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Supporting Mathematic Achievement for Students with Learning Disabilities Through Enhanced Anchored Instruction

Abstract

Difficulties in mathematical learning are common and significant.The struggle has increased exponentially with the Common Core State Standards in effect. Students with or without learning or mathematical disabilities may respond to continued failure by withdrawing their effort, carrying low self-esteem, and/or displaying avoidance behaviors. Enhanced anchored instruction is designed to provide students the opportunity to construct knowledge and design solutions to problems collaboratively. The approach of enhanced anchored instruction attempts to guide students to become more active in learning through the use of technology. Enhanced anchored instruction provides students the opportunity to work through problems attached to a visual anchor. These anchors help develop higher-order thinking and contextualized learning. This article discusses the steps to use enhanced anchored instruction to assist students with learning disabilities to improve problem-solving skills and increase mathematical achievement.

Keywords

Enhanced Anchored Instruction, contextualized learning, technology, mathematic achievement, learning disabilities, mathematic disabilities

Supporting Mathematic Achievement for Students with Learning Disabilities Through Enhanced Anchored Instruction

Wendie Lappin Castillo

Research relating to students with mathematic disabilities exhibits a gradual increase in focus on students who demonstrate challenges in the learning of mathematic skills and concepts in a school environment (Myers et al., 2015). When a child with a learning disability has difficulty solving mathematic problems, the mathematic problem most often involves encoding a problem in text (Bottge et al., 2015). For example, in attempting to solve a word problem, a child may experience difficulty in decoding, comprehending, understanding the question, sorting important from extraneous information, creating a plan to solve the problem, working through each step, and/or knowing what calculations to use (Bottge et al., 2015; Myers et al., 2015). Validated studies in this context focus most closely on adolescents, particularly sixth grade and up, who have a mathematic disability (Bottge et al., 2015).

Historically, anchored instruction is described as an inquiry-based approach to learning designed to guide students toward becoming actively involved in the learning process. Anchored instruction is one element of a larger instructional model known as situated cognition (Cognition and Technology Group at Vanderbilt, 1990, 1993). Anchored instruction provides an anchor, which acts as a focal point or catalyst for meaningful activities. This approach makes it possible for teachers to design learning environments that encourage students' construction of knowledge and active problem solving and is designed to provide students the opportunity to think about and work on problems collaboratively (Cognition and Technology Group at Vanderbilt, 1990, 1993). Enhanced anchored instruction is a technology-based approach to instruction that demonstrates the pedagogical benefits of an integrated video-based learning environment (Bottge et al., 2015). To assure the success of implementation of Enhanced Anchored Instruction, it is important to note that this approach is successful when students have been taught foundational skills through explicit instruction, as well as the importance of guidance provided by the special education teacher (Bottge et al., 2014, 2015). The supports and phases to be implemented by the students with direction from the special education teacher are discussed further in this article (see Table 3 and Figure 1).

Enhanced Anchored Instruction Defined

Enhanced anchored instruction (EAI) (formerly known as *anchored instruction* and in more current literature referred to as *Collaborative Techno-Enhanced Anchored Instruction*) is rooted in situated cognition and defined as an inquiry-based approach to learning that encourages students to become actively involved in the learning process (Bottge et al., 2015; Bransford, 1993; Cognition and Technology Group at Vanderbilt, 1990, 1993; D'souza & Kumari, 2018). Enhanced anchored instruction allows learners, with or without learning disabilities, to construct knowledge, evaluate their work, and engage in designing solutions to authentic problems (Bottge et al., 2015). Teachers are able to use these video or photo adventures to organize lessons that aid students in finding challenging topics. This process allows learners to find the meaning of the problem and collaborate with their peers and teachers through the problem-solving process. The purpose of EAI is to bridge the gap between natural environments and school learning environments by allowing students to generalize concepts through the use of media clips prior to going out into the community to generalize concepts learned. This assists in the cognitive shift to the next level of Bloom's Taxonomy prior to leaving the familiar environment of the classroom (Bloom, 1956).

Enhanced anchored instruction is beneficial for teachers who plan to use EAI to support the bridge of applying learned content to more realistic situations. This supports the progression of acquisition to generalization within phases of learning, as well as the steps of cognitive development within Bloom's Taxonomy (Bloom, 1956; Changnam & Picanco, 2013). Appropriate scaffolding during the EAI intervention, through the use of the outlined phases provided in this article, will give teachers the ability to monitor students' learning progress and determine any need for assistance (Bottge et al., 2018).

Finding Video Clips on the Internet to Create Anchored Mathematic Problems

In consideration of the practice of EAI, the assumption is that the teacher locates appropriate video clips to be used as anchors for problem solving sequences. Several websites exist which contain an abundance of multimedia (see Table 2**).** When exploring the Internet, remember to keep in mind the specific kind of resource you are looking for (D'souza & Kumari, 2018). When searching for video clips that will serve as anchors, look for videos that are realistic, are no more than four to five minutes in length, have multiple scenarios presented, and are presented in a narrative format or story with embedded data (Bottge et al., 2015; D'souza & Kamari, 2018).

[Insert Table 2]

Creating Anchored Mathematic Problems with support of the Internet

Learning environments that utilize EAI combine video and audio technologies into a story format. Students who participate in technology-based instruction identify with the characters and/or events in the videos (Myers et al., 2015). Because of this connection, the students become situated in the problem and are motivated to find a solution (D'souza & Kumari, 2018). Not all students relate to the same stories or anchors therefore, it is important to tailor the content of the EAI so it meets the interests and needs of students. Websites can be used to provide the context of a problem. Media available on the Internet include news clips, pictures, and graphics. Other anchored media available on the Internet include virtual field trips, virtual tours, VLOGS (video blogs) and simulations. Such media provide virtual situations (Zydney et al., 2014). Once students contextualize the problem, they then use the Internet to research information needed to solve their anchored problem. Students may select pictures, graphics, video clips, or audio clips to help them create a solution to their problem (Bottge et al., 2015). Teachers need to make specific considerations when using the Internet for anchored instruction (see Table 1).

[Insert Table 1]

Phases of Implementation of Enhanced Anchored Instruction

The following phases are an explicit outline of how to implement EAI in the classroom (see Figure 1). Phases may be accomplished over several days or weeks. This allows students to work through the sequence. The use of EAI allows for differentiated learning, which translates into the fact that students will move through the phases at different paces. If the phases need to be implemented over a period of days or weeks, it allows students to view the anchored video each day; this repetition supports the process of construction of the problem. The usual time allotted for a full EAI sequence is six weeks. Remember to allow plenty of time for this instruction.

[Insert Figure 1]

Phase I: Select Materials

When choosing EAI materials, first make sure the material is approved by your school district for use in the curriculum for your particular grade level (see Table 3) (Bottge et al., 2015).

Phase II: View Media

Phase II involves viewing EAI media. More than one piece of anchored instruction media may be used. Differentiated groups within your classroom will determine appropriate anchors for groups. If you have differentiated groups in your class, you will need to either allow this phase to take place at different times for each group or provide each anchor on different devices with enough headsets or ear buds for the number of students per group. Once you have determined your groups, it is time to implement the video anchor(s) from the Internet to the class or to each group (see Table 3). Be sure to adjust viewing to meet the needs of students and available technology (D'souza & Kumari, 2018). As a teacher, adjusting the viewing includes things such as turning on closed caption, adjusting sound for students with sensory sensitivity, making sure all headsets/ear buds are in good working condition, assuring videos are narrated for students with visual impairments, etc. It is important that the teacher roams the room for any needs students have during the viewing of the media clip(s).

Phase III: Analyze

Once students watch the anchored video clip, it is time to work with the teacher. The students can work in groups or as a class to retell the story orally to the teacher. Individualized instruction takes place for teachers to guide students through the metacognitive process of attaching the anchor to an actual problem-solving scenario. This phase is when students use higher-order questions to categorize the content of the anchor. Once the story is retold, students need to break into the groups determined by the teacher in Phase II and record what they saw in the anchor. Students can do this by writing down contextual information as if they were using a strategy such as journaling or mind mapping (Zydney et al., 2014). The teacher focuses on providing materials for students to create their mind maps or other activity that help the students note what thoughts are provoked by the media, as well as ask higher-level questions. An example of how to help students develop higher-level questions and critical thinking is by teaching students to ask “why”, “how”, “what if”, or “when” questions about the content in the video selection (Zydney et al., 2014). In some instances, questions may be posed in the media clip which help generate thought and require problem solving attached to the anchored media (see Table 3).

Phase IV: Determine the Problems to be Solved

Once students write what they remember about the anchored video clip, they continue to work in groups to construct the problems that need to be solved, which were presented in the video segment. In this phase, the video anchor can be viewed multiple times and paused during the viewing to support the construction of the problem. This will assist the students in focusing on the problems to be solved without worrying about forgetting what was presented in the anchor. At the end of this phase, students have an outline of the problems they will be working together to solve (Zydney et al., 2014) (see Table 3).

Phase V: Research a Solution Process

This is the research phase. Students work together and research what mathematical methods best help to calculate each problem they are solving. This phase takes time, as the methods to use will not be apparent to the students. The students use higher-order thinking skills and work collaboratively to determine how their group will best solve each problem derived from the anchored video (Akdemir, 2018). This is where students consider learned strategies and foundational skills to assist in an approach to the solution (see Table 3).

Phase VI: Solve the Problems

Students work collaboratively to solve each problem of the scenario from the anchored video through a trial-and-error process. This phase of EAI takes time. Students work together collaboratively to try different methods to problem-solve (Akdemir, 2018). Learned foundational skills and strategies should be considered for the solution and can be put into use during this phase. Students also consult the teacher for direction and affirmation during this phase (see Table 3). Once the students arrive at solutions with the problems and believe they solved all problems derived from the anchor, the students collaborate to determine how they will present their solutions to the class.

Phase VII: Present the Solutions

In this phase, each group is given time to present their solutions to the class. Each group tells the following: 1.) Which anchored video they watched and which website the video clip came from, 2.) What problems they constructed from the anchor that needed to be solved, 3.) How they solved each problem, and 4.) Their final conclusion and solution to the problems solved. At this time the class asks the group questions in regard to their anchored video problem and solution. Again, higher-level questioning takes place. This phase completes the full sequence of anchored instruction (Bottge et al., 2014) (see Table 3).

[Insert Table 3]

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Table 1

Considerations When Searching for Media

Considerations	Solutions
How to locate multimedia clips.	Browse multimedia sources in Table 2.
Be cautious when using the Internet.	Use the browser platform provided by your school district.
Filter websites to find appropriate media clips suitable for use in the classroom.	Set your browser restrictions to ‘G’ or ‘PG’.
Media clips should be as realistic as possible.	Find clips that relate to the age of your students.
Clips should be no more than four to five minutes in length.	Review the time length of the video clips.
Digital media is best for playback purposes.	Try to avoid taped recordings and look for digital video recordings.
Have a choice of clips to choose from.	Consider using more than one source from Table 2.

Table 2

Internet Multimedia Sources

Website	Type(s) of Multimedia Available
Freestockphotos.com	Stock photography images
Istockphoto.com	Stock photography images
School.discoveryeducation.com/teachers/	Educational video clips
www.cnn.com	News clips
www.filmclipsonline.com	Short film clips from major motion pictures News clips
www.funnyplace.org	Commercial clips Video clips
www.msnbc.com	News clips
www.nbcolympics.com	Sport video clips Event video clips
www.pixar.com	Short films
www.freeimages.com	Stock photography images
www.thinkport.com	Interactive media clips
www.youtube.com	Video clips Music videos

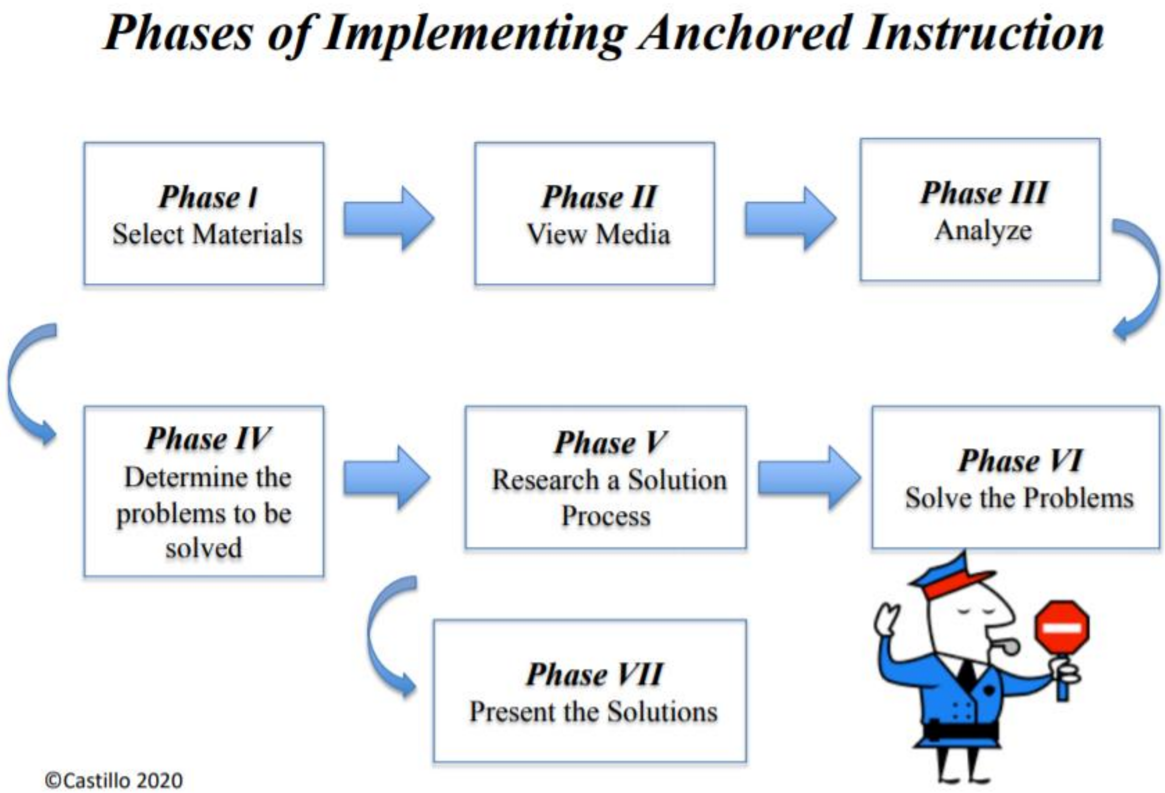
Table 3

Sample Mathematic Problem using Media as an Anchor

Phase	Example
Phase I: Select Materials	This is a video on Youtube created as a piece of Anchored Instruction media https://www.youtube.com/watch?v=zO5q2FdV-wk (Gar, 2013)
Phase II: View media	Click on the hyperlink and watch the video; it is 2:09 minutes in length. For this activity, only one piece of media is used.
Phase III: Analyze	Students talk with the teacher about what was discussed in the media clip and note the questions asked in this video clip using a strategy most comfortable for them to take notes (e.g., journaling, mind mapping, bulleted notes). The teacher then shows the video clip again and pauses periodically to allow students to take note of the goals. Example: Goal: to spend under $50 on lunch and gas
Phase IV: Determine the Problems to be Solved	1. Look up café location closest to get to. 2. Look on google maps to determine which Wild Wings Café location is most cost efficient with gas. 3. How much would it cost to fill up a 10-gallon tank of gas at $3.72 per gallon? 4. Goal: to find something to eat and drink for under $15. 5. Will need to visit the Wild Wings Café website to find out the prices of the food items. 6. Find three different meal choices, with a drink, that could total under $15. Don't forget to add an 18% tip.
Phase V: Research a Solution Process	1. To calculate how much it will cost to fill up a 10-gallon tank of gas at $3.72 per gallon. We will need to use multiplication. 2. We need to find three items on the menu that, each with a drink, will be under $15.

Phase VI: Solve the Problems	Ultimate goal: to spend under $50 on lunch and gas. 1. 10 x 3.72 =$37.20 for a tank of gas. 2. Hamburger, $6.99, plus a Coca-Cola, $2.99, plus 18% tip, equal $11.77. (6.99 + 2.99) * .18 = 11.77 $37.20 + 11.77 = $48.97 $48.97 < $50.00 The goal was reached. Complete this process for 2 more items on the menu.
Phase VII: Present Solutions	Each student group will use the SmartBoard ™ projector and show their work. Each group will likely have different items from the menu. Students will show the steps of their work (e.g., like the example in Phase VI above). They will then share which of the three items they chose on the menu they would be able to purchase with the goal of spending less than $50 in mind.

Figure 1


Phases of Implementing Anchored Instruction
Phase I
Select Materials
Phase II
View Media
Phase III
Analyze
Phase IV
Determine the problems to be solved
Phase V
Research a Solution Process
Phase VI
Solve the Problems
Phase VII
Present the Solutions
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