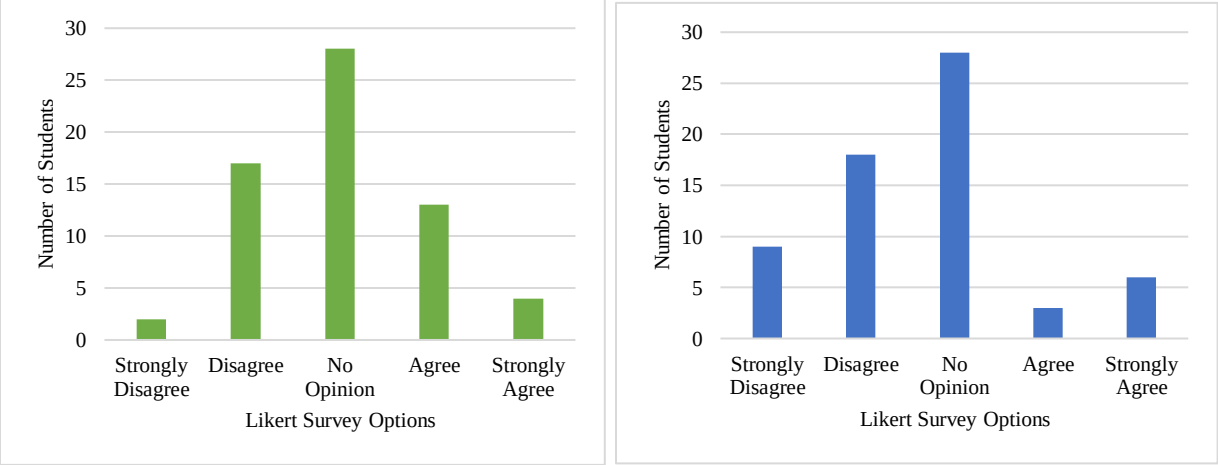


Figure 13. Honors science response to "I am more likely to speak during science class discussions (Socratic Seminars) than in my other subjects' class discussions," (*n*=64). Pre-treatment survey responses on the right and post-treatment survey responses on the left.

For the honors treatment group, both the pre-treatment survey and post-treatment survey had a median response of "No Opinion". In the pre-treatment survey, the number of responses on the "Agree" and "Disagree" sides were equal. In the post-treatment survey, there were more students on the "Disagree" side then the "Agree" side, with the "No Opinion" number staying the same. Unlike the general treatment group, the honors group had six students select "Strongly Agree" in the post-treatment survey to this statement. Overall, honors students are more likely to speak in other class discussions, but there are a small group of students that are speaking more during science class by the end of the treatment.

An open-ended question on the post-treatment survey asked students if they participated in Socratic Seminars in other classes this school year. Theoretically, because a population of students in both treatment groups are in the AVID elective, they should have had other opportunities to complete a Socratic Seminar outside of science. Only one student in the general treatment group and one student in the honors treatment group recalled doing a Socratic Seminar in their Academic Block (ELA/History) class. This surprising result leads me to believe that

students are being challenged in science to actively speak and listen, and therefore might find other classes to be more comfortable because this expectation is not regularly present.

The Socratic Seminar Tracking Form was used in each Socratic Seminar. The percentage of pairs who spoke during the Socratic Seminar can be seen in Table 2. For the general treatment group, less than half of the pairs spoke during the first, second, and third Socratic Seminar. However, during the fourth Socratic Seminar, a big jump to 75% of the pairs spoke at least once. For the honors treatment group, the same range of speakers happened in each Socratic Seminar. During the third Socratic Seminar, one class had a lower participation percentage of 53%. However, this was the seminar that had to end early due to timing and therefore this lower participation rate was most likely due to this constraint. Usually, students in the Honors treatment group are more willing to speak when given a chance, due to their understanding of science to be placed in the honors class. However, it is interesting to see the bump in general science students participation by the last Socratic Seminar. This increase could be from students being more comfortable with the process of Socratic Seminars or enjoying the topic of that particular Socratic Seminar.

Table 2. Pair participation during Socratic Seminars. For General treatment group, *n*=23. For Honors treatment group, *n*=64.

	Socratic Seminar 1		Socratic Seminar 2		Socratic Seminar 3		Socratic Seminar 4	
	General	Honors	General	Honors	General	Honors	General	Honors
Percent of Pairs Who Spoke	38%	76-81%	44%	73-93%	36%	53-80%	73%	78-81%

For each Socratic Seminar, students set a personal goal on their note sheet. In prompting students to write a goal, students had four categories to choose from: respectful conversation, participation, restate the ideas of others, or refer to evidence to support ideas. In Figure 14, the

general students' goals for each Socratic Seminar are shown. In Figure 15, the honors students' goals for each Socratic Seminar are shown.

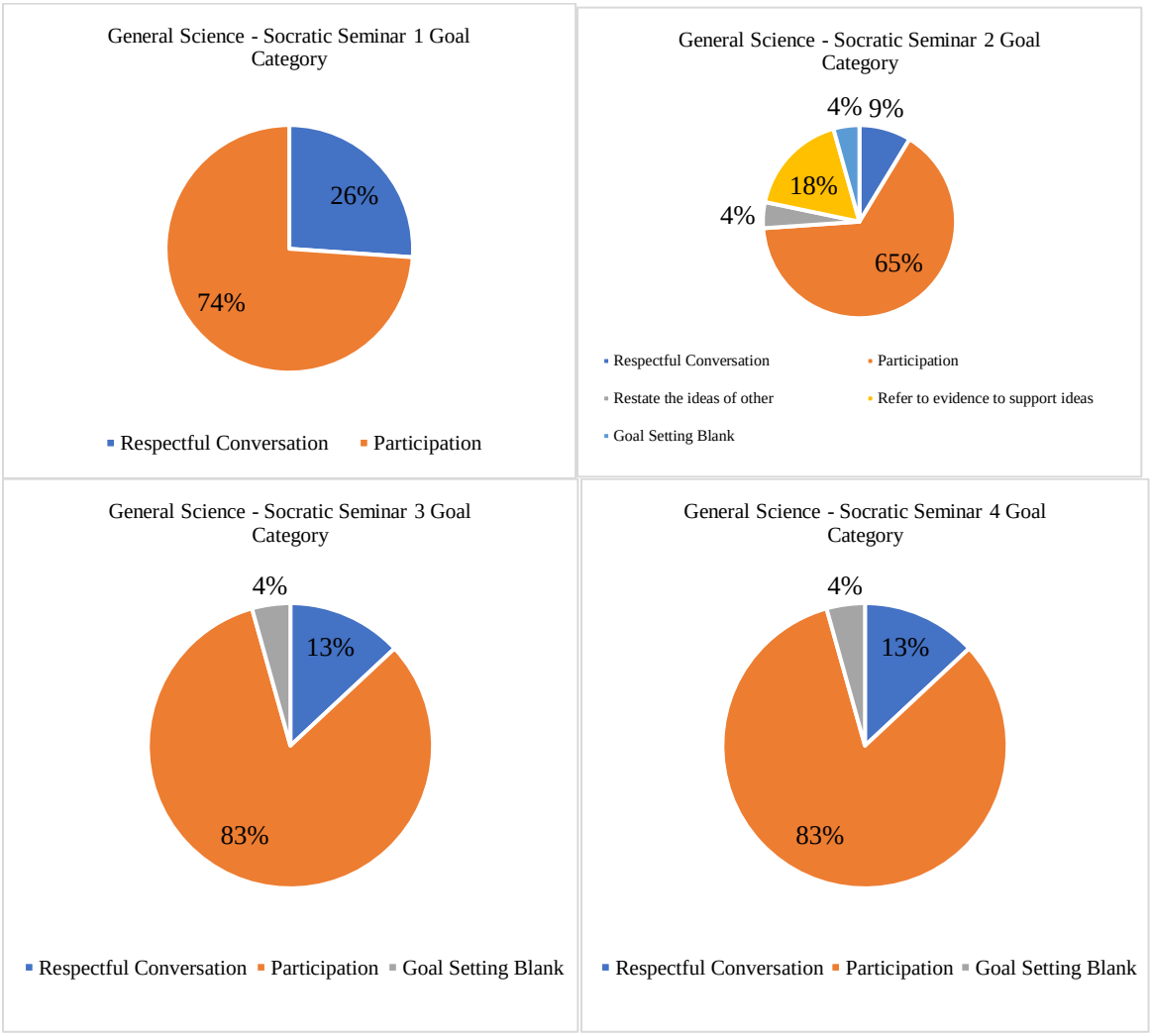


Figure 14. General science goal setting, (*n*=23).

For the general group, participation is always the greatest category throughout all four Socratic Seminars. The participation goals students wrote centered around either talking a certain amount of times, listening or focusing on what is being said, or taking notes during the conversation. Goals around having respectful conversation were also present in every seminar. Referring to evidence and restating the ideas of others only showed up as a goal in the second

Socratic Seminar. Many students are focused on participating and not many in this treatment group are setting goals to achieve the higher levels of conversation.

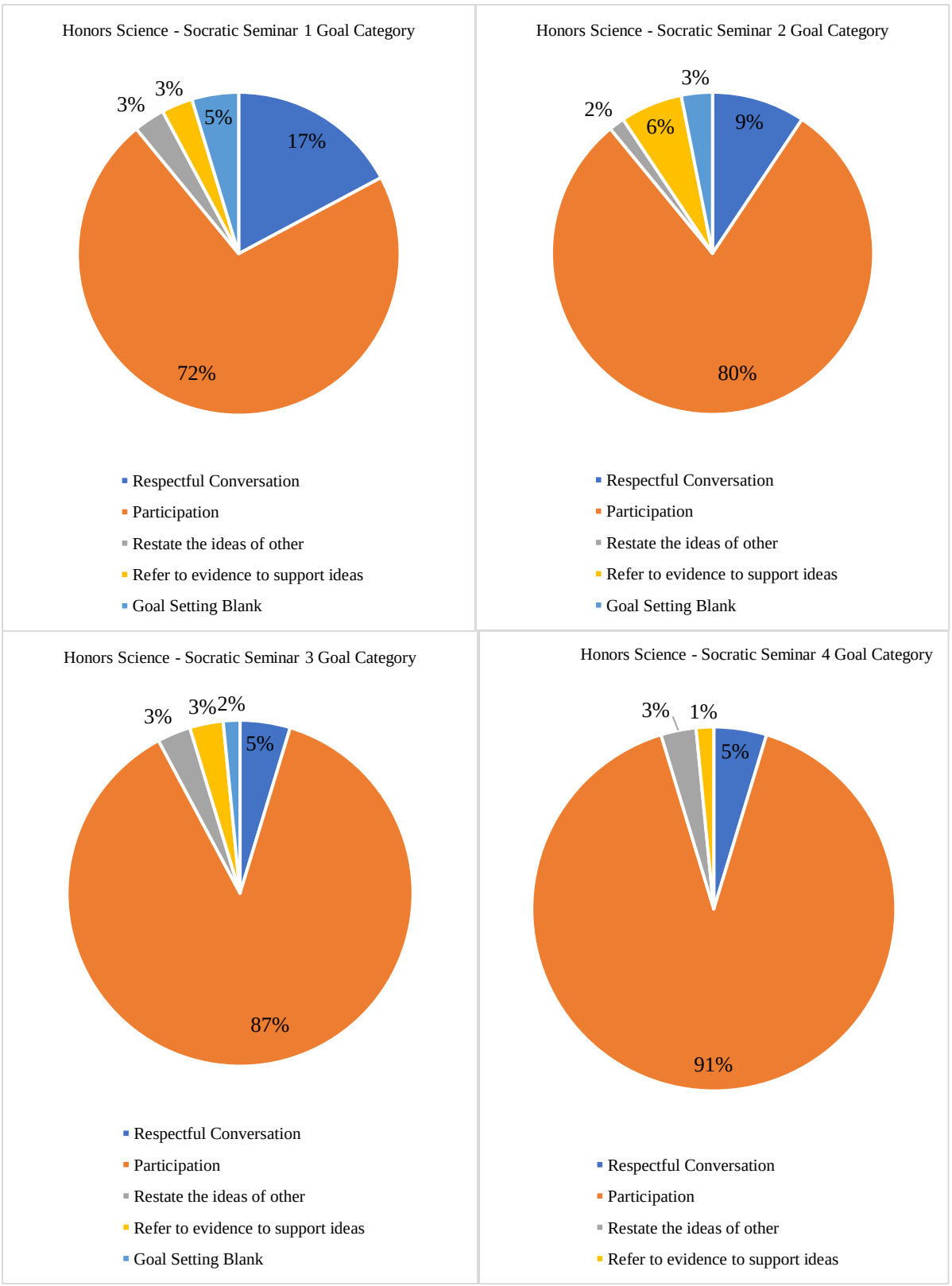


Figure 15. Honors science goal setting, (*n*=64).

Similarly to the general treatment group, the honors treatment group always had the most students selecting a participation goal. However, in the honors treatment group, all four categories of goals were represented in each Socratic Seminar. Even though the higher rigor cateogories were less selected, more students in the honors treatment group were willing to aim for more demanding discussion goals.

Sub Question 3

The third sub question asks how incorporating regular Socratic Seminars affect the teacher. Three instruments are used to provide evidence for this question: Teacher Socratic Seminar Assessment (Appendix E), Teacher Journal, and Socratic Seminar Teacher Survey (Appendix H).

After the conclusion of the discussion portion of the second through fourth Socratic Seminars, I filled out a Teacher Socratic Seminar Assessment. On this assessment, I gave an overall ranking of the seminar on a scale from one (needs improvement) to four (excellent) as well as wrote down comments on what could be improved for next time.

For the second Socratic Seminar, the general group received an overall ranking of 1.5. The main concerns for this group were including more students in the discussion and having students listen to each other to make a cohesive conversation. For the honors group, the overall scores range from 3 to 3.5. The honors group concerns were having particular students dominate the conversation, having students referring to other sources than the given text of the Socratic Seminar, and students engaging in side conversations during the seminar.

For the third Socratic Seminar, the general group received an overall ranking of 1. Concerns for this seminar continued to be students listening to each other and involving more students in the conversation. A new concern was how to get students to utilize the concepts we

are learning about in science in the discussion. Students were struggling to make a connection between the specifically chosen Socratic Seminar topic and what we had been learning for the previous month in science. All sections of the honors group scored a 3.5. A new concern for this seminar was finding more time in our schedule to accommodate for Socratic Seminars. I also began to think more about refining the main question the seminar was built around, including making sure it was open ended enough to encourage conversation. Similar to the general group, I was concerned in the honors sections about including more students in the conversation.

In the fourth and final Socratic Seminar of the year, the general group of students were ranked as a 2 in their overall score. This time my concerns did not involve student participation but did involve getting students to have deeper conversations and tying in evidence from the text of the seminar. For the honors section, the overall score of one class was 2 and the other two classes ranked at 3.5. I continued to be concerned about finding a way to naturally invite students who aren't speaking into the conversation and whether this was a role for the leader or the students. I felt that if I was to call out students individually, this would not be the welcoming whole class discussion I was trying to achieve during Socratic Seminars. In the class that ranked as a 2, I saw very low maturity during this seminar. Five students in this seminar were making jokes and this hindered the academic environment myself and other students were trying to achieve.

Throughout the entire treatment cycle, I wrote down thoughts in a teacher journal. Common themes present during this time included student participation in Socratic Seminars and time management. With student participation, in the first two seminars, students were often saying something in order to note that they participated, but their comments didn't academically add to the conversation. The statements themselves were valid, but it was not a conversation,

instead a random sampling of statements. This led to continuing frustration on how students can have a meaningful conversation without overloading them with papers, rules, and tracking.

For time management, I saw two different problems. In my general treatment group, often no one talked and we would sit for minutes in silence. This silence would lead to side conversations or students trying to make jokes to ease the tension. I contemplated many times in my journal wondering how to manage this situation without completely taking over the conversation. For my honors treatment group, often the problem was too little time. Students would be eager to talk and add new ideas, but there simply wasn't enough time in the period or in the week when the Socratic Seminar was scheduled. Many of the seminars in the honors treatment group had to end prematurely due to the period ending.

There were two occasions when I saw an impact on students outside of the Socratic Seminars. In October, a student in the honors treatment group during a non-Socratic Seminar class discussion observed that the conversation between students was a lot like having a Socratic Seminar without being in the circles. We took a moment as a class to realize that we were doing a great job listening and responding to one another during a class demonstration activity. This was especially impressive due to the arrangement of students in groups at the time. Furthermore, during Open House in April, a parent of a student in the honors treatment group approached me and said that their student had come home excited after the last Socratic Seminar because they had met the goal of speaking in a class discussion. The parent said they were very shy and speaking unprompted by the teacher in front of the class was a big accomplishment. The student added to the conversation that having their friend as a co-pilot in the Socratic Seminar helped give them the support to speak. These two interactions show that students were adapting to this new type of classroom discussion, and it did have impacts on individual students.

Because I was the only teacher in my department implementing Socratic Seminars this school year, I felt it was appropriate to reach out to other teachers in my district to see if their experiences resembled my own. I sent out a Socratic Seminar Teacher Survey to AVID teachers in my district and received six responses: four middle school teachers and two high school teachers. These teachers had between 4 and 38 years of teaching experience and had been using the Socratic Seminar Method anywhere from 3 to 15 years. All these teachers taught at least one period of AVID elective as well as other core subjects. The four middle school teachers were all Academic Block (ELA/History) teachers. Of the two high school teachers, one taught math and one taught history. A summary of their responses can be seen in Table 3.

Table 3. Socratic Seminar teacher survey responses, (*n*=6).

Benefits for Students: • Collaboration • Deepening of understanding • Learning to use text • Ownership	Drawbacks for Students: • Student engagement/student buy in • Classroom layouts • Large Classes (38+ students) • Same kids always speaking • Scared to talk in front of peers • Lots of front loading involved • Maturity Level of Students
Benefits for Teachers: • Informal observation of other non-content skills such as speaking, listening, and social skills. • Get students out of their comfort zone • Takes the instruction piece from teacher and puts accountability for learning back on the students	Drawbacks for Teachers: • Creating the amount of time in curriculum mapping for student-focused Socratic Seminars takes away time from content focused instruction • Finding good materials to talk about • Possible topics could get controversial
Modifications: • Having co-pilots • Intentionally pairing students together • Making sure each student speaks • Run on 2 hour block days instead of splitting between two 50-minute class periods	Socratic Seminars Compared to Other Class Discussion Techniques: • Socratic seminars can be more intimidating for shy students • Socratic seminars are less confrontational than debates • Socratic seminars are a high-prep, immersive activity so don't do as often but does make an impact when utilized.

Many of the responses from the teacher survey ran parallel to my own. Knowing that others in my district struggle with finding the time and space to run the Socratic Seminars helps me understand that the challenges I was experiencing in my treatment were not uncommon. In addition, others often express concerns with having other students participate or having students participate too much. Lastly, I felt concerned that I was only able to fit in four Socratic Seminars during my treatment plan. However, all teachers who responded to the survey said they used Socratic Seminars two to six times a year. I think viewing this as a quarterly activity instead of

trying to make it a monthly activity would help me fit it into my curriculum better by finding well-developed topics.

CHAPTER 5

CLAIM, EVIDENCE, AND REASONING

Claims From the Study

Sub Question 1

My first sub question asks, "Do Socratic Seminars provide an environment that fosters productive student dialogue?" After my treatment, it seems as if the honors group was able to achieve more instances of productive student dialogue than the general group.

In the honors treatment group, I as the teacher was never a dominant speaker (speaking more than five times in the Socratic Seminar). However, in the general treatment group, I was a dominant speaker every time. For the general treatment group, I spoke to try and break the silence after a minute or so, to redirect side conversations, or to remind students of the expectations of the Socratic Seminar. Opposite of the general treatment group, the honors treatment group's conversation was usually lively with students continually adding to the discussion. As the leader, I only had to speak to propose a sub question or signal to turn to their co-pilot or switch roles. For the general treatment group, I often had to speak to get the conversation starting, during many points of the discussion. While I did my best to sit in silence and wait for someone to speak, there came a point where I would need step in to add support.

Windschitl et al. (2018) emphasized strong norms, predictable routines, and strategic scaffolding within a classroom in order to achieve any talk strategy attempted to be put in place in a classroom. Despite utilizing the same routines for every Socratic Seminar, the infrequent occurrence (every few months) and being the only teacher implementing this strategy for all but two of my students, many students were left struggling to meet the demands of the Socratic

Seminar. For the honors treatment group, these students require less support from the teacher and are more likely to be engaged in science topics. They adapted better to this new system, with room to improve in deepening their conversations, connecting their statements to evidence, and asking questions of each other.

Sub Question 2

My second sub question asks, "How does incorporating regular Socratic Seminars affect the student?" By running four Socratic Seminars in my classroom, students were given the opportunity to practice speaking in front of large groups and reflect on their own challenges with public speaking.

The biggest improvement was seen in participation with the general treatment group. This group went from 38% participation in the first seminar, to 44% participation in the second seminar, to 36% in the third seminar, and finally 73% participation in the fourth seminar. While not everything that was shared was necessarily rigorous thinking, the increased level of participation gave students an opportunity to practice speaking in front of others. In addition, in both treatment groups, setting a "Participation" goal was always the most often selected goal in each Socratic Seminar.

NGSS aims to have students be the driving factors of learning and discovery and one way to achieve this is through discourse (NGSS Lead States, 2013). As many students first exposure to a single subject science class and one of few utilizing these types of talk strategies, these whole group discussions are meant to set students up for success and full participation in future science classes. Students taking a moment to reflect on their own participation, rather than it being set by the teacher, gives students ownership over their own learning. While many students

push back by expressing some fear or awkwardness in public speaking, if they never get a chance to practice the skill then they will never get a chance to improve.

Sub Question 3

My third sub question asks, "How does incorporating regular Socratic Seminars affect the teacher?" From the teacher's viewpoint, Socratic Seminars provided a structured space to run whole class discussions.

The rankings for Socratic Seminars in the general science group was 1 out of 4 and the ranking for the honors science group was 2 to 3.5 out of 4. I was able to set a consistent routine when we did Socratic Seminars using slides, common note taking worksheets, and consistent room set up. Furthermore, I received feedback from a parent on how their student came home excited because they conquered their fear of speaking in front of the class.

While every Socratic Seminar was not successful, especially in the general treatment group, students were still given space to try talking and work on group discussion skills. By the fourth Socratic Seminar, most students understood the routine and needed little prompting when setting up the room and filling out their note sheets. Students will likely continue to push back against public speaking, especially when this not a utilized structure in other classes. However, with whole class discussions, I had insights to their thinking, which components of our concepts they were understanding, and where they needed more support. It also showed me how many students provided statements with no support. There is a need for reminders and reinforcements to provide evidence with their statements in academic conversations.

Values of the Study and Considerations for the Future

Many of my discoveries while implementing Socratic Seminars in my 7th grade classroom match experience of previous research on the topic of class discussions. First, scaffolding this process into manageable steps proved to be key (Windschitl et al., 2018). Expecting students to be expert communicators by middle school is not realistic. Breaking down the steps, taking the time to frontload, and providing a structured guided note sheet set students up for more success during the Socratic Seminar.

I realized the importance of finding the right question and allowing time for students to think before talking over them (Jimenez-Alexiandre et al., 2000). For science, open-ended questions in middle school can be challenging due to the introductory material being learned versus the complex solutions to real world problems. Since this was my first year running Socratic Seminars, all questions I tested out were new to everyone. Approaching each seminar took time for me to consider a good starting question and try to pre-think where students might go with the conversation. Once the seminar got going, letting the students have time to think through the questions and speak was crucial. Sometimes this is a challenge due to the maturity level of the students. It is imperative to aid students in understanding that it is their time to actively participate in their learning.

In the future, it would be interesting to track students who participate in Socratic Seminars in multiple classes or over multiple years to see if there is an effect on their confidence in public speaking and their depth of conversation.

Impact of Action Research on the Author

At the end of my action research, I was disappointed that students' reception to Socratic Seminars wasn't always stellar, especially in my general treatment group. However, as I look back on what we were able to achieve in those seminars, I must think about the individual impact on students. For a few, this was their first time speaking in front of a whole class without being prompted by a teacher. For others, they discovered the value in a co-pilot that can support you when you are speaking.

Socratic Seminars helped break away from, if even for a moment, the teacher question and answer routine that so often whole class discussions turn into. Students quickly realized that I wasn't going to always step in and would allow them to sit in silence if no one was talking. I saw my honors treatment group shine in this new set up, sometimes not wanting to stop the seminar because they had so much more to say, even though the end of class bell was about to ring. In the upcoming school year, I will continue to have Socratic Seminars be a corner stone in my honors class section as my data shows that these students flourished the most in this environment and began to reach the true class discussion environment that was my vision at the start of this action research. For my general classes, I will explore more scaffolds to help foster more participation and deeper thinking when approaching the open-ended questions.

Overall, this project showed the need to establish a culture on campus where more whole class, student centered discussions are taking place. Often teachers are resorting to direct instruction because of time constraints due to curriculum pacing. While I went into this action research thinking I needed to do Socratic Seminars monthly, I realized that even doing two solid seminars a year can be enough to give students a place to practice. Ideally, Socratic Seminars would be utilized in multiple classes, in order to alleviate the burden placed on a single teacher. Using my data and test methods, I hope to present this to other AVID teachers on my campus

and create a professional learning community where teachers from all subjects can support each other in running Socratic Seminars on our campus. Finding other science teachers in my district and beyond that run Socratic Seminars could also help in building up a database of exemplary starting questions and supporting text for the seminar.

I plan to continue building on the work I started this year, utilizing the materials that went well, refining the ones that could be improved on. With these findings in mind, I will continue to work towards implementing daily student-lead discussions in my middle school science classroom.

REFERENCES CITED

Chowning, J.T. (2009). Socratic seminars in science class: Providing a structured format to promote dialogue and understanding. Science Teacher, *76*(7), 36-41.

Colley, C., & Windschitl, M. (2016). Rigor in elementary science students' discourse: The role of responsiveness and supportive conditions for talk. *Science Education, 100*(6), 1009-1038.

Griswold, J., Shaw, L., & Munn, M. (2017). Socratic seminar with data: A strategy to support student discourse and understanding. *The American Biology Teacher, 79*(6), 492-495.

Jiménez-Aleixandre, M.P., Bugallo Rodríguez, A., & Duschl, R.A. (2000). "Doing the lesson" or "doing science": Argument in high school genetics. *Science Education, 84*(6), 757-792.

NGSS Lead States. (2013). Next Generation Science Standards: For states, by states. http://www.nextgenscience.org/

Pimentel, D. S., & McNeill, K. L. (2013). Conducting talk in secondary science classrooms: Investigating instructional moves and teachers' beliefs. *Science Education, 97*(3), 367-394.

Rivard, L. P., & Straw, S. B. (2000). The effect of talk and writing on learning science: An exploratory study. *Science Education, 84*(5), 566-593.

Ryu, M., & Sikorski, T. (2019). Tracking a learner's verbal participation in science over time: Analysis of talk features within a social context. *Science Education, 103*(3), 561-589.

Short, R. A., Van der Eb, M. Y., & McKay, S. R. (2020). Effect of productive discussion on written argumentation in earth science classrooms. *The Journal of Educational Research, 113*(1), 46-58.

Windschitl, M., Thompson, J., & Braaten, M. (2018). *Ambitious science teaching*. Harvard Education Press.

APPENDICES

APPENDIX A

INSTITUTIONAL REVIEW BOARD EXEMPTION

Gmail

Elizabeth Davidson <lizdavidson11@gmail.com>

Exempt Review for MSSE Form

Beiswanger, Kelly <kelly.beiswanger@montana.edu> Wed, Oct 20, 2021 at 4:00 PM
To: Elizabeth Davidson <lizdavidson11@gmail.com>
Cc: "Woolbaugh, Walter" <walter.woolbaugh@montana.edu>

Dear Elizabeth,

Thank you for your application. This email acknowledges receipt of the request for IRB Review and serves as the Approval Letter for your research. Your new **IRB Exempt Protocol # is ED102021-EX.**

Study Title: **Socratic Seminars in a Middle School Science Classroom**

As the PI, it is your responsibility to facilitate subject understanding by informing subjects of all aspects of the project, providing an opportunity to ask questions, and describing risks and benefits of participation. Submit any new changes to the research protocol to the IRB via Amendment Form **prior to implementing.**

The research described in your submission is exempt from the requirement of additional review by the Institutional Review Board in accordance with 45 CFR 690.104(d). The specific paragraph which applies to your research is:

(1) Research, conducted in established or commonly accepted educational settings, that specifically involves normal educational practices that are not likely to adversely impact students' opportunity to learn required educational content or the assessment of educators who provide instruction. This includes most research on regular and special education instructional strategies, and research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

Thank you,

Kelly Beiswanger

IRB Administrator & Program Manager

Office of Research Compliance

Hamilton Hall 114

Montana State University

kelly.beiswanger@montana.edu

406-994-4706

https://www.montana.edu/orc/irb

[Quoted text hidden]

APPENDIX B

STUDENT SOCRATIC SEMINAR NOTES SHEET

Socratic Seminar Notes Name _____ Period ___

QUESTION: Why do we study science?

EVIDENCE NOTES

SOCRATIC SEMINAR GOAL

INITIAL THOUGHTS:

DISCUSSION NOTES

WRITING PROMPT

SOCRATIC SEMINAR GOAL (REFLECTION) :

APPENDIX C

SOCRATIC SEMINAR TRACKING FORM

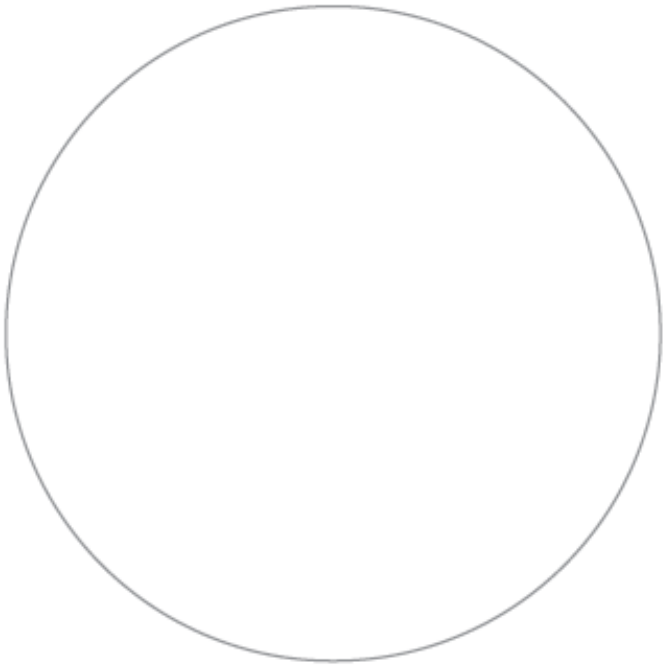
Handout 4.14a

Tracking Form for Socratic Seminar

Teacher/Grade Level:		**Date:**	
Focus Area for Scripting:		**Leader:**	

Scripting Key:

?: asked a question **I**: ah-ha **S**: statement **X**: explanation **R**: referenced the text



APPENDIX D

STUDENT OBSERVATION CHECKLIST

Handout 4.11a

Observation Checklist for Socratic Seminar

Directions: Each time your partner does one of the following, put a check in the box.

Your Name: _____ **Partner's Name:** _____

Speaks in the discussion	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Makes eye contact with other speakers or as she/he speaks	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Refers to the text	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Asks a new or follow-up question	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Responds to another speaker	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Paraphrases and adds to another speaker's ideas	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Encourages another participant to speak	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Interrupts another speaker	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Engages in side conversation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dominates the conversation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

After Discussion:

What is the most interesting thing your partner said?

After Discussion:

What would you like to have said in the discussion?

Valdez, S., Carter, M., & Rodgers, J. (2013). *The write path English language arts: Informing ourselves and others through writing and speaking*. San Diego, CA: AVID Press.

APPENDIX E

TEACHER SOCRATIC SEMINAR ASSESSMENT

STUDENT HANDOUT

Socratic Seminar Self-Assessment – Leader

Name: _____ Seminar Text: _____

Group Members: _____

Directions: Score your performance in today's seminar, using the following criteria:

4 = Excellent ***3 = Good*** ***2 = Showing Progress*** ***1 = Needs Improvement***

I listened carefully and helped clear up confusion.

_____ I asked questions to clarify or probe for higher-level thinking.

_____ I helped the group get back on track if they strayed from the text or moved to debate.

_____ I helped participants work together cooperatively.

_____ I did not dominate the conversation.

_____ I encouraged other participants to enter the conversation.

_____ I treated all other participants with dignity and respect.

_____ The group used the text as a reference throughout the Socratic Seminar.

_____ Group members shared in the discussion of the topic.

_____ The group asked in-depth questions.

_____ Everyone in the group was respectful of other ideas.

_____ The group was able to take the Socratic Seminar to a high level of understanding.

Overall Score (circle one): 1 1.5 2 2.5 3 3.5 4

Two goals I have for my leadership development:

1.

2.

An area where I would like help:

APPENDIX F

STUDENT PRE-TREATMENT SURVEY

Student Survey Name: Period:

Please respond honestly to the questions below by circling only answer for each statement. As an option, explain why you circle the answer you did. Your answers on this survey will not impact your grade in science.

1. I feel comfortable speaking during science whole class discussions (Socratic seminars).

Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree

Why I circled my answer: _____

_____

_____

2. I am more comfortable speaking in small groups than in front of the whole class in science.

Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree

Why I circled my answer: _____

_____

_____

3. I see class discussion (Socratic seminars) as a valuable use of class time in science.

Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree

Why I circled my answer: _____

_____

_____

Please continue on back side.

4. Tracking my co-pilot's participation helps me become a better participant in science class discussions (Socratic seminars).

Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree

Why I circled my answer: _____

_____

_____

5. I am more likely to speak during science class discussions (Socratic seminars) than in my other subjects' class discussions.

Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree

Why I circled my answer:

_____

_____

6. Describe your previous experience speaking in front of others. This could include previous classes, activities outside of class, and/or activities outside of school.

Why I circled my answer: _____

_____

_____

APPENDIX G

STUDENT POST-TREATMENT SURVEY

Student Post-Survey Name: Period:

Please respond honestly to the questions below by circling only answer for each statement. As an option, explain why you circle the answer you did. Your answers on this survey will not impact your grade in science.

1. I feel comfortable speaking during science whole class discussions (Socratic seminars).

Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree

Why I circled my answer: _____

_____

2. I am more comfortable speaking in small groups than in front of the whole class in science.

Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree

Why I circled my answer: _____

_____

_____

3. I see class discussion (Socratic seminars) as a valuable use of class time in science.

Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree

Why I circled my answer:

_____

_____

Please continue on back side.

4. Tracking my co-pilot's participation helps me become a better participant in science class discussions (Socratic seminars).

Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree

Why I circled my answer: _____

_____

_____

5. I am more likely to speak during science class discussions (Socratic seminars) than in my other subjects' class discussions.

Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree

Why I circled my answer: _____

_____

_____

6. Which Socratic Seminar was your favorite this year? Why?

_____

_____

_____

7. Do you have Socratic Seminars in any of your other classes this year? YES NO

If yes, what class(es) have you done Socratic Seminars this year?

_____

APPENDIX H

SOCRATIC SEMINAR TEACHER SURVEY

Name:

Grade/Subject Currently Taught:

Years of Teaching:

Current School Site:

How many years have you been using Socratic Seminars in your classroom?

Approximately how many times a year do you run a Socratic Seminar?

Benefits/Drawbacks

What benefits do Socratic Seminars provide to your students?

What drawbacks and/or challenges do Socratic Seminars present to your students?

What benefits do Socratic Seminars provide to you as a teacher?

What drawbacks and/or challenges do Socratic Seminars present to you as a teacher?

Modifications

What different modifications have you made to Socratic Seminars in order to best fit the needs of your students?

Alternative Techniques

Have you used any other techniques for whole class conversations other than Socratic Seminars?

If yes to above, where do Socratic Seminars rank with those other techniques and why?

Future

Do you see yourself continuing to use Socratic Seminars in the future? Why or why not?

Further Questions

Are you available for further questioning if needed?