

Master's Thesis

**Evaluating Nearpod as an Anticipatory Set Tool in Secondary Mathematics
Education**

Samantha Pastore

Educational Technology Specialist (K-12)

Dr. Wen Wen

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Department of Secondary Education and Educational Technology

SUNY Oneonta

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Abstract

An important aspect to teaching is finding the most effective strategy for starting a class period that allows for continued discussion and connecting key ideas throughout the lesson. The purpose of this qualitative study is to discover how using Nearpod as an anticipatory set encourages students to make connections within the material for high school math students. An Algebra II teacher was the participant of this study. This study was a qualitative case study with notes on lesson plan design, planned Nearpod activities, and a reflection from the teacher through an interview. The data collection consisted of digital notes taken during and after the interview. The data and participant interview supported the idea that Nearpod anticipatory sets increases students' willingness to participate in discussion both at the beginning and throughout the rest of the class period. The results showed that Nearpod anticipatory sets are beneficial for promoting discussion, reviewing fluency skills quickly, and having students create predictions further into the lesson.

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Introduction

One of the most exciting new technologies in secondary mathematics education is Nearpod. There has been research into Nearpod as a technology tool for mathematics (Salansan et al., 2023). These researchers were trying to determine if Nearpod was effective by using various representations and tools to teach while comparing the concepts. Other focuses of secondary education research have included identifying an anticipatory set for the beginning of a class period (West & Deutsch, 2017). There are some examples of what an anticipatory set could be and there is an explanation for its purpose within a lesson.

An issue specific to school districts that have low performances on the Map NWEA is trying to determine different strategies to improve reading skills in making connections and identifying key ideas. Nearpod is a technology tool that has interactive features that could allow students to brainstorm connections. Nearpod could also be used to highlight main ideas and then throughout instruction be referred to make connections. Therefore, the problem this study addressed was the usefulness of Nearpod as an anticipatory set with the goal of making connections throughout the lesson.

Background of the Problem

A major topic of discussion in education is the best way to start a class period to get the attention of the class and to maintain a structured start for students. Education researchers have identified a strategy for starting class as an anticipatory set (West & Deutsch, 2017). There are various types of anticipatory sets that are appropriate, but all types occur at the beginning of the

class period and set up the rest of the lesson. Since Nearpod is a tool for multimedia presentations with embedded activities for students, this technology tool could be used to create an anticipatory set.

An article written by West and Deutsch (2017) outlined different concepts for an anticipatory set and explained its role in various classrooms. A study from Salansan et al. (2023) examined Nearpod in a secondary mathematics classroom. Educators need to draw in the attention of their students at the beginning of class and anticipatory sets are a strategy to do so. Nearpod was created as an interactive tool for students with the rise of technology being available to students. This study combined the discussion of Nearpod in a mathematics classroom with the concept of an anticipatory set.

Context of the Local Problem

At a district in the northeastern region of the US, the high school runs a Map NWEA diagnostics exam and has identified making connections and identifying key ideas as a problem area for all students. Therefore, the school district had been looking for ways to improve reading scores. The administration searched for reinforcement of vocabulary and students making connections throughout lessons. Therefore, this study examined how Nearpod as an anticipatory set addresses the problem of making connections through course material. Currently the high school is 1:1 computing with Lenovo laptops. These laptops can fold into a tablet and come with a stylus so that students can easily use draw features through different programs. The high school paid for Nearpod so there was existing access, and the rest of the lesson was available on paper for the students. This study took place in an Algebra 2 classroom with access to a Clear touch

device for instruction. I interviewed the participant on their implementation of Nearpod as an anticipatory set.

Description of the Technology

The technology that was examined through this study is Nearpod. On the media side there are blank slides, slideshows, and sway (premade sites and presentations); you can also upload PDFs, PowerPoints, images, and audio files. Interactive tools in a presentation are video questions, URLs, BBC Videos, 3D objects, simulations, VR fieldtrips, Flocabulary videos, and Brain Break videos. The other side of Nearpod include its activities such as multiple-choice quizzes, Draw It, fill in the blank, memory tests, a quiz game, drag & drop, and matching pairs. Nearpod also allows for discussion tools such as the collaborate board, Flipgrid, polls, and open-ended questions. In an additional math license, there are algebra tiles, base 10 blocks, color tiles, and fraction tiles (Nearpod's content, n.d.).

Nearpod can be completed at the teacher's pace for full group instruction, or it can be done student-paced for individual assignments. After the completion of either mode, Nearpod was able to generate reports based on student responses per slide. This feature is beneficial for formative feedback after each lesson. Nearpod also allows educators to make the responses to any slide anonymous for students. With these features, Nearpod has created a truly versatile technology tool for educators.

Purpose

This qualitative study's purpose was to discover how using Nearpod as an anticipatory set encourages students to make connections within the material for high school math students. With low scores in diagnostic tests regarding identifying key ideas and making connections, it is

important to find teaching practices that allow students to make connections which involve referring to prior knowledge identified in the anticipatory set throughout the lesson. Anticipatory sets can be an appropriate time to focus on making connections as it is a time to set up the lesson and class period.

Significance

I am interested in exploring a technology tool as an anticipatory set to see how we can make connections to different skills within a lesson. Anticipatory sets are critical to a lesson as an opportunity to activate prior knowledge and make connections between lessons. In mathematics education, students are constantly expected to build skills based on foundational fluency skills and will need to recall various skills and information. That expectation is why good quality anticipatory sets are critical in a mathematics classroom. Therefore, I wanted to see if there is an observable effect that Nearpod has on the rest of the lesson and if it is something that can be reliably referenced. I hoped to find a technology tool that can be utilized at the start of every lesson to build discussion and activate prior knowledge for students going into new lessons. Math education is something that constantly builds on its topics as nothing is isolated and encouraging students to see that could be very beneficial to their learning. This study also contributed to learning more about Nearpod and ways to build a technology based anticipatory set for secondary math students. Secondary mathematics teachers may benefit from this study.

Research Question(s)

The problem this study addressed was the effectiveness of Nearpod as an anticipatory set with the goal of making connections throughout the lesson. This qualitative study's purpose was to discover how using Nearpod as an anticipatory set encourages students to make connections

within the material for high school math students. How does a math teacher design anticipatory sets by using Nearpod? How does the math teacher perceive the usefulness of Nearpod in creating anticipatory sets in secondary mathematics?

Literature Review

Teachers need to start their class periods strong by gaining the attention of their students right away. Students need help building their literacy skills, specifically in making connections and identifying key ideas. Nearpod is an educational technology tool that is utilized by many districts. The Elaboration theory can be referred to for this study.

Learning Theory- Elaboration theory

A learning theory that aligns with this study is the Elaboration theory as described by Reigeluth. The method is structured around the idea of an epitome. An epitome in this sense is a simple case that can represent any task as a whole. Simplifying conditions get taken away from the epitome as students learn more complex ideas regarding the topic (Reigeluth, 1992).

Activating prior knowledge and scaffolding scenarios from simple to complex or concrete to abstract is an important part of instruction.

A part of the lesson that can be utilized for addressing prerequisite knowledge is an anticipatory set. There is an opportunity to build the beneficial organization and structure that comes from the Elaboration theory with a strong introductory piece. Giving students an epitome for the base case allows students to focus on the key aspects of the problem resulting in more connections and identifications being made throughout the lesson (English & Reigeluth, 1996). Utilizing this theory and observing it through the anticipatory set can provide various results for our students.

Anticipatory sets are the foundation of any lesson with the opportunity to activate prior knowledge relating to the lesson of the day. It is a common phrase for the activity that starts a class period. Examples identified in published work are to use analogies to activate prior knowledge, use media to bring relevance to students, and replicate a task related to the topic of discussion (West & Deutsch, 2017). These examples serve the purpose of engaging students with their interests and/or prior knowledge (West & Deutsch, 2017).

An anticipatory set relates to the Elaboration theory by referring to prior knowledge and basic tasks to learn new knowledge and more complex tasks. Every lesson starts with an anticipatory set even if it is not explicitly called on. Different lesson plan structures call for an anticipatory set in its own way. The importance of starting a lesson strong with engagement and prior knowledge is not a new phase that will go away. One common lesson plan structure is known as the “5es.” The first two areas of instruction outlined by this lesson structure are to engage and explore (Seiboldt et al., 2019). These two areas relate to the goals of an anticipatory set. The article further explained a hands-on activity that aimed to develop a deep understanding of the foundation for future lessons using prior knowledge and exploration. This study aims to analyze lesson plans that have the same intent with anticipatory sets but instead use technology as its delivery system. Nearpod is an educational technology tool that has features that align well with the purpose of an anticipatory set.

Affordance of Technology in Mathematics Education

Discussions on math in class would be more beneficial if students participated more and had an environment of deeper conversations that were more conversational rather than just providing short answers. Discussions require conversations not simply questions and answers.

The prompts for discussions should be open-ended and spark critical thinking and problem solving from students. Math class is a space where opportunities for discussion may seem limited, but with proper structures and supports it could happen organically.

Studies have shown that student artifacts promote true discussions even in a math classroom (Huang & Sutherland, 2022). Giving students opportunities to discuss their process and even justify it will help involve them in discussions whether it be a small group or whole class. Utilizing technology could make artifacts more presentable for students and allow visual cues for the discussion. Another aspect of technology that could aid discussion is immediate feedback (Huang & Sutherland, 2022). Immediate feedback will allow students to know if they are right or wrong, and a student knowing how they did may make them ask better questions and be more willing to share what they did when they were correct.

Some activities researched that can be done with the use of technology or not are journal writing and the Frayer model. These activities can help students learn and remember their vocabulary better (Bruun et al., 2015). Giving students time to think before sharing with a class could be beneficial. Using the Frayer model to draw depictions of the topic will be helpful for multiple representations. Both can be done with paper or with technology. Using technology could help students stay organized and have a single place of reference to go to for sharing information. Either way, starting a lesson strong with an anticipatory set, particularly an online tool with various features, can provide beneficial opportunities for conversation and discussion in a mathematics classroom.

Nearpod in Mathematics Education

Nearpod is an educational technology tool that can review fluency skills and promote classroom discussions. This tool is researched for many of its capabilities in a classroom, but it was difficult to find research pertaining to secondary math specifically. This study will look at Nearpod focusing on its effect on in-class discussions. Whereas previous studies looked at achievement scores and showed some significant increases in scores, but there was no decrease in scores from students (Styers et al., 2024).

Nearpod is an interactive slide deck application that has various features such as collaboration board, open-ended questions, and polls that encourage in class discussions (“Nearpod's content,” n.d.). These tools and others enable Nearpod to be used as an anticipatory set. Nearpod has been claimed to be an easy tool to design with and implement into the classroom (Styers et al., 2024). There are collaborative features such as live whiteboard and Draw It that could lead to peer discussion (Salansan et al., 2023). These interactions during the activities can then be turned into in-class discussions with minimal input from the instructor. Allowing students to discuss with people not directly involved in their work could spark beneficial discussions with minimal prompting.

The collaboration board is an activity to spark further discussion about a prompt given. This feature includes anonymous answers which relieves pressure from students (Salansan et al., 2023). When students can respond freely without worrying about being right or wrong, it will result in better responses that they can all learn from. Nearpod also allows for easy monitoring through the teacher dashboard screen (Salansan et al., 2023). Whether it is student paced, or instructor paced, it is easy to keep students on task and contributing to the activity. Furthermore,

the results on any slide of Nearpod could be reflected on by the teacher for real time feedback for other in-class discussions.

Methods

This study was a qualitative case study aimed at exploring the use of Nearpod in a high school math classroom. I started my study when I had received four lesson plans that included the use of Nearpod as an anticipatory set. After I reviewed the lesson plans, I conducted an interview for a reflection on the utilization of Nearpod. My participant was already implementing Nearpod in their lessons prior to my study, and I wanted to understand its utilization and possible benefits for students in an Algebra II classroom.

Participants

The participant was a high school math teacher who specifically teaches Algebra II. Their students are typically in grades 10 to 12, and the students may be in different grades in one class period. The students in these classrooms tend to be at various levels working towards an advanced regents diploma.

Procedures

The study adopted a qualitative case method, exploring how a high school math teacher designs and integrates Nearpod as an anticipatory set to foster students' math literacy. Data sources included: 1) the math teacher's unit plan design, and 2) interview with this math teacher. The math teacher talked through their unit plan, particularly, how they incorporate Nearpod for a specific educational purpose. The teacher then articulated the rationale behind the design and the affordances of Nearpod. After a week of teaching practice, the teacher was interviewed to talk about their practices with using Nearpod. The teacher then reflected on the triumphs and

challenges of implementing Nearpod with students. The identity of the teacher interviewed was protected, ensuring that no identifiable information was included in the collected data.

Instrument(s)

The two data sources were the math teacher's unit plan design and an interview with the math teacher. The unit plan design was analyzed to find common themes evident in the teacher interview. The interview was an opportunity of reflection for the teacher to explain the rationale behind the lessons and how Nearpod was used throughout the lesson. These data sources were digital within OneNote and have been removed after completion of this study. Neither data sources had any personal information or identifiable information collected.

Data Analysis

I organized my data digitally in OneNote keeping pages for each artifact collected. I highlighted and annotated my data looking for and chunking the information into patterns. Things that were related were highlighted the same color and I looked for information that came up often. Some of the codes that I had for my data were the different activities in Nearpod, engagement, review, explain, explore, and anonymous. Those words and concepts found in my data as codes lead to the discovery of my three themes.

When I went through the data, I found frequent mentions of discussion and engagement from students while taking part in the activities, therefore engagement and discussion were grouped together for my first theme. When analyzing my data, I found that predicting was connected well with exploring new information, so they were grouped together for a theme as well. Lastly, I found that the participant had used various techniques to review earlier material,

and any mention of review was grouped together as my third theme. These groupings of data resulted in my themes of review, discussions, and exploring predictions.

Results

Exploring predictions

There was evidence in the lesson plan data that students engaged with the Draw It feature to model volume-over-time graphs for two different scenarios. This activity required students to predict which scenario would or would not yield a constant slope. The students demonstrated their understanding of the relationship between volume and time through the visual representations, giving them the opportunity to translate their conceptual knowledge into visual form during the anticipatory set.

Also, in the interview data, the participant described how Nearpod anticipatory sets helped the learning process by allowing students to draw out their thinking and track their discoveries as they happened. This included recalling prior knowledge and constructing a deeper understanding of the concepts. The drawing feature helped students do exploratory discovery which involves picturing and manipulating the concepts directly. The participant stated that students “used Nearpod to draw their thinking, discovering the idea.” The ideas that the students learned from these drawings in the anticipatory set were later reinforced in the note taking during the rest of the lesson, which helped to solidify and organize their understanding. The combination of exploratory discovery through drawing, followed by structured note taking, appeared to increase the students' ability to keep and apply the material in more advanced contexts.

In-Class Discussions

Each Nearpod anticipatory set began with a Social-Emotional Learning collaboration board. Some Nearpod anticipatory sets included poll slides designed to get student opinions. These initial activities created a collaborative and inclusive classroom environment and let students share their thoughts and engage in the lesson at the start.

The participant described in the interview data classroom discussions through Nearpod where students submitted and worked with responses that hid the students' names after submitting. These anonymous responses helped to significantly increase student participation and engagement in the class discussions. The students were more comfortable sharing their answers without being embarrassed and led to more active involvement. In other Nearpod anticipatory set activities, students were called upon to elaborate on their responses.

The Nearpod drawing activity for the volume over time drawing was referenced the day after formally learning about average rate of change, when students were asked to put the definition of "rate of change" into their own words using the Nearpod Open Ended Question activity. This sparked conversation about misconceptions or alternative ideas of the concept. Students could see each other's answers show up on the screen as they submitted them which helped create a shared learning experience. This real-time discussion feature encouraged student engagement and helped correct misunderstandings by giving instant reflection and feedback.

Review

Different interactive features in the Nearpod anticipatory sets were used in the lesson plan to test student understanding and review key concepts. The Draw It activity was used to test the students' ability to use a line test to determine if a relation is a function which let students visually engage with the previously taught math concepts and demonstrate their understanding

through drawings. The Time to Climb activity was used to review functions from Algebra I and let them remember and apply previous material by putting multiple choice questions in a game format. The Fill in the Blank activity was used to review important topics such as inverse functions, one-to-one functions, and more general function-related concepts, encouraging students to actively recall and apply the definitions from previous lessons.

The participant said in the interview that Nearpod overall allowed for efficient review of foundational topics from previous courses that were needed to understand the current lesson. Specifically, Nearpod “saves time reviewing a topic they should already know that is out of the curriculum but necessary foundation for students in the course.” Activities were also used to review recent topics such as material from the lesson before which helped reinforce key concepts before moving to more advanced topics during the rest of the lesson. The participant planned for constant review and checks that made sure students were building foundational skills.

Discussion

The data in this study showed how Nearpod can support the creation of anticipatory sets and contributes to in-class discussions. The data also showed the challenges and opportunities for future research in this area. One of the major findings of this study was the positive impact of Nearpod in designing anticipatory sets that activate prior knowledge through review of previous topics. This helped prepare students for more complex tasks during the rest of the lesson which agrees with Elaboration Theory as described by Reigeluth. This was done through Nearpod activities such as the Draw It activity which let students visualize and manipulate the concepts in real time which allowed for deeper learning later on. The students represented abstract concepts with drawings such as volume-over-time graphs which made the relationship between variables

more concrete. This agrees with the assertion that using simple and visual representations of the math concepts as a foundation for more complex ideas helps students build better conceptual connections (Reigeluth, 1992).

Student engagement and participation increased during the implementation of Nearpod as an anticipatory set. The ability for students to instantly see each other's responses encouraged discussions that addressed misconceptions immediately which improved the learning environment which supports previous research on the use of student's artifacts in classroom discussions (Huang & Sutherland, 2022). The use of the Nearpod's collaborative board and poll slides at the start of the lesson created an environment with better communication and collaboration. The interview data revealed that students were more willing to elaborate on their answers and engage in discussions due to the anonymous feature in Nearpod. These students that were typically shy and hesitant to participate would feel comfortable sharing responses in this situation. Anonymous responses took the pressure away from students that didn't want to be seen as wrong to their peers. Without the pressure of worrying about what other students think, students are in a safer learning environment for discussions. Therefore, the study also found that Nearpod supported students' willingness to participate through the anonymity of the responses (Salansan et al., 2023).

The educator's reflection of Nearpod's usefulness in being an anticipatory set was generally positive. The teacher believed that Nearpod was a tool that was easy to use. It was easy to monitor student progress and see their responses in the teacher dashboard. The Nearpod activities that were examined were solely used as an anticipatory set taking up the first ten to fifteen minutes of the lesson. Using Nearpod saved the teacher time on preparations year after

year, as the activities were already available to them saved in the account. Any tweaks or adjustments that the teacher wanted to make to the anticipatory sets were quick to make.

For future research on this topic of study, there should be a larger sample of both teachers and students. This study specifically focused on Algebra II topics, but other secondary mathematics topics and courses may use different features of Nearpod. This study also focused on the perspective of a single participant while more participants may supply different rationale behind different activities. Further studies could also examine student data and specifically their responses to measure the sustainment of engagement and understanding. Examining long-term effects of Nearpod as an anticipatory set would also provide further insights into this learning style.

Action Plan or Recommendations

To implement the results of my study I planned to initially introduce Nearpod with the discussion board as a quick launch. This would get students used to loading the program and allow me to quickly gather thoughts for an important question or for an SEL question as described in the study. I planned to then move into creating checks for understanding at the beginning of the lesson with review purposes from the earlier class. I thought that with slow implementation it could build students up to the idea of using the tool and make them comfortable using it. I integrated Nearpod into my teaching by creating lesson practicing fluency skills from the earlier class. I have also “quick launched” a discussion board to have responses from all students for an essential question from the earlier class.

The recommendation for other teachers in this field is to try it out at least once. When you see the reactions from students you will be hooked into finding various ways to utilize

Nearpod as an anticipatory set. If you have handouts for an anticipatory set already, see if it fits into one of the slides formats in Nearpod. I learned that students would share information if given appropriate places to do so where they feel comfortable without pressure. Nearpod gives students options for various methods of showing their understanding.

Conclusion

The problem this study addressed was the usefulness of Nearpod as an anticipatory set with the goal of making connections throughout the lesson. The purpose of the study was to discover how using Nearpod as an anticipatory set encourages students to make connections within the material for high school math students. The research questions addressed were: How does a math teacher design anticipatory sets by using Nearpod? How does the math teacher perceive the usefulness of Nearpod in creating anticipatory sets in secondary mathematics? The method for this study was a qualitative case study with data from lessons plans and a reflective interview from a participant.

The data analysis of the study included coding information to form three themes of exploring predictions, in-class discussions, and review. The participant of this study designed anticipatory sets with Nearpod to reach various goals including but not limited to having student predictions, having in-class discussions, and reviewing previous concepts. The participant of this study believed that Nearpod made students engaged in the material and were more willing to participate due to the anonymous feature within Nearpod. I strongly recommend trying Nearpod to see if it works in your classroom as it is extremely versatile and allows students a space to participate without the pressure of being wrong. Overall, Nearpod can successfully be used as an

anticipatory set for a high school mathematics classroom where students are engaged in their learning.

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Appendix A

Interview Questions

1. How did the Nearpod activity engage students in the mathematical concepts covered?
2. In what ways did the Nearpod activity support the learning objectives of the math lesson?
Did you observe connections between the activity and the mathematical concepts being taught?
3. Were there any challenges or obstacles that arose during the Nearpod Activity? How did you address them?
4. How did the interactive features of Nearpod, such as quizzes, polls, or interactive simulations, enhance student understanding of the math content? Were there any specific features that you found particularly effective in promoting student engagement and learning?
5. Reflecting on the overall effectiveness of the Nearpod activity, what adjustments or modifications would you consider making for future implementations to further enhance student learning outcomes and conceptual understanding in math?