

Accessibility Strategies for Mathematics

"Equity does not mean that every student should receive identical instruction; instead, it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students."

Principles and Standards for School Mathematics
(NCTM, 2000, p.12)

This document provides an organized list of strategies that teachers can use to make mathematics more accessible to students with disabilities. The goal is to enable teachers to provide support so students with learning disabilities can succeed, while maintaining high standards and the integrity of the mathematics.

The *Addressing Accessibility in Mathematics* (AAM) group examined current research on student difficulties in mathematics, and analyzed the kinds of tasks students are asked to use in various middle school mathematics curricula. Based on this, AAM identified six areas in which students' strengths and needs strongly affect mathematics learning. The lists that follow detail the types of tasks commonly required in the six areas, along with examples of student difficulties and corresponding accessibility strategies. Note that some problems, such as multi - step problems, involve tasks from multiple areas.

Many of the strategies provide scaffolding so that students can focus on the main mathematical content. For example, a strategy might take over a mechanical aspect of a task, such as drawing a table, so students can focus on higher - order thinking and demonstrate their grasp of concepts. Over time, the scaffolding is often removed — therefore, part of planning accessibility strategies is considering how and when to remove the scaffolding. It's akin to learning to ride a bicycle: at first, training wheels help a child focus on riding without having to worry about falling over.

Some students may always need certain supports; others may leave the supports behind. In either case, the students can expand their own repertoires of strategies, building on their strengths to help bypass their weaknesses.

The three of the six accessibility areas as highlighted below will be examined in this presentation:

- Visual-Spatial Processing (page 4)
- Memory (page 6)
- Attention (page 7)

While the strategies in this document are targeted at improving the learning experience for students with disabilities, many are also common teaching strategies that you may already use in your classroom.

Visual - Spatial Processing

Representing mathematical ideas is key to understanding mathematics. Students use representations to solve problems, explore concepts, and communicate ideas. For example, students use different visual representations for percents, including number lines, fraction circles and bars, base ten blocks, and hundred-grids. In algebra, students use visual patterns to determine rules, analyze graphical representations of functions, and create mathematical models. Some difficulties with such tasks are caused by a breakdown in the processing of visual information. Students may benefit from such strategies as color-coding systems to help them focus on key information, and from learning explicit strategies for interpreting visual representations

Visual-Spatial Processing		
Type of Task	Examples of Student Difficulty	Accessibility Strategies to Consider
Create and interpret visual representations	<ul style="list-style-type: none"> Has difficulty representing mathematics concepts visually Does not connect graphics to the concepts they represent 	<ul style="list-style-type: none"> Provide handouts of the representations for students to draw on, highlight, measure, and cut out Provide manipulatives
	<ul style="list-style-type: none"> Finds it difficult to visualize and represent a three-dimensional model in two dimensions Finds it difficult to interpret a two-dimensional representation of a three-dimensional model 	<ul style="list-style-type: none"> Provide examples of actual 3-D models for students to view or manipulate
Work with tables and graphs	<ul style="list-style-type: none"> Has difficulty figuring out how to create tables or graphs or has difficulty physically creating them Has difficulty reading or interpreting graphs 	<ul style="list-style-type: none"> Use larger fonts Provide oral versions (spoken, taped) of the instructions and text, where appropriate Use text-to-speech software Provide Braille version of the text
Read Text	<ul style="list-style-type: none"> Cannot read standard-sized text 	<ul style="list-style-type: none"> Reorganize the material into a handout Make all of the handouts single-sided and provide ample white space
Read handouts and book pages	<ul style="list-style-type: none"> Finds crowded pages distracting 	<ul style="list-style-type: none"> Re-organize the materials into a handout Make all of the handouts single sided and provide ample white space
	<ul style="list-style-type: none"> Has difficulty focusing on the important information Finds extraneous material distracting 	<ul style="list-style-type: none"> Have students highlight the key information Eliminate extraneous page features Explicitly teach how to find information in a book, noting chapter structures, bold text, previews, and summary boxes In preparing materials, consistently use methods such as bolding or underlining
Copy or read information displayed on a blackboard, chart, or overhead	<ul style="list-style-type: none"> Does not see board well Does not know where to focus 	<ul style="list-style-type: none"> Use large font sizes for overhead masters and give copies of the masters as handouts Seat students close to the blackboard Reduce glare from the windows Use a consistent format for displaying information on the board Color code

Memory

Both long-term memory and short-term memory play essential roles in learning mathematics. For example, students use their memories to perform calculations and procedures, identify geometric figures, and create graphs that have all of the necessary parts.

Long-term memory. Students with long-term memory deficits may not easily store information (such as number facts or the steps of algorithms) in memory, or may have difficulty retrieving information. Long-term memory difficulties also affect their abilities to use mathematical vocabulary and to make connections among concepts that they have learned in prior months or years.

Short-term memory. Students with short-term memory deficits may have difficulty keeping track of several pieces of information for a brief time, such as keeping track of calculations in multi-step problems, or performing mental calculations. Short-term memory difficulties also affect their ability to remember directions, follow a presentation, or build on others' responses in a class discussion.

Memory		
Type of Task	Examples of Student Difficulty	Accessibility Strategies to Consider
Use basic arithmetic facts	<ul style="list-style-type: none"> Has difficulty memorizing or recalling basic facts Retrieves incorrect facts 	<ul style="list-style-type: none"> Allow students to use a number line Provide a multiplication chart Ask students to find patterns in the facts Allow the use of calculators
Carry out algorithms	<ul style="list-style-type: none"> Does not remember sequence of steps in an algorithm 	<ul style="list-style-type: none"> Provide a model of worked-out calculations, highlighting the steps Teach mnemonic devices Provide practice problems and examples Allow the use of calculators
Perform mental calculations	<ul style="list-style-type: none"> Cannot keep the steps of a calculation in his or her working memory 	<ul style="list-style-type: none"> Allow students to use pencil and paper Have students talk about which operations they would use instead of calculating Allow the use of calculators
Solve multi-step problems	<ul style="list-style-type: none"> Does not have needed information in his or her working memory to solve a problem 	<ul style="list-style-type: none"> Provide resource sheets Provide templates or organizers for recording information Break the problem into smaller chunks Allow the use of calculators
Use previously - taught skills and concepts	<ul style="list-style-type: none"> Does not remember skills and concepts that were taught earlier in the year or in previous year 	<ul style="list-style-type: none"> Use a notebook organization system to help students find information in their prior work Review the needed skills at the beginning of the lesson or in the resource room Provide resource sheets with cues to remembering the skills
Use math vocabulary	<ul style="list-style-type: none"> Has difficulty remembering math vocabulary 	<ul style="list-style-type: none"> Preview the needed vocabulary prior to the lesson Have students look up vocabulary words and write the definitions on a resource sheet Provide resource sheets for needed vocabulary

Attention

In middle school, the increasingly complex math content and tasks lead to demands for longer attention spans from students. They need to complete multi-step investigations and long-term projects, pay attention to details, and complete tests and assessments, often within limited time. Students have to listen to directions and explanations, filter out extraneous information, participate in class discussions, and work effectively by themselves.

Conceptual		
Type of Task	Examples of Student Difficulty	Accessibility Strategies to Consider
Complete long - term projects	<ul style="list-style-type: none"> ○ Cannot maintain attention for the details needed to complete the project ○ Loses track of what needs to be completed 	<ul style="list-style-type: none"> ○ Provide a project organizer ○ Schedule frequent check - in points for longer projects
Complete math work accurately	<ul style="list-style-type: none"> ○ Makes careless errors because of going too quickly or poor attention to detail 	<ul style="list-style-type: none"> ○ Encourage or require that students check their own work
Focus on teacher presentations	<ul style="list-style-type: none"> ○ Gets distracted easily ○ Has difficulty listening for long periods of time 	<ul style="list-style-type: none"> ○ Provide key questions to help students focus ○ Use visuals ○ Include student activities and participation
Work in pairs or small groups	<ul style="list-style-type: none"> ○ Distracts the group 	<ul style="list-style-type: none"> ○ Set clear behavioral and academic expectations ○ Assign group roles, such as recorder
Participate in class discussion	<ul style="list-style-type: none"> ○ Distracts the group ○ Does not listen to other students ○ Makes irrelevant comments 	<ul style="list-style-type: none"> ○ Use visuals ○ Reduce the time for whole class discussions ○ Break into small groups and have them report back to large group
Work with manipulatives	<ul style="list-style-type: none"> ○ Uses manipulatives for activities that are not task -oriented 	<ul style="list-style-type: none"> ○ Set clear behavioral and academic expectations ○ Check - in frequently on manipulative use