MATH Strategies for Students with Disabilities

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Abstract

Students become increasingly negative towards academics as they transition through the school years. Students, especially students with disabilities in the general education classroom, report a markedly decreased interest and level of participation in mathematics classes upon entering adolescence. A student with disabilities' Motivation to participate and Attitude towards mathematics, his or her Thinking about mathematical abilities and perceptions of the Helpfulness of teachers have been found to predict academic success beginning in the middle school years and later into the high school and college years. These behaviors affect the performance and success of students with disabilities towards mathematics and form the acronym MATH (Motivation, Attitudes, Thoughts, and Helpfulness). The purpose of this review is to help middle and high school general and special education mathematics teachers to recognize how these factors will affect the performance and success of students with disabilities in their math classes.

Keywords: Mathematics, Students with disabilities, Motivation, Attitude, Thinking, Helpfulness, Teaching strategies

Educators are placing more emphasis on the value on mathematics learning as researchers report decreased student motivation and interest in mathematics as student's progress to the secondary level (Mata, Monteiro & Peixoto, 2012). Adolescent interest, or lack of interest, in mathematics can be assessed informally by observing student body language or level of participation in class. Informal ways to directly assessment student interest also include observation and interviews with students. It is important for teachers to gauge student motivation, attitudes, thinking about student abilities and perceptions of helpfulness of teachers in their mathematics classes in order to increase classroom engagement and produce higher levels of student participation. In order to facilitate successful achievement, Motivation to participate and Attitude towards mathematics, his or her Thinking about mathematical abilities and perceptions of the Helpfulness of teachers in the general education classroom (Tier 1) are the focus of this review. Middle school general and special education mathematics teachers' ability to recognize student motivation and attitudes and thinking and perceived helpfulness of teachers in mathematics class and the impact on student performance in their math classes are important issues for teachers to help students with disabilities be more successful.

Student motivation, attitudes, thinking about student abilities and perceptions of teacher helpfulness affect their scores on summative assessments. According to the Rich (2015), mathematics scores on summative measurements for eighth grade students have decreased from scores in previous years. Data analysis, statistics, and geometry were identified by Rich as areas requiring the most improvement. This is cause for concern for middle and secondary level mathematics teachers who must scramble to reevaluate their instruction in these areas in order to improve student test scores. The scores of students with disabilities were included in the results of Rich's study. In an earlier study, Cole & Washburn-Moses (2010) reported that only 8% of students with disabilities scored proficient on standardized measurements. Improving student motivation, attitudes, thinking about their abilities and perceptions of teacher helpfulness were areas of focus to improve and increase scores on summative measurements.

It is important to address the lack of student motivation, attitudes, thinking about their abilities and perceptions of teacher helpfulness. If not addressed, students continue to have these negative perceptions and thoughts beyond high school and into the college years. Mata, Montiero, and Peixoto (2012) explored apathy in high school students in relation to self-belief regarding their math abilities into the college classroom. Mata, Montiero, and Peixoto found that negative student attitudes towards mathematics stem from negative emotional dispositions as a result of negative belief in ability. In a related study, Howard (2016) studied student apathy and lack of engagement in the college mathematics classroom. By the time they reached the college classroom, students had learned to disguise these perceptions and thoughts by displaying body language that indicated they are paying attention, even while not engaged, making lack of motivation and negative attitudes towards mathematics more difficult for professors to detect and address.

Motivation to participate and Attitude towards mathematics, Thinking about mathematical abilities and perceptions of the Helpfulness of teachers have been found to predict academic success. These behaviors form the acronym MATH (Motivation, Attitudes, Thoughts, and Helpfulness). No studies were found that specifically address MATH issues for students with disabilities in the general education classroom. Ample research is focused on inclusion of students with disabilities and teaching strategies, but few studies focus on the negative perceptions of students with disabilities in the inclusion classroom. The purpose of this review is to examine the research literature to make general education teachers aware of the needs of their students with disabilities in the inclusion classroom and its educational relevance to student learning. Previous research was reviewed to make teachers aware of these problematic MATH perceptions by their students with disabilities. The results are presented to reduce negative perceptions towards mathematics and to improve student outcomes.

Motivation to Participate

Motivation to participate in class activities is key to student success. Students with disabilities experience low self-esteem and low expectations for success and often respond to teacher efforts to intervene in negative ways. They fear and are less winning to work through challenges. They fail willingly to escape feelings of fear and failure.

Student motivation towards success in school was found to be linked to how students with disabilities think about intelligence (Viadero, 2009). Students who believed they had to be born smart in order to do well in school were less motivated to study than students who thought intelligence can be developed and that it comes from hard work. Students with disabilities have experienced repeated failure and doubt their academic abilities, leading to lack of motivation and belief that they are dumb. Unmotivated students had no belief in their own abilities to study and don't believe in improvement through practice. Instruction that was too easy or too difficult also affected student motivation. Classwork must be on the student's level in order to participate. Other students, when their classwork was too easy, became bored. When their classwork was too difficult, they got frustrated. Whether bored or frustrated, too easy or too difficult instruction led to the student shutting off and/or not participating.

Viadero also found that student interest went beyond the teacher just getting the instruction and classwork on the right level to meet the learning needs of the students with disabilities. Teachers spent days, hours, often hours the night before presenting a lesson in planning for student differentiation and for engaging lessons only to find their students were not engaged, not taking part, or switched off after their best efforts to interest students. Despite the teacher's best efforts, interesting lesson plans, no matter how inspired and interesting the lesson, some students showed no motivation and refused to participate in class activities according to Viadero. Unmotivated students appear totally disinterested in the lesson; their hands may be kept in their pockets or folded. Unmotivated students have made up their minds before the lesson even started that they didn't want to be there, appeared to be totally disinterested and have switched off before the teacher had a chance to start teaching them.

Table 1. Strategies to Increase Student Motivation

According to Posamentier (2013), teachers should focus on extrinsic and extrinsically based forms of student motivation in mathematics.

1. Extrinsically, teachers should provide feedback to make students aware of the holes in their learning. Intrinsically, students should be aware of their learning gaps in order to make adjustments.
2. Extrinsically, students should be encouraged to look for patterns and sequences in their everyday lives. Patterns in addition and subtraction lead to understanding multiplication and division.
3. Extrinsically, practical applications should be introduced in order to motivate student interest in learning new skills. Intrinsically, problems that enticement with unbelievable results or that challenge student belief with mathematical curiosities or that tell a story should be used to encourage motivation.

Source:
Posamentier, A. (2013). 9 Strategies for motivating students in mathematics. Edutopia. Retrieved from https://www.edutopia.org/blog/9-strategies-motivating-students-mathematics-alfred-posamentier

DESCRIPTION: Strategies to Increase Student Motivation

Student Attitude

Student attitudes are colored by their perceptions of the way the world operates, including students with disabilities. These perceptions form their attitudes. Students act every day as if their perceptions were reality. Students do not act differently from what they value, believe, or perceive. A student with disabilities' attitude is affected by their level of participation in the classroom, attitude towards mathematics, interest in mathematics, and perceived value of mathematics in their education. Students with disabilities carry negative thoughts, feelings of hopelessness, and negative emotions regarding their academic abilities with them to class. These students have lower levels of participation, negative attitudes towards school, display little interest in academic subjects, and see little value in learning mathematics. In mathematics classes, these negative attitudes often result from direct experience, current and past, resulting in failure (Wilkins & Ma, 2003). The failing student with disabilities was often presented the same lesson repeatedly, in the same manner, and found the activity negative, repetitive and boring. These repetitive tasks were sometimes too difficult or too easy. The tasks were something the student mastered at an earlier date, and negative attitudes abounded.

Negative attitude also resulted when the student with disabilities disliked the mathematics teacher or believed the teacher wasn't concerned with or didn't care about his or her learning in the class. Other times, peers may have expressed negative attitudes regarding the student's lack of ability in math or the student with disabilities didn't relate well with their fellow classmates whom they perceived to be smarter in their group. Negative attitudes also came from peers and friends or older siblings who told them that they didn't have a good time during a particular lesson or teacher's class, so the student with disabilities won't either (Wilkins & Ma, 2003). Whatever the source of these negative thoughts, feelings, and emotions, some students made up their minds before the math lesson starts that they were not going to have a good time, that they were not going to take part, or that they didn't want to be in the class. Teaching students when they were in this state of mind was a difficult situation for a math teacher.

Certain factors were found to play a role in student attitude towards mathematics according to Mata, Monteiro, and Peixoto (2012). These factors were centered around student factors, classroom factors, and home factors. Student attitude towards mathematics was affected by their achievement in math class. Students with disabilities tend to have lower levels of achievement leading to anxiety towards ability, which affects the student's self-concept, motivation to participate in class. Past classroom failures lead to negative attitudes towards math class, which impacts achievement.

According to Mata, Montiero, and Peixoto (2012), high school students displayed an overall decrease in motivation and competence-related beliefs in their abilities affected their attitude towards mathematics. Possible explanations for this decreased attitude towards mathematics included a more increased and demanding math curriculum or that the adolescent developed stronger interests in other fields of experience (sports, music, art, dating, driving). Positive attitudes led students to be more successful in mathematics (Farooq & Shah, 2008).

Students with disabilities had lower expectations for attending college or who were in college preparatory classes developed a more negative view of mathematics due to course requirements or expectations (Mata, Montiero, and Peixoto). Mata, Monteiro, and Peixoto attributed this negative attitude to the perceived pressure of college entrance exams and certain, more difficult, mathematics courses required for college entry. Students were more desirous of popularity rather than being perceived as a nerd or geek.

Table 2. Strategies to Improve Negative Student Attitudes

According to Willis (2010), a teacher's strategies affect student attitudes towards mathematics. The following strategies will help to improve negative student attitudes:

1. Help students who tense up to relax. Intervene with laughter, visual representations, and motivating stories that will help to loosen up students along with stress management training.
2. Utilize and employ errorless math strategies.
3. Scaffold learning. Analyze and break tasks into small, achievable components to insure student success and build a positive attitude towards understanding of math tasks.

Source: Willis, J. (2010). Reversing Math Negativity with an attitude makeover. ASCD. Retrieved from http://www.ascd.org/publications/books/108073/chapters/Reversing-Math-Negativity-with-an-Attitude-Makeover.aspx

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Thinking About One's Mathematical Abilities

According to Sparks (2013), the effect of teacher and student mindset on academic success is difficult to assess and questionable as to how to change mindset once it has been set. Dweck (2015) linked student motivation to the way the student perceives his or her own intelligence. Students with a "growth mindset" thought that intelligence was improved by effort. The students in Dweck's study who exhibited positive thinking sought challenges, learned from their mistakes, and maintained faith in their ability despite failures. Students with a 'growth mindset' were found to be more socially engaged and showed greater improvement in academics. Students who understood that they were responsible for building their intelligence and for taking risks, were interested in learning from their mistakes rather than focusing on how others see them and focused less on perfection and quickness. Students with disabilities have more experiences with failure and are more focused on their own weaknesses and deficits. They expect to fail because their teachers often focus solely on their weaknesses and deficits.

Students who felt well-treated and who liked the way they were learning, indicated more positive thinking towards academics (Bernhardt, 2013). Students who did not have fun learning or did not like the instructional methods used by their teachers indicated less positive thinking. Students who did not feel that a specific teacher, or any teacher, cared about them or treated them fairly, indicated a lower interest in academic subjects.

Gender affects student thinking. Lubienski, Robinson, Crane and Ganley (2013) researched gender patterns in mathematics achievement and attitudes. Their findings indicated gaps in confidence between males and females. The gender gap in math confidence was greater than the gaps in achievement between males and females. Girls and boys interpreted and reported differently regarding interest and confidence towards mathematical abilities on survey questions. Most of the significant gender differences found were consistent with traditional societal stereotypes and expectations for males and females according to the researchers.

Surveying 465 sixteen- year-olds in 1997, Sullivan (2006) found that girls underestimated their abilities in comparison to boys. Boys were more likely to think themselves as above average in academic ability. Boys also predicted significantly higher grades for themselves than girls. Sullivan also found that students from higher socioeconomic backgrounds who participated in cultured activities provided a higher estimation of their own abilities for both male and female students. According to Marsh, Trautwein, Ludtke, Koller, and Baumert (2005), a positive academic self-concept has a beneficial effect on learning and educational interest. The classroom performance of girls is especially affected by their thinking. Lack of self-confidence in mathematics or math anxiety is an obstacle to performance faced by many females (Miller and Bichsel, 2004).

Lubienski, Robinson, Crane, and Ganley (2013) indicated that students believe in attitude or intelligence in relation to their academic success. One explanation for academic success was the belief in intelligence as a fixed asset, where some individuals won the genetics lottery and others were left wanting. If a student wasn't born smart, he or she may as well give up on academic success. Other students viewed intelligence as a result of effort. If you fail a test or don't understand a concept, it's not that you are stupid—you just haven't worked hard enough yet. Some students learned from mistakes and believed in themselves despite failures. Success was linked to the way the student perceived his or her own intelligence. Students who perceive themselves as more intelligent are focused less on the opinion of others or on perfection and quickness. Willis (2010) also found that students who believed that intelligence was a fixed asset thought that some people were winners in the genetics lottery. Students who held the belief that they didn't win the genetics lottery were less motivated to study.

Willis (2010) identified several thoughts students hold regarding math ability. Students believed that you had to be intelligent to be good at math. Thus, many students thought it acceptable to be bad at math because most people were bad at math. Students also believed that math doesn't have much value outside of school. Other students came from homes where their parents were never good at math, so their parents did not encourage them to value mathematics.

Table 3. Strategies to Improve Student Thinking

1. According to Lucariello and Naff (2012), conceptions form student thinking. Students with negative thinking claim they cannot do the work. Before the teacher explains the work the student with disabilities approaches the task by acting scared and insisting he or she cannot do the work. Lucariello and Naff referred to this preconceived thinking as misconception. Teachers must determine what they are and correct these misconceptions.

Source: Lucariello, J., & Naff, D. (2012). How do my students think: Diagnosing student thinking. American Psychological Association. Retrieved from http://www.apa.org/education/k12/student-thinking.aspx

DESCRIPTION: Strategies to Improve Student Thinking about Mathematics

Perceived Helpfulness of Teachers

Certain factors were found to play a role in student attitude towards mathematics according to Mata, Monteiro, and Peixoto (2012). These factors were centered around student factors, classroom factors, and home factors. The teacher played a huge role in Classroom factors included teaching materials used by the teacher, classroom management strategies, teacher knowledge of disability, and attitude towards their own ability to teach the different areas of math. Students mirror the attitudes of their teachers. Classroom factors also included teacher support, student-to-student interaction in class, academic and behavioral expectations of the teacher towards students.

Students were more successful when they perceived teachers as treating them with care, affection, and warmth (Furrer, Skinner & Pitzer, 2014). Furrer, Skinner & Pitzer (2014) and Cabello and Terrell (1994) studied how teachers created classroom climates to provide social and emotional support to students. Cabello and Terrell found that underachievers are continuously ego protecting in the classroom. If a student perceives either the teacher or a task as threatening the student will engage in an ego protecting strategy such as coping (trying with partial success), dissembling (pretending to try or to do the work), or failing. Teachers who recognize ego protecting strategies and engage students by offering verbal support, guidance, or letting the student know that they care about the student's progress were more successful in in persuading underachievers to increase their level of effort.

Based on the premise that class management is related to student behavior, Bru, Stephens, and Torsheim (2002) studied the extent to which a teacher's class management skills in the areas of emotional support, academic support, monitoring, and student influence, affected student behavior. The study revealed that students who perceived that their classroom climate allowed them a greater degree of self-rule were more committed and motivated to learn than students who perceived their classroom climate was ruled by the teacher. Student satisfaction and achievement were maximized only when teacher support was accompanied by an academic focus, efficient organization, and clear guidance on expectations.

The study by Bru, Stephens, and Torsheim also revealed that students from different social classes were treated differently. Teachers in the study treated students differently within the same class, generating different student responses within a class. Negative feedback and more control were used more with low achieving students. Bru, Stephens, and Torsheim stated that, "The greatest potential for improving student behavior through class management lies in improving adaptation of management to…student needs, and ensuring that no student is favored over others." (p. 303). Bru, Stephens, and Torsheim suggested that teachers tailor management strategies to individual students and avoid the perception of individual favoritism to improve student behavior.

Cothran, Kulinna, and Garrahy (2003) found that student misbehavior was an attempt to alleviate what students saw as tediousness. Cothran, Kulinna, and Garrahy recommended that teachers plan enjoyable learning activities to lessen the need for students to generate their own forms of entertainment. Students wanted to connect with and desired communication and care from teachers, reflecting a need for a personal relationship with teachers. According to students, motivated teachers taught meaningfully and communicated their personality and skill in their techniques.

Classroom misbehavior and poor behavior management had an impact on students. Tsouloupas, Carson, and Matthews (2014) examined factors associated with teacher ability to manage student behavior. The teacher's management style influenced the classroom environment by creating a climate that encouraged or discouraged social interactions among students, student participation, and academic achievement. Students were also affected by teacher personality. Teachers with extroverted personalities were found more likely to establish good rapport with students and to accommodate student behavior needs. Student behaviors were related to socioeconomic status. Belief in student ability, rather than the socioeconomic status of the student, along with creating a classroom climate enhanced social interactions and student participation.

Students indicated that a good teacher showed caring by listening to students and accepting them, provided students with challenging work, feedback, and a clear set of rules. Students reported that exemplary teachers indicated emotional engagement with students by listening to them, providing work and feedback, and by being strict, but fair (Cabello and Terrell, 1994).

Table 4. Strategies to Improve Perceived Helpfulness of Teachers

The following strategies, according to GreatSchools (2016) will help teachers to improve their perceptions by students with disabilities:

1. Helpful teachers communicate high expectations for their students with disabilities. They expect all students to learn and work to ensure students are successful.
2. Teachers who show interest in individual students and commitment to help student learning are perceived as helpful. Helpful teachers care about their students and are willing to motivate and engage reluctant learners.
3. Helpful teachers are knowledgeable about their subject matter and are eager to share their knowledge with students, and spend time constructing lessons for students with disabilities.

Source: GreatSchools. (2016). What makes a great teacher? Retrieved from http://www.greatschools.org/gk/articles/what-makes-a-great-teacher/
DESCRIPTION: Strategies to Improve Perceived Helpfulness of Teachers

Discussion

Because mathematics play such a critical role in a student's academic career, knowledge of factors that affect the performance of students with disabilities in the general education math classroom is important for teachers to understand their needs and help students be successful. Helping teachers to understand the motivation, attitudes, thinking, and perceptions of students with disabilities will promote understanding of these factors. Knowledge of these factors may assist teachers to understand their students better.

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