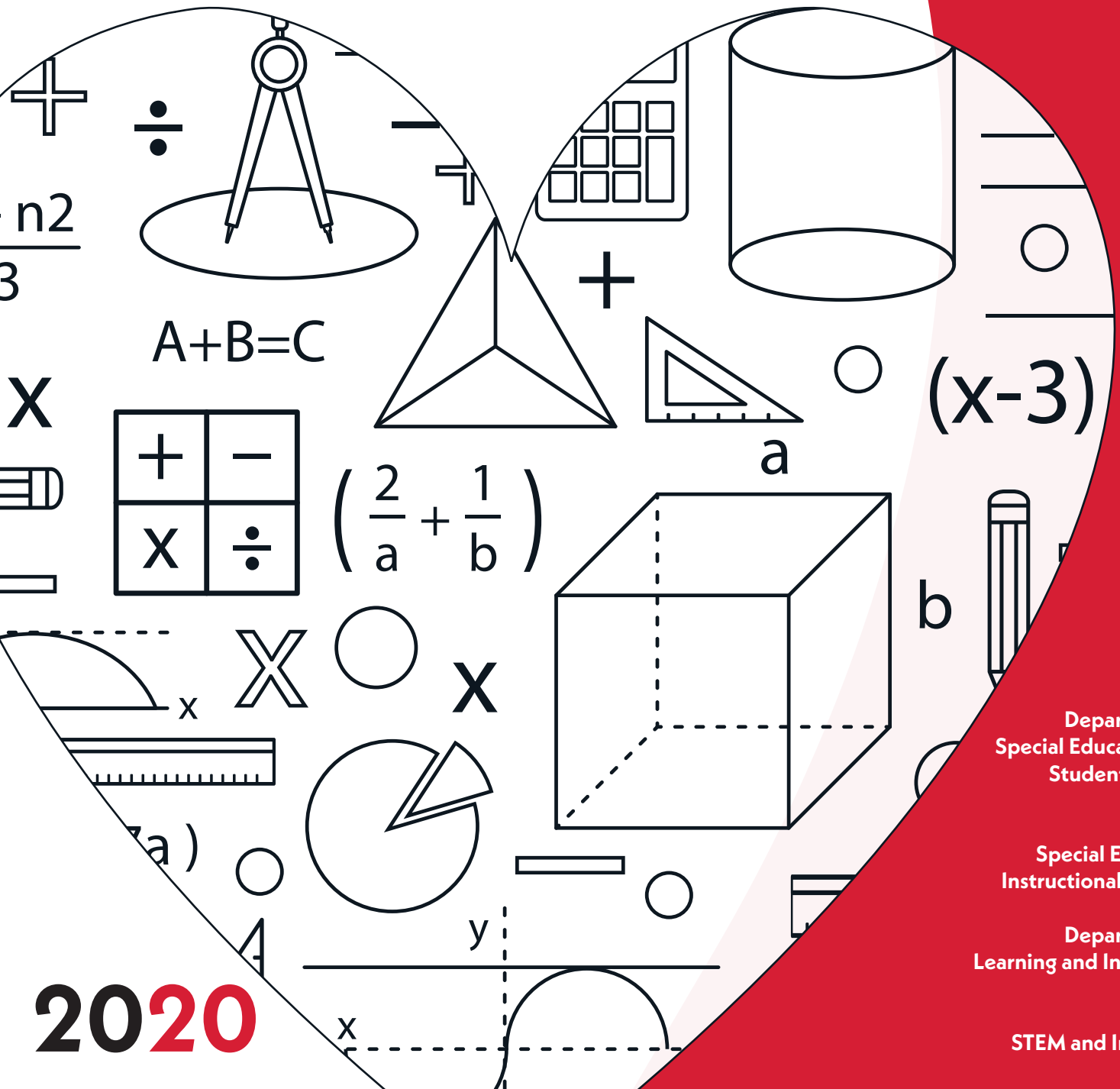
# STUDENTS WITH DISABILITIES IN MATHEMATICS

VIRGINIA DEPARTMENT OF EDUCATION

# FREQUENTLY ASKED QUESTIONS

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Department of Special Education and Student Services

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VIRGINIA DEPARTMENT OF EDUCATION

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# PREFACE

The vision for K-12 mathematics education in the Commonwealth of Virginia is that all students have access to high-quality, equitable, and engaging mathematics instruction. Students participate in relevant learning opportunities that develop both conceptual and procedural understanding. Teachers develop classroom communities that promote student ownership of learning through the use of mathematical discourse, problem solving, and rich tasks. Students and teachers exemplify resilience and a growth mindset, believing that all students can learn mathematics at high levels. This vision is for all students, including students with disabilities and diverse learning needs, and spans across the continuum of all settings.

According to the Individuals with Disabilities Education Improvement Act of 2004 (IDEA 2004), extensive research and experience has demonstrated that the education of children with disabilities can be made more effective with maintaining high expectations for students while ensuring their access to the general education curriculum in the regular classroom as appropriate. The Regulations Governing Special Education Programs for Children with Disabilities in Virginia further explains that Least Restrictive Environment (LRE) means that to the maximum extent appropriate, children with disabilities, including children in public or private institutions or other care facilities, are educated with children who are not disabled, and that special classes, separate schooling or other removal of children with disabilities from the regular educational environment occurs only when the nature or severity of the disability is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily (34 CFR 300.114 through 34 CFR 300.120). Review of school divisions' LRE data in the 2017-2018 Virginia Department of Education (VDOE) Special Education Annual Performance Report shows that 68% of students with disabilities in Virginia's classrooms are spending at least 80% of their day in the general classroom. However, according to the 2018-2019 State Performance Report, approximately 55% of students with disabilities passed the Virginia Standards of Learning assessments in mathematics. Furthermore, statewide data show that achievement gaps in mathematics continue to exist for students with disabilities across the state.

This discrepancy in data may indicate that educators need more support and guidance in providing specially designed instruction and appropriate accommodations to students with disabilities in the general classroom. In an effort to enhance the performance of students with disabilities in the mathematics' classrooms, this frequently asked questions document serves as a resource for educators, administrators, and parents to address the educational needs of students with mathematics disability and/or mathematics difficulty.

This document provides an overview of the characteristics of mathematics disability and presents evidence-based strategies to support students with mathematics disability and/or difficulty at all instructional levels. Importantly, the strategies outlined in this document are targeted at improving learning outcomes for the following student populations:

- Students with a formal school identification of a specific learning disability in mathematics.
- Students with a non-mathematics related disability (e.g., speech and language disorder, specific learning disability in reading) who experience mathematics difficulty.
- At-risk students without a formal disability diagnosis who experience mathematics difficulty.

Essentially, this frequently asked questions document, along with the companion **VDOE *Resource Guide for Evidenced Based Specially Designed Instruction in Mathematics***, is intended to support any student who experiences mathematics difficulty – with or without disability identification – in any setting. For those schools who implement Virginia Tiered System of Supports (VTSS) , many of the strategies outlined in this Frequently Asked Questions document could support Tier 1 instruction, while many of the strategies outlined in the accompanying resource guide could support Tier 2 and Tier 3 instruction.

The Virginia Department of Education (VDOE) and its Department of Special Education and Student Services and Department of Learning and Innovation is committed to ensuring that the public education system is positioned to advance equitable academic outcomes by providing access to learning environments that meet the needs of its diverse student population. This Students with Disabilities in Mathematics Frequently Asked Questions document aligns with those efforts as it outlines effective supports for students with learning disabilities in mathematics; and offers support to school divisions and parents seeking to improve outcomes in mathematics for students with disabilities. It also serves for professional development and technical assistance from the VDOE.

# CONTENTS

# SECTION I: INTRODUCTION

## DEFINING MATHEMATICS DISABILITIES

### *How is a mathematics disability defined in Virginia?*

In Virginia, mathematics disability is recognized as one of the conditions under the category of Specific Learning Disability (SLD). According to the Individuals with Disabilities Education Act (IDEA, 2004) and the Regulations Governing Special Education Programs for Students with Disabilities in Virginia ("the Virginia Regulations") at 8VAC-20-81-10, Specific Learning Disability is an umbrella term used to describe:

*"a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations, including conditions such as perceptual abilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia."*

Mathematics disability, frequently referred to as dyscalculia or developmental dyscalculia, is defined as:

*"the inability to understand and remember mathematics concepts, rules, formulas, basic computation skills, and sequence of operations. Students with dyscalculia have poor understanding of number concept and the number system and skills that are the foundation of higher order mathematical skills."*

### *What are the causes of a specific learning disability in mathematics?*

- A mathematics disability is considered a neurodevelopmental disorder that involves dysfunction in specific brain regions that are important for mathematics skills.
    - Brain regions associated with mathematics skills include (but are not limited to): the parietal lobe, prefrontal cortex, dorsal basal ganglia, temporal lobe, and hippocampus (Soares et al., 2018).
- There is a strong genetic influence on the development of mathematical skills.
    - One study found that 50% of siblings of a student with a mathematics disability can be expected to experience similar difficulties (Shalev & Gross-Tur, 2001).
    - Parents of a student with a mathematics disability are 10 times more likely to have a mathematics disability than members of the general population (Hannell, 2013).
- Environmental factors such as motivation, behavior and attention challenges, and/or poor teaching may contribute to or exacerbate a mathematics disability (Szücs & Goswami, 2013).

### *What is the incidence of students with a specific learning disability in mathematics in the school-age population?*

Despite a wide range of prevalence data, there is general agreement that approximately 3-7% of students are identified as having a specific learning disability in the area of mathematics (Shalev, 2007).

### *What are the primary criteria for diagnosing a specific learning disability in mathematics?*

Although students with mathematics disability experience one or more of the challenges described above, IDEA (2004) states the primary criteria for diagnosis of mathematics disability is difficulty in one or both of the following areas:

- mathematics calculation
- mathematical reasoning

### *What is the difference between mathematics disability, dyscalculia, and mathematics difficulty?*

Mathematics disability refers to students who have a formal school identification of a Specific Learning Disability (SLD) in mathematics under the Individuals with Disabilities Education Act (IDEA, 2004) federal mandate. Students with a mathematics disability have Individualized Education Program (IEP) goals in mathematics.

Several terms exist to describe a mathematics disability and often are used interchangeably. The list below highlights terms used to describe conditions equivalent to mathematics disability.

- Dyscalculia
- Developmental dyscalculia
- Arithmetic-Related Learning Disability(AD)
- Arithmetical Disability (ARITHD)
- Mathematical Disability (MD)
- Mathematics Learning Disability (MLD)
- Specific Learning Disability in Mathematics

(Szücs & Goswami, 2013)

The term mathematics difficulty refers to students who:

- Do not have a formal disability identification, but experience mathematics difficulty; or
- Have a non-mathematics related disability (e.g., speech and language disorder, specific learning disability in reading) and experience mathematics difficulty.

## CHARACTERISTICS OF DISABILITIES IN MATHEMATICS

### *What are the global characteristics of a specific learning disability in mathematics?*

Students with mathematics disability experience difficulty in one or more of the following areas (Hannell, 2013):

- counting
- comparison of quantities
- understanding operations
- mathematics fact fluency
- problem solving
- conceptual understanding
- procedural efficiency
- spatial reasoning
- verbal reasoning

### *What are the signs that a student has a specific learning disability in mathematics and/or mathematics difficulty?*

There are a wide range of signs that indicate that a student has a specific learning disability in mathematics and/or mathematics difficulty. However, it is also important to consider how the student is progressing within the trajectory of mathematics understanding in relationship to these signs.

The chart on the next page outlines several common indicators (Hannell, 2013).

| AREA OF DIFFICULTY | WHAT DOES IT LOOK LIKE? |
|---|---|
| Number sense | • Has difficulty recognizing small quantities without counting<br>• Does not grasp comparison or the relative value of numbers<br>• Has difficulties with mental calculations<br>• Uses fingers to count simple totals – beyond early elementary grades<br>• Uses tally marks where others use mental calculations – beyond early elementary grades<br>• Uses the 'counts all' method instead of 'counting on' for addition<br>• Finds it difficult to estimate or give approximate answers |
| Response time | • Requires extended time to answer mathematics questions<br>• Requires extended time to complete problems<br>• Works very mechanically |
| Math language | • Finds it difficult to talk about mathematical processes<br>• Does not ask questions, even when he/she does not understand<br>• Finds it difficult to generalize learning from one situation to another<br>• Makes mistakes in interpreting word problems and instead just 'number crunches' the numbers in the text<br>• Mixes up terms like equal to and greater than |
| Memory for facts and procedures | • Finds it difficult to remember mathematics facts<br>• Has trouble remembering what symbols like + mean<br>• Forgets previously mastered procedures very quickly<br>• Has to recite the entire multiplication table to get an answer such as 4 x 6 = 24<br>• Works multiplication tables out by adding on rather than by automatic recall<br>• Finds mental mathematics difficult<br>• Forgets the questions before the answer can be worked out |
| Sequencing | • Loses track when counting<br>• Loses track when saying multiplication tables<br>• Has difficulty remembering the steps in a multi-stage process |
| Spatial organization | • Is confused about the difference between 21 and 12 and uses them interchangeably<br>• Mixes up signs (e.g., + and -)<br>• Puts numbers in the wrong place when regrouping or exchanging<br>• Has trouble setting up calculations and work on a page<br>• Scatters tally marks instead of organizing them systematically<br>• Is unaware of the difference between 6-2 and 2-6 (i.e., thinks the answer for both problems is 4)<br>• Is easily confused with division (e.g., Is it 6 divided by 3 or 3 divided by 6?)<br>• Takes the lesser number from the greater, regardless of position<br>• Finds rounding numbers difficult<br>• Finds telling time on an analogue clock difficult<br>• Is easily overloaded by crowded mathematics worksheets<br>• Copies work inaccurately<br>• Relies on imitation and rote learning instead of understanding<br>• Can find the sum when computing, but cannot explain the process<br>• Often uses the wrong working method in exchanging or regrouping (e.g., treating 10 as 1 or vice versa) |

*(Hannell, 2013)*

### *Are there other common areas of difficulty for students with a specific learning disability in mathematics?*

Students with mathematics disability and/or difficulty also may present with challenges in the following processing areas (Brodesky et al., 2002; Hannell, 2013):

- Language and reading (English and math)
  - Understanding the words and vocabulary used in mathematics
  - Reading and interpreting mathematics texts
- Memory and information processing
  - Using short-term memory (e.g., when solving a computation problem)
  - Accessing information from long-term memory
  - Retaining and using knowledge
- Processing speed and response time
  - Working problems in a timely manner
  - Responding to questions
  - Retrieving math facts
- Visual-spatial processing and spatial organization
  - Understanding visual information
- Fine motor skills
  - Making movements with the fingers and hands
- Executive functioning skills
  - Planning, organizing, and monitoring learning, behavior, and emotions
- Attention
  - Focusing on tasks without being distracted
- Psychosocial skills
  - Monitoring emotions and reacting appropriately

# SECTION II: MEETING THE INSTRUCTIONAL NEEDS OF STUDENTS WITH MATHEMATICS DISABILITIES

## SPECIALLY DESIGNED INSTRUCTION IN MATHEMATICS

***What are evidence-based, specially-designed strategies to support students with mathematics difficulty across grade levels during mathematics instruction?***

When delivering mathematics instruction to students with mathematics difficulty at any grade level, teachers should incorporate the following practices, all of which have a strong evidence base:

1. **Explicit Instruction**
2. **Formal Mathematical Language**
3. **Concrete, Representational, and Abstract Connections**
4. **Fact and Computational Fluency**
5. **Word-Problem Solving**

The following table highlights key points for each of the five evidence-based strategies that are effective in supporting students with mathematics difficulty. More detailed information on the implementation of each of these five evidenced based strategies can be found in the accompanying **VDOE *Resource Guide for Evidenced Based Specially Designed Instruction in Mathematics.***

**Evidence Based Specially Designed Instructional Strategies**

| STRATEGY | KEY POINTS |
|---|---|
| **Explicit Instruction** | • Effective explicit instruction involves the teacher providing the following:<br>o Modeling steps using concise language<br>o Providing guided practice opportunities<br>o Providing independent practice opportunities<br>o Using supports during modeling and practice<br>▪ Asking the right questions<br>▪ Eliciting frequent responses<br>▪ Providing feedback<br>▪ Being planned and organized |
| **Formal Mathematics Language** | • Teachers should promote students' understanding of formal mathematics vocabulary by:<br>o Using formal mathematics vocabulary terms<br>o Using similar or related terms correctly and precisely<br>o Planning for language use prior to instruction<br>o Including explicit vocabulary activities in instruction<br>o Holding students accountable |
| **Concrete, Representational, and Abstract Connections** | • The Concrete-Representational-Abstract (C-R-A) framework includes three forms of mathematics: concrete, representational (pictorial), and abstract.<br>o Concrete: three-dimensional, hands-on materials and objects<br>o Representational (Pictorial): two-dimensional pictures, images, or virtual manipulatives<br>o Abstract: numbers, symbols, and words<br>• The use of C-R-A supports students in developing a deeper conceptual understanding of mathematics beyond superficial procedural knowledge. |

| STRATEGY | KEY POINTS |
|---|---|
| **Fact and Computational Fluency** | • Students exhibit computational fluency when they demonstrate strategic thinking and flexibility in the computational methods they choose and are able to explain and produce accurate answers efficiently.<br>• Teachers should use activities and games to promote fact fluency.<br>• Beyond mathematics facts, students should develop fluency with computation (i.e., multi-digit addition, subtraction, multiplication, or division).<br>• Fluency practice should be brief and occur daily. |
| **Word Problem Solving** | • The majority of routine word problems that students solve in elementary and middle school fall into one of the six different schemas:<br>o Total<br>o Difference<br>o Change<br>o Equal Groups<br>o Comparison<br>o Ratios or Proportions<br>• Teachers should provide students with verbal and gestural cues to review and recall the six schemas.<br>• When teaching problem solving strategies, DO NOT tie key words to operations.<br>• When teaching problem solving strategies, DO NOT define word problems by the operation.<br>• When teaching problem solving strategies, DO teach students an attack strategy to help guide the process of problem solving.<br>• When teaching problem solving strategies, DO teach word-problem schemas. |

***What are examples of specially designed instructional strategies that can be utilized when addressing the needs of students with autism spectrum disorder (ASD) or more significant behavioral needs?***

There are important instructional considerations that must be taken into account to promote student learning. Given the difficulty individuals with ASD have with acquiring skills incidentally, it is crucial to provide carefully planned and predictable instruction. Students will benefit from direct teaching of skills and concepts as well as strategies to encourage active engagement. Additionally, some students with autism or more significant behavioral needs may need specially designed instruction in strategies related to emotional regulation and responses. Examples could include role play, feedback, and reinforcement for appropriate responses. Further information can be found Guideline for Educating Students with Autism Spectrum Disorders and Models of Best Practice in the Education of Students with Autism Spectrum Disorders. Resources can also be found at VCU Autism Center of Excellence.

Additional behavioral support strategies can be found at Positive Behavioral Interventions and Supports (PBIS), a nationally-recognized evidence-based approach to support positive academic and behavioral outcomes for all students. In Virginia schools, PBIS is the behavioral component of the Virginia Tiered Systems of Supports (VTSS).

# SECTION III: SUPPLEMENTARY AIDS AND SERVICES FOR STUDENTS WITH DISABILITIES IN MATHEMATICS

## ASSISTIVE TECHNOLOGY

### *What is assistive technology?*

As described in the Virginia's Guidelines for Educating Students with Specific Learning Disabilities document and the Virginia regulations, an assistive technology (AT) device is defined as "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of a child with a disability." According to the United States Department of Education Office of Special Education and Rehabilitative Services (OSERS), AT must be provided by the school division at no cost to the family. If the IEP team decides that AT is needed for home use in order for the child to access Free Appropriate Public Education (FAPE), it must be provided by the school division at no cost to the family as well. To ensure FAPE, the need for AT must be included in the IEP and determined on a case-by-case basis, depending on the need of the student.

### *Who is responsible for determining assistive technology needs?*

IDEA requires IEP teams to identify assistive technology needs of students using a process called AT Consideration (IDEA, 2004). AT consideration is a thoughtful, proactive approach used by IEP teams to identify specific AT devices and services needed to meet the student's educational needs. It is common for AT consideration to occur more often for students with complex disabilities, rather than for students with mild disabilities. However, any student with a disability might benefit from AT and it is important to engage in AT consideration for all students. The likelihood of a student using the identified AT is increased when the student and family are involved in these AT decisions. The Virginia Assistive Technology Consideration Guide is a tool for IEP teams to use in determining areas where a student may benefit or require assistive technology devices and/or services. The AT Considerations Guide prompts teams to discuss whether the student's current assistive technology meets his/her needs and select additional AT needed for trials. The Virginia Assistive Technology Resource Guide provides a framework for identifying relevant tasks within instructional areas as well as appropriate accommodations, modifications, and technology solutions. This guide is helpful to IEP teams in making AT decisions.

### *What are some recommendations for the use of AT with a student with a disability in mathematics?*

Effective integration of technology within mathematics instruction may enhance the outcomes of students with specific learning disabilities in mathematics and maximize their accessibility to the general education curriculum. For example, some students with a specific learning disability in mathematics can benefit from using an equation writing software, virtual manipulatives, or a talking calculator. When choosing assistive technology for students with a specific learning disability in mathematics, there is a need to identify the technology that addresses the student's area of identified need, supports the goal of instruction and supports student outcome. Educators should integrate technology supports as they consider which accommodations and instructional strategies are most appropriate for their students with specific challenges (e.g., memory and information processing, executive functioning difficulties).

The table on the next page provides examples of possible assistive technology resources that can support students in mathematics. This list is not endorsed by the VDOE, nor is it exhaustive.

| NAME OF RESOURCE | DESCRIPTION |
|---|---|
| Accessible Math Tools for the Classroom | National Center on Accessible Educational Materials (AEM)- This page provides an overview of classroom tools for making math content more accessible with supports such as text to speech for reading math expressions aloud, handwriting recognition, sonification of graphs and more. |
| MathShare | MathShare helps students show and organize their math work. Mathshare is a free, open source tool developed by Benetech, a nonprofit that empowers communities with software for social good, whose mission is to make math accessible for all students. Mathshare is free for schools to use and for learning management systems to integrate into their platforms. This Mathshare Accessibility Features document describes the accessibility features that are offered in Mathshare. |
| Desmos | The online calculator, Desmos, offers several accessibility features such as keyboard shortcuts and features for visually impaired students. |
| Equatio | Equatio software allows users to create mathematical equations, formulas and more directly on their computer. A user can type, handwrite or dictate any expression, and EquatIO will convert it to accurate digital math which can be added into a Microsoft Word doc or G Suite apps. This software is offered free for teachers. |

***How are Desmos calculators being utilized in Virginia Classrooms?***

The revised Standards of Learning online assessments measuring the 2016 *Mathematics Standards of Learning* include access to Desmos Virginia versions of the online four function, scientific, and graphing calculators.

***What are the benefits of Desmos calculators for students with disabilities?***

The Desmos calculators have many features that are particularly beneficial to students with disabilities. The multi-line display of the four-function and scientific calculators are beneficial to students in solving multistep problems. The Desmos graphing calculator serves as both a calculator and an instructional tool to promote inquiry, conceptual understanding, and mathematical discourse. Its multiple visual representations, colorful graphs, and ability to animate changes with sliders assist students with making connections between mathematical ideas. The various features of the Desmos calculators, along with the ease of use, afford students more opportunities for success in mathematics. Additionally, Desmos has developed a bank of mathematics classroom activities located at the Desmos Activity Center that support and enhance classroom instructional practices utilizing the Desmos calculators. Many of the existing Desmos-created activities, as well as activities created by Virginia educators, have been reviewed and aligned to the 2016 Mathematics Standards of Learning and included on the Virginia Department of Education Desmos Activity Log. This log, an Excel spreadsheet, contains a tab for each grade-level/mathematics course from Grade 2 through Algebra II. Each grade level sheet includes a list of SOL-aligned Desmos activities with a brief description and direct link to the activity on the Desmos website.

The Standard Desmos Calculators, as well as the Desmos Virginia Calculators, can be accessed online with a computer or tablet. In addition, apps that allow users to access the calculator without using Wi-Fi or data are available at no cost for both the Standard Desmos Calculators and Desmos Virginia Calculators. Further information related to Desmos and Special Education can be found on the VDOE's Desmos Page, as well as outlined in the FAQ: Special Education and Desmos document.

## MODIFICATIONS

### *What are general recommendations for modifications?*

A modification is a change in the course of study, standards, test preparation, location, timing, scheduling, expectations, student response and/or other attributes, which provide access for a student with a disability to participate in a course, standard, or test. It *does* fundamentally alter or lower the standard or expectation of the course, standard, or test. Modifications are generally made in content for students with significant cognitive disabilities and/or physical disabilities. Modifications involve lowering the level of the materials presented and/or reducing the depth and complexity of the content. Examples of modifications include:

- Materials are adapted; texts are simplified by modifying the content areas—simplifying vocabulary, concepts, and principles.
- Grading is subject to different standards than general education, such as based on IEP goals.
- Assignments are changed using lower level reading materials, worksheets, and simplified vocabulary.
- Testing adaptations are used, such as lowering the reading level of the test.

Modifications to the curriculum for students with more significant learning and behavior needs can be made in the general education setting if the IEP team determines appropriate. The student will have an IEP which specifies which specific learning objectives will need modifications and will identify how the student will be held accountable for making progress. In some cases, the student will receive educational benefit by being exposed to more of the general education curriculum than the student is being held accountable for or required to master. The student may be working on objectives below grade level, but the subject should be the same as the rest of the class. In addition, depending upon the nature and severity of the student's disability, it may be that the student requires in-class support to be successful within the LRE.

Below is a general list of modifications for teachers to consider as they plan their mathematics instruction for students with disabilities.

General recommendations for modifications in mathematics include changes to the following:

- Instructional level of the concept or task
    - If a fourth-grade class is solving word problems but a student is functioning on a second-grade level, modify the content of the word problems to align with the second-grade standards. The Mathematics Vertical Articulation Tool can be used for assistance in identifying vertical alignment of skills. Content or curriculum
    - If a student is working on developing knowledge about addition and the class is practicing addition and subtraction facts, present the student with fact fluency practice activities that focus solely on addition.
    - If a student has not mastered a skill (e.g., multiplication), continue to practice the skill with the student while the class moves onto a different skill or standard.
    - Use alternative books or materials on the topic being studied.
- Performance criteria
    - Assess students using a different standard than other students,
    - Offer a pass/no pass option, and
    - Modify grades based on the IEP.

- Assignments
    - Answer different homework problems than peers,
    - Answer different test questions than peers,
    - Create alternative projects or assignments,
    - Rewrite questions using simpler language, and
    - Allow outlining instead of writing for a mathematics writing prompt.

Additional resources to assist teachers with addressing the needs of students with more significant learning and behavioral needs or those participating in the aligned standards of learning in mathematics can be found at TTAC Online.

## ACCOMODATIONS AND INSTRUCTIONAL STRATEGIES

### *What are accommodations?*

Accommodations refer to the supports that allow students to access their grade-level curriculum and demonstrate learning and mastery of grade-level content. IEP teams determine both accommodations and modifications based on individual needs. Some of the most common accommodations include calculators, multiplication charts, and manipulatives.

Accommodations provided to students with disabilities as part of the instructional and assessment process should allow equal opportunity to access the assessments in the Virginia Assessment Program. Accommodations used on the state assessments must be documented in the student's Individualized Education Program (IEP) or 504 Plan and used in daily instruction. The Math Aids: Accommodation 19 document contains examples of math aids which are either allowed or not allowed for use by a student with a disability participating in the Virginia Assessment Program.

Teachers are encouraged to utilize the Virginia Department of Education Mathematics Instructional Plans, as well as the Co-Teaching Mathematics Instructional Plans, as they include suggestions for differentiation. The Co-Teaching Mathematics Instructional plans utilize the six common co-teaching approaches: teaming, station teaching, parallel teaching, alternative teaching, one teaching/one assisting, and one teaching/one observing. These plans also contain suggestions for specially designed instruction, accommodations, and modifications, as well as suggestions as to how co-teachers can effectively utilize the expertise of each teacher to enhance lessons and activities in a co-taught classroom. The plans align instruction with the expectations of the 2016 ***Mathematics Standards of Learning***, and were vetted by VDOE content and special education specialists.

### *What are some examples of accommodations and instructional strategies that can be used to support students with mathematics difficulty?*

- The tables below provide suggestions for accommodations and instructional strategies for students with mathematics disability and/or difficulty organized by area of challenge. *(Adapted from a variety of resources including.....Chesterfield County Public Schools; Brodesky et al., 2002; Hannell, 2013; Kentucky Department of Education, 2014; McCloskey et al, 2009).*

## CHALLENGE AREA: LANGUAGE AND READING

| SPECIFIC DIFFICULTIES | ACCOMMODATIONS | INSTRUCTIONAL STRATEGIES |
|---|---|---|
| • Following and understanding verbal directions; giving directions<br>• Using and understanding vocabulary (multiple meanings, similarities/ differences)<br>• Reading and interpreting mathematics texts<br>• Recalling newly learned information<br>• Formulating and/or responding to "wh" questions<br>• Sequencing events, stories, and steps<br>• Making inferences<br>• Communicating responses in oral and written formats<br>• Solving word problems<br>• Understanding the steps of a problem-solving approach when multiple steps are involved<br>• Ordering numbers and quantity | • Read text aloud to students<br>• Create digital versions of pencil/ paper documents<br>• Use an audio recorder<br>• Provide word banks or word walls<br>• Highlight vocabulary in directions<br>• Highlight key concepts and identify unnecessary information<br>• Use math models (e.g., graphs)<br>• Chunk information<br>• Allow adequate time for students to complete assignments<br>• Allow wait time and processing time to enable students to think through language<br>• Pair the student with a reading partner<br>• Pair the student with a notetaking partner | • Present instructions both orally and in written form with visual cues<br>• Keep oral and written instructions short and simple<br>• Ask students to restate multi-step directions<br>• Provide ongoing review/practice of newly learned skills, strategies, etc.<br>• Explicitly teach and expand math vocabulary<br>• Use manipulatives (e.g., number lines, base ten blocks)<br>• Consistently use the same math vocabulary over time<br>• Activate prior knowledge with new vocabulary<br>• Group similar vocabulary terms with visuals<br>• Model using appropriate and formal math vocabulary<br>• Use visual representations<br>• Check frequently for feedback and understanding by having students paraphrase instructions<br>• Teach recall strategies<br>• Teach memorization and mnemonic strategies<br>• Scaffold retelling, paraphrasing, and summarizing experiences<br>• Use think/pair/share techniques |

## CHALLENGE AREA: MEMORY AND INFORMATION PROCESSING

| SPECIFIC DIFFICULTIES | ACCOMMODATIONS | INSTRUCTIONAL STRATEGIES |
|---|---|---|
| • Recalling information that has just been seen and heard<br>• Showing inconsistent recall (i.e., remembers one day, forgets the following day)<br>• Remembering information over long periods of time (e.g., days and weeks).<br>• Memorizing factual information<br>• Remembering basic fluency facts: addition, subtraction,<br>• division, multiplication<br>• Remembering the meaning of operational signs (e.g., greater than, less than)<br>• Solving multi-step problems (e.g., word problems)<br>• Demonstrating consistent progress<br>• Attending to tasks<br>• Following directions, especially multi-step<br>• Remembering mathematical procedures and operations<br>• Sequencing information<br>• Listening to and comprehending lengthy presentations | • Chunk longer text into shorter increments<br>• Structure long-term<br>• assignments into incremental tasks<br>• Use word walls and color coding to promote recall<br>• Provide number lines and multiplication charts<br>• Provide models of completed problems and highlight the steps<br>• Provide templates, organizers, and resource sheets with cues for recalling and recording information and vocabulary definitions<br>• Use a notebook to help students use prior work for support<br>• Provide whiteboard during instruction<br>• Allow the use of calculator when the focus is not on computation<br>• Post or provide handouts of instructions<br>• Use multiple choice questions to assess application of knowledge and understanding<br>• Structure tasks to ensure question and answer spaces are displayed together | • Keep oral directions short and clear<br>• Actively engage students with the text by using instructional tools such as highlighter tape, highlighters, craft sticks, and clear transparencies<br>• Use manipulatives and models (e.g., number lines)<br>• Teach strategies for storing, accessing, and retrieving information such nonlinguistic representations (i.e. graphic organizers, pictographic<br>• representation, mental images, physical models, kinesthetic representation)<br>• Use mnemonic strategies to promote recall<br>• Use multi-sensory approaches<br>• Increase fluency fact memory through games<br>• Teach sequencing strategies<br>• Teach comprehension skills/ strategies through modeling, guided practice, and<br>• independent practice<br>• Provide opportunities for rereading text<br>• Activate prior knowledge and relate new concepts to background knowledge<br>• Preview the needed vocabulary prior to the lesson<br>• Build background knowledge<br>• Connect math concepts to meaningful contexts when possible (e.g., fractions in baking, measures of central tendency in sports) to enhance comprehension<br>• Scaffold learning experiences<br>• Provide opportunities for students to talk about math orally and in writing<br>• Frequently check for understanding<br>• Revisit key understandings frequently and throughout the year |

## CHALLENGE AREA: PROCESSING SPEED AND RESPONSE TIME

| SPECIFIC DIFFICULTIES | ACCOMMODATIONS | INSTRUCTIONAL STRATEGIES |
|---|---|---|
| • Working or completing problems quickly or in the same time frame as peers<br>• Copying and/or completing work in a timely manner<br>• Concentrating when too much information is presented<br>• Responding to mathematics questions, including visual and verbal prompts<br>• Retrieving math facts | • Structure short-term and long-term assignments into incremental tasks<br>• Break assignments/lessons into smaller tasks<br>• Provide extended time or shortened assignments that align with grade-level curriculum standards<br>• Reduce the number of questions that address the same grade-level concept<br>• Allow wait time or tell students in advance when they will be called on<br>• Offer preferential seating<br>• Offer untimed tests<br>• Limit quantity of written work<br>• Reduce visual confusion on written documents<br>• Limit distracters on the page<br>• Provide back-up copy of notes<br>• Provide or post handouts of instructions<br>• Use graphic organizers, word banks, and word walls<br>• Use audio recorder to aid with planning/prewriting<br>• Allow for calculator when the focus is not on computation<br>• Allow students to use timers and schedules<br>• Use music to support rhythmic pacing<br>• Increase or decrease the level of lighting | • Offer positive reinforcement when work is completed on time<br>• Eliminate speed-based math activities (e.g., Around the World, Mad Minute) |

## CHALLENGE AREA: VISUAL-SPATIAL PROCESSING AND SPATIAL ORGANIZATION

| SPECIFIC DIFFICULTIES | ACCOMMODATIONS | INSTRUCTIONAL STRATEGIES |
|---|---|---|
| • Understanding written words on chalkboard, overhead, or textbook, if presented with too<br>• many visual distracters or in small print<br>• Copying information from the board or text accurately<br>• Understanding visual information<br>• Printing letters, words, and numbers (e.g., letter and number reversals)<br>• Tracking and copying print<br>• Lining up numbers and columns<br>• Telling time<br>• Understanding fractions and discriminating between sizes and parts<br>• Discriminating with numbers with decimals, hands on a clock, and mathematical and<br>• scientific symbols<br>• Reading keys and numbering graphs<br>• Holding or gripping pencil<br>• Handling manipulatives<br>• Composing and drawing figures and shapes<br>• Holding and using math tools (e.g., ruler, protractor)<br>• Cutting and gluing items onto paper<br>• Maintaining hand-eye coordination<br>• Writing for extended periods of time<br>• Organizing and making good use of space on paper | • Provide handouts of the representations for students to draw on, highlight, measure, and cut out<br>• Reorganize the material into a handout<br>• Consider reducing the number of questions that address the same skill or concept when visual-motor demands are high (e.g., paper and pencil work)<br>• Use large font sizes for handouts<br>• Make all of the handouts single-sided<br>• Provide adequate space on the page for written response<br>• Use lined or graph paper within the task to support organization<br>• Use grip paper or turn lined paper sideways for lining up place values<br>• Seat students close to the board<br>• Use a consistent format for displaying information on the board<br>• Reduce the glare from the windows<br>• Provide manipulatives<br>• Provide examples of actual three-dimensional models for students to view or manipulate<br>• Provide templates that address particular needs (e.g., larger or partially filled in tables)<br>• Limit the amount of cutting, tracing, and coloring required<br>• Reduce the need for note taking and provide notes, photos, and/or digital copies of the representations | • Introduce new skills/strategies with concrete materials as you move toward the representational an d abstract<br>• Use instructional tools such as highlighter tape, craft sticks, clear transparencies to help students interact with the text<br>• Use math tools, manipulatives, and models to develop understanding and show mathematical thinking during instruction and assessment tasks<br>• Pair concrete teaching materials with pictorial representations<br>• Provide visual models to help correct reversals<br>• Accompany written information<br>• with oral directions, clarification, and modeling<br>• Verbally repeat steps of a process for understanding how to solve complex problem or equations<br>• Provide multiple opportunities to<br>• capture mathematical thinking<br>• (e.g., taking photos, photocopies<br>• of notes, math journals)<br>• Do not require speed when copying<br>• Use scaffolding strategies to help students eventually develop their own templates for tables, charts, and graphs |

## CHALLENGE AREA: FINE MOTOR SKILLS

| SPECIFIC DIFFICULTIES | ACCOMMODATIONS | INSTRUCTIONAL STRATEGIES |
|---|---|---|
| • Writing (letter size, spacing, legibility, numbers, symbols, and words)<br>• Writing for extended periods of time<br>• Completing written work in a timely manner (i.e., writes and draws slowly)<br>• Copying from board or paper<br>• Organizing and making good use of space on paper<br>• Printing numbers (e.g., letter and number reversals)<br>• Composing and drawing figures and shapes<br>• Lining up columns and place values<br>• Drawing straight lines<br>• Holding or gripping pencil<br>• Using manipulatives and math tools (e.g., scissors, ruler)<br>• Making patterns, building, or aligning concrete manipulatives<br>• Maintaining hand-eye coordination | • Break written assignments into<br>• shorter increments<br>• Allow adequate time for written responses<br>• Provide ample space for written responses<br>• Display question and answer spaces together on one side of a page<br>• Consider reducing the number of questions that address the same skill when motor demands are high<br>• Reduce the number of problems that need to be copied<br>• Allow students to respond in<br>• a variety of modalities (oral,<br>• written, artistic)<br>• Provide back-up copies of notes, photos, and/or digital copies of representations<br>• Provide graphic organizers to<br>• help with spatial organization of information<br>• Provide templates for forms, either blank or partially filled-in<br>• Provide lined or graph paper within the task to support organization<br>• Provide paper with vertical lines or place lined paper sideways<br>• Use larger grids<br>• Provide finger grips or nonskid rulers to promote better control<br>• Use nonskid matting on desks to prevent sliding<br>• Provide a range of sizes and shapes of manipulatives<br>• Provide hands-on activities with adequate space and time<br>• Provide pre-cut pieces or allow students to work in pairs with one partner cutting<br>• Allow use of technology supports (e.g. keyboard program, computer) to type answers<br>• Allow students to record answers on an audio recorder<br>• Allow students to report answers orally<br>• Have students work in pairs or cooperative groups with a designated recorder<br>• Set realistic expectations for neatness | • Teach text structure (i.e., text features, organizational patterns)<br>• Use math tools, manipulatives, and models to develop mathematical thinking during instruction<br>• Provide ample space and time for students to complete tasks during instruction and assessments<br>• Avoid speed-related tasks and activities |

## CHALLENGE AREA: EXECUTIVE FUNCTIONING SKILLS

| SPECIFIC DIFFICULTIES | ACCOMMODATIONS | INSTRUCTIONAL STRATEGIES |
|---|---|---|
| • Starting a task (e.g., writing prompt, test, homework independently)<br>• Planning and organizing for a task or schedule<br>• Organizing class notes<br>• Completing a task<br>• Multi-tasking or balancing more than one task<br>• Determining the sequence of steps for solving a problem<br>• Identifying relevant and important information (e.g., focuses on small details)<br>• Estimating the time needed to complete a task (e.g., rushes or takes excessive time)<br>• Remembering tasks (e.g., homework)<br>• Keeping track of belongings<br>• Keeping belongings neat and orderly (e.g., messy desk, messy backpack, crumpled papers, numerous eraser marks)<br>• Following directions<br>• Answering questions (e.g., forgets the question, provides an off-topic answer, does not provide answers for some of the questions)<br>• Recording and organizing information in tables<br>• Showing flexibility when plans and routines change (e.g., tantrums)<br>• Controlling emotions (e.g., frustrates easily, difficulty expressing feelings) | • Use a timer<br>• Use music to simulate a rhythmic pace<br>• Provide extended time on assignments<br>• Provide frequent breaks during longer tasks and assignments<br>• Shorten or chunk assignments into smaller steps<br>• Increase or reduce level of lighting<br>• Use study carrels<br>• Provide two sets of materials: one for school; one for home<br>• Use graphic organizers and visual supports<br>• Use picture and tactile schedules<br>• Use highlighters, underlining, bolding, and color coding to organize tasks and materials<br>• Use colored dividers and colored notebooks to promote organization (e.g., homework folder is red, math folder is blue, etc.)<br>• Use a notebook organization system and reinforce it with notebook checks (use the same system across all subject areas)<br>• Provide clear calendars, schedules, and checklists for tasks<br>• Provide resource sheets that list the steps involved and provide examples and templates<br>• Use cue cards for definitions, examples, and flow charts<br>• Allow the use of calculators, when the focus is not on computation<br>• Provide frequent positive reinforcement<br>• Provide frequent redirections and corrective feedback<br>• Develop a behavior contract<br>• Use a token economy behavior reinforcement system to reward on-task behavior<br>• Use self-monitoring checklists to promote accountability | • Provide clear, step-by-step instructions<br>• Establish clear routines for all tasks and transitions<br>• Frequently clarify directions<br>• Increase wait time after posing questions<br>• Provide verbal prompts and cues<br>• Model steps for identifying relevant and irrelevant information<br>• Model steps for self-monitoring strategies<br>• Model steps for creating and following a schedule and managing time<br>• Maintain an organized and neat classroom<br>• Model steps for developing and maintaining an organizational system for assignments and homework<br>• Assign a peer tutor to work with the student<br>• Develop clear rubrics and scoring guides for assignments<br>• Preview all assignments to review timelines<br>• Set expectations for how much time students should spend on a task<br>• Provide countdowns and frequent reminders for how much time remains to complete a task<br>• Provide opportunities for repeated practice<br>• Guide students in transitioning from guided to independent practice activities<br>• Integrate student interests into lesson content to promote engagement<br>• Use role play and social stories to help students regulate their emotions |

## CHALLENGE AREA: ATTENTION

| SPECIFIC DIFFICULTIES | ACCOMMODATIONS | INSTRUCTIONAL STRATEGIES |
|---|---|---|
| • Remembering important pieces of information<br>• Attending to tasks without becoming distracted<br>• Paying attention for extended periods of time<br>• Starting or finishing tasks<br>• Maintaining attention to details (e.g., operational sign)<br>• Maintaining attention copying problems from the board to paper<br>• Staying organized<br>• Transitioning from one assignment to the next<br>• Remembering and following multi-step instructions<br>• Solving multi-step tasks<br>• Distinguishing relevant from irrelevant information<br>• Ignoring irrelevant information<br>• Regrouping and quickly retrieving facts<br>• Performing procedures with accuracy<br>• Taking their time during work (i.e., rushes)<br>• Tuning in (i.e., frequently tunes out)<br>• Selecting and staying on topic<br>• Sitting still | • Chunk longer text into shorter increments<br>• Allow the student to work in a quiet space when needed<br>• Move the student away from distractions or distracters<br>• Use planned breaks to motivate students to complete tasks<br>• Allow students to verbalize when they need breaks<br>• Provide project organizers<br>• Support students to develop a plan and use the plan as a checklist for problem-solving tasks<br>• Provide self-monitoring checklists | • Provide written/visual instructions<br>• Provide key questions to help students focus<br>• Provide visual, verbal, and non-verbal physical prompts and guiding questions<br>• Use verbal or nonverbal cues for<br>• important information/directions<br>• Ask the student to restate<br>• information/directions verbally<br>• Reduce time of whole-class discussions<br>• Check frequently for feedback<br>• and understanding<br>• Actively engage students with the text by using instructional tools such as highlighter tape, highlighters, craft sticks, and clear transparencies<br>• Begin with concrete examples and then connect to semi-abstract and abstract representations on paper<br>• Pair auditory and visual information<br>• Use multi-sensory approaches<br>• Monitor appropriate use of manipulatives<br>• Provide opportunities to self-assess against co-constructed criteria<br>• Assign group roles, such as a recorder<br>• Include student activities and participation in lessons<br>• Use motivational techniques to help students complete tasks in a timely manner<br>• Set clear academic and behavioral expectations |

## CHALLENGE AREA: PSYCHO-SOCIAL SKILLS

| SPECIFIC DIFFICULTIES | ACCOMMODATIONS | INSTRUCTIONAL STRATEGIES |
|---|---|---|
| • Monitoring emotions and reacting appropriately<br>• Managing feelings during competitive games and activities (especially when losing)<br>• Exhibiting appropriate social skills<br>• Developing peer relationships<br>• Feeling confident<br>• Learning concepts due to frustration and focus rather than a lack of understanding<br>• Receiving constructive feedback | • Provide frequent academic praise and positive feedback<br>• Use a structured feedback process by providing handouts for students to complete<br>• Approach students with a positive attitude<br>• Reinforce positive thinking<br>• Celebrate both small and great advances<br>• Promote immediate success with one or two problems before attempting the entire assignment<br>• Use a motivational system to promote success<br>• Provide risk-free opportunities to learn and practice math<br>• Promote self-monitoring strategies<br>• Provide additional wait time<br>• Break tasks into chunks | • Set clear expectations for student collaboration and individual accountability in small groups<br>• Provide positive reinforcement when expectations are met<br>• Choose groups with a specific purpose in mind (e.g., to mix skill levels, promote social interactions)<br>• Model giving and receiving constructive feedback<br>• Check to make sure students have the prerequisite skills before introducing new concepts<br>• Connect new concepts to concepts with which students have experienced success<br>• Frontload background knowledge and vocabulary needed for comprehension<br>• Tap into students' background and interests to personalize instruction and promote positive relationships<br>• Reteach skills and strategies<br>• Allow students to teach a skill/task to a classmate or younger student (i.e., promote confidence and leadership)<br>• Begin with concrete examples and then connect to semi-abstract and abstract concepts<br>• Teach metacognitive strategies<br>• Present games as experiments to minimize competition<br>• Create a safe, inclusive, and responsive learning environment |

## SECTION IV: REFERENCES


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