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MATH 4990

The Effectiveness of Middle and High School Math Inclusion Classes

Chapter 1 – Introduction

When I was in second grade, I was diagnosed with ADHD. I was medicated and I did not seem to struggle that much until I got to high school. I was in a magnet program and constantly felt like I was not as smart as everyone else in my grade. This combined with my mother being a special education teacher has led me to take an interest in the teaching and learning of students with learning disabilities. We cannot leave these students out of the picture when discussing effective methods of teaching, especially when teaching a complex subject like math.

Math is often viewed by many as being a particularly difficult subject compared to others. For that reason, it is imperative that research be conducted on various ways to teach math to a diverse range of students. One setting in which math, and various other subjects, are taught is in an inclusion class. An inclusion class is a class containing both general education students and students with learning disabilities. They typically consist of two teachers, one who is a general education teacher who specializes in a particular academic subject and the other who specializes in teaching students with learning disabilities, such as a special education teacher or a paraprofessional.

My research questions are as follows: (1) Do teachers believe students, both with and without learning disabilities, are best taught math in an inclusion class? (2) Are general education math teachers and special education teachers equipped to properly facilitate a math

inclusion class? And (3) What types of teaching strategies are most effective when teaching in a math inclusion class? Are these strategies being used?

Chapter 2 – Literature Review and Theoretical Framework

When searching for past research on this topic, there was one thing that became very apparent: there is a lack of research that specifically addresses middle and high school math inclusion classes. There are several studies concerning math education and inclusion classes but very few concerning math inclusion classes. Luckily, the research that is out there which addresses math inclusion classes is very informative and provides a lot of insight. However, there is still a great need for more research.

The present study is largely inspired by a study by DeSimone and Parmar (2006). In this study, mathematics general education teachers who teach in middle or high school inclusion classes were asked about their beliefs and attitudes towards math inclusion class. This study was divided into two parts: surveys and interviews. In all, they obtained 228 surveys and conducted 26 interviews. Findings revealed that overall, teachers agreed that students with learning disabilities should be afforded every opportunity to learn alongside students without learning disabilities in an inclusion class. However, teachers tended to feel undecided as to whether learning in a math inclusion class benefits students with learning disabilities. Additionally, teachers generally felt inadequately prepared to teach inclusion classes. The article points out 3 major issues concerning the implementation of middle and high school mathematics inclusion classes: limited understanding of the needs of students with learning disabilities, lack of teacher collaboration, and inadequacy of preservice and in-service teacher preparation for inclusion.

While new education reform is put in place, it is rare for researchers to ask teachers about their opinions and beliefs. However, as this article reveals, this can provide vital feedback on how this reform is being implemented and how effective it is. Whether or not teachers like teaching in inclusion classes or feel comfortable teaching in them will likely reflect the classroom environment and the success of the students. This study revealed a lot about teacher's perceptions of inclusion classes. Many of the quotes included in the paper were surprising. One teacher said that students with learning disabilities are too "immature" to understand a fraction, so they do not cover the topic at all. Another teacher said they use similar methods for students with learning disabilities as they use with low performing math students. It appears many general education teachers have a distorted perception of what it means to have a learning disability. One would think that any teacher who is to teach a class that contains students with learning disabilities should be well versed on what a learning disability entails and how to meet these students' needs (DeSimone & Parmar 2006).

Karp and Voltz's (2008) study focused on three teaching strategies that are useful in an inclusion class. These teaching strategies are all a part of what the article calls "interwoven instruction." This is the idea that teachers should be knowledgeable on the content they are teaching and implement several teaching strategies to help students effectively learn this content. The first strategy is explicit instruction. This approach involves the teacher giving students very specific instructions on what to do. Oftentimes, it involves the teacher modeling procedures while students replicate what they do. The second strategy is the apprentice approach. In this approach, knowledge is given to students only as they need it. Additionally, learning tasks are more authentic under this model. The last strategy is the constructivist approach. Under this

approach, students are encouraged to understand material using their own unique thought processes. Student choice and opportunities for leadership are highly important to this model.

Berry and Kim's (2008) study focused on teacher talk in a first-grade mathematics inclusion class. Teacher talk is essentially everything a teacher says while students are in the class. This can include lecturing, asking questions, responding to questions, etc. There were four teachers in the class in this study, and the authors observed one lesson taught by each. The study found that the teacher talk for all four teachers did not align with the talk encouraged by the NCTM Communication Standard because there were not enough questions being asked to students.

Witzel and Allsopp's (2007) article discusses the potential benefits of implementing dynamic concrete instruction when teaching math to students with learning disabilities because it gives these students the opportunity to experience multisensory learning. The article discusses three strategies teachers can use when working with manipulatives. These strategies are illustrated by a sixth-grade math inclusion class where the teachers' goal is to introduce addition of fractions with unlike denominators.

The first strategy is "linking prior knowledge to new concepts." Students already know how to use fraction circles to add fractions with like denominators. The teachers use this concept to introduce using fraction strips to add fractions, which is very similar to using fraction circles. The students were encouraged to use touch and movement to explore these similarities, especially regarding the proportionality of the parts to the whole. This approach resembles the constructivist approach since students can use what they already know and expand on their knowledge by using their senses to explore the new topic in their own unique way. It also

incorporates the NCTM connections standard since students are using past math knowledge and relating it to new information (Witzel & Allsopp 2007).

The second strategy is “emphasizing thinking-aloud modeling.” Once the students can physically see the similarities between the two types of manipulatives, they need to know how to use the new manipulative. The teacher does this primarily through “thinking aloud.” Since students already know how to add fractions with like denominators, she takes them through the process of doing this with fraction strips instead of fraction circles. Furthermore, she discusses her thinking on how fraction strips can relate to written fraction addition problems. Students also take time to try going through the thinking process themselves. This strategy requires quite a bit of teacher talk when walking students through the thinking process. It also fits nicely in line with the NCTM communication standard, which encourages students to verbally explain their work to others. This strategy is especially beneficial to those students who are quick to start solving a problem without analyzing it first. Thinking aloud helps these students learn what they should be thinking when presented with a certain type of problem (Witzel & Allsopp 2007).

The third strategy is “applying multisensory cueing.” This involves providing clues which appeal to student senses to help them learn a concept. Using the example of adding fractions in the article, the teacher folded a fraction strip in halves to get students to see how one can divide the strip into fourths. First, she divided it in half, asked students if that was enough to represent fourths, to which students responded no. She folded the strip once again, dividing it into fourths. Once again, she asked if this was enough and students agreed that it was. Additionally, the teacher appealed to students’ visual senses by color coding the fraction strip to show how the numerator and denominator are represented. This involved outlining the whole strip, including the lines which divides the sections, in red, demonstrating the denominator.

Similarly, she shaded the appropriate number of divided sections for which the fraction represented in blue, demonstrating the numerator (Witzel & Allsopp 2007).

Studies like these are vital to increase the effectiveness of inclusion classes. The idea of inclusion classes is still a rather new concept, meaning there is still much to be discovered on how to make these classes as impactful as possible. Oftentimes, teachers are thrust into an inclusion class knowing little about them and how they operate. To make these classes worthwhile, teachers must know the most meaningful ways to interact with students and their co-teachers.

It is especially important for prospective math and special education teachers to know how to properly facilitate a math inclusion class because they could be assigned to teach in one at any point during their teaching career. One can imagine it is scary to be placed into an inclusion class feeling unprepared and unknowledgeable on how to facilitate this environment effectively. Prospective and current teachers should be prepared and informed for any situation so that they will be able to serve their students no matter what. More research must be done so that all students can have the best possible experience in mathematics classrooms.

Chapter 3 – Methodology

For this study, I put together an online survey on Google Forms. Participants were found by looking at the faculty lists from Baldwin, Jones, Putnam, Cobb, and Haralson counties in Georgia. Teachers were sent an email which briefly gave some background information about me and my study. The email explained that participants must have taught in a middle or high school mathematics inclusion class at some point. If the receiver of the email does not meet this requirement, they were encouraged to forward the email to individuals they may know who do.

The participants included general education teachers, special education teachers, paraprofessionals, and supply teachers.

The survey was heavily based off the survey that DeSimone and Parmar put together in their study. It included an informed consent statement where teachers clicked a box, verifying their consent. The survey had three sections: (I) general information such as degrees and grade levels taught, (II) beliefs in which participants ranked how much they agreed with a number of statements on a Likert scale, and (III) short answer questions in which teachers were asked to expand on some of their answers from section II. See Appendix A for the full survey and a link to the online survey.

The main goal of section I is to get a broad picture of who exactly is filling out the survey and to see if there happens to be any sort of unexpected correlations. For example, section I question 4 asks how long the teacher has been teaching in an inclusion class. One may expect that if a teacher has been teaching in an inclusion class longer, they may be more comfortable or confident in their ability to teach math to students with learning disabilities. It is worth noting that although this section provides information about specific participants, in no way can this information be linked to the name of any specific participant.

Each statement or question from sections II and III are associated with one of the three research questions. For example, statement 1 in section II, “I have received adequate training on methods for teaching math to students with learning disabilities,” aligns with research question 2, “Are general education math teachers and special education teachers equipped to properly facilitate a math inclusion class?” The survey in Appendix A is color-coded to show which research question each statement or question is related to. The highlighted color of each statement or question will match the highlighted color of the research question listed at the top.

For section II, responses were analyzed using a relative frequency approach. For each statement, I observed the number of respondents who selected each possible response. For some statements, one or two responses may be overwhelmingly more popular than the others and in other statements, responses may vary evenly among participants. If responses tend to lean heavily towards 1 and 2 or 4 and 5, then it is assumed teachers strongly felt one way about the statement. If 3 is the most popular response, then it is assumed teachers felt neutral on the statement or were undecided. If responses are spread out across the board, it is assumed that teachers have varying feelings on the statement.

For some statements, responses will be compared to another statement. For example, statement 6 says, “I ask the students with learning disabilities to explain their work to me often,” and statement 7 says, “I ask the students without learning disabilities to explain their work to me often.” Comparing the responses to these two statements, for example, may inform us on whether students in math inclusion classes are being treated equally. Responses were also compared to the responses DeSimone and Parmar got to similar questions in their study to see if there were any major differences and similarities.

For section III, responses to questions were analyzed to see if there were any similarities or differences in the way teachers responded. This section will also help to clarify responses from section III and provide elaboration to see why teachers responded the way they did. For example, question 4 asks: “What are your thoughts on math inclusion classes versus small classes just for students with learning disabilities? Do you have any opinions?” Responses to this question helped give more information on questions 10 and 11 from section II on why they feel inclusion classes are beneficial or not.

The first three questions to this section corresponded to research question concerning teaching strategies. Witzel and Allsopp's study provided a good framework for what strategies work well in math inclusion classes. Although this article mainly looked at three key strategies with regards to using manipulatives, these strategies can also be applied outside the use of manipulatives. However, as the article points out, manipulative use can be very beneficial to students with learning disabilities, so this was a key strategy that was searched for when analyzing responses. Responses were analyzed to see if teachers are using strategies that resemble the three main strategies discussed in Witzell and Allsopp's study: linking prior knowledge to new concepts, emphasizing thinking-aloud modeling, and applying multisensory cueing.

Chapter 4 – Results

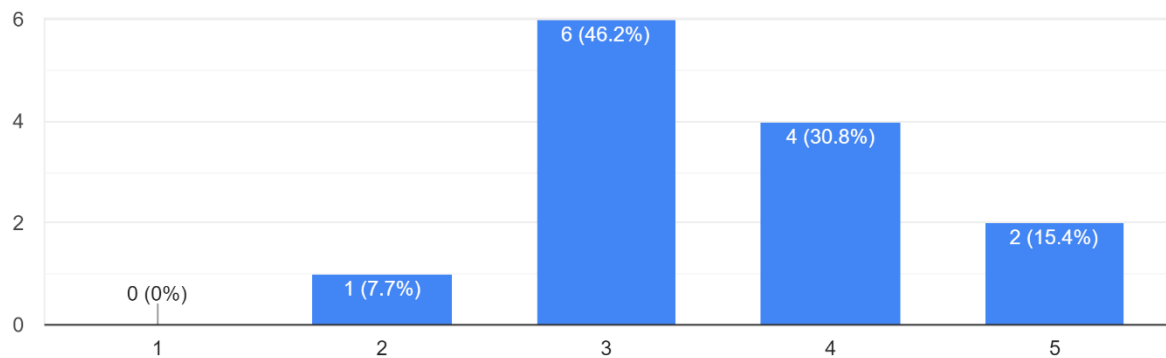
Research Question 1: Do teachers believe students, both with and without learning disabilities, are best taught math in an inclusion class?

Section II Questions 10 and 11 ask teachers to rate the degree to which inclusion environments benefit the learning of students with and without learning disabilities. The mode for both questions was a 3 rating, which is neutral. This means, for the most part, teachers do not have strong opinions as to whether inclusion classes benefit students both with and without learning disabilities. However, it is interesting to note that the results for question 10 are much more right skewed than question 11 meaning teachers believe inclusion classes benefit students with learning disabilities more than students without learning disabilities. For example, 46.2% of respondents rated a 4 or 5 for question 10 while only 15.4% rated 4 or 5 for question 11. Additionally, 7.7% rated a 1 or 2 for question 10 while 30.8% rated 1 or 2 for question 11. This

means teachers tend to feel more strongly that inclusion classes benefit students with learning disabilities but do not benefit those without learning disabilities. This does not necessarily mean teachers think inclusion classes hurt those without learning disabilities, though. They just feel they do not benefit from them.

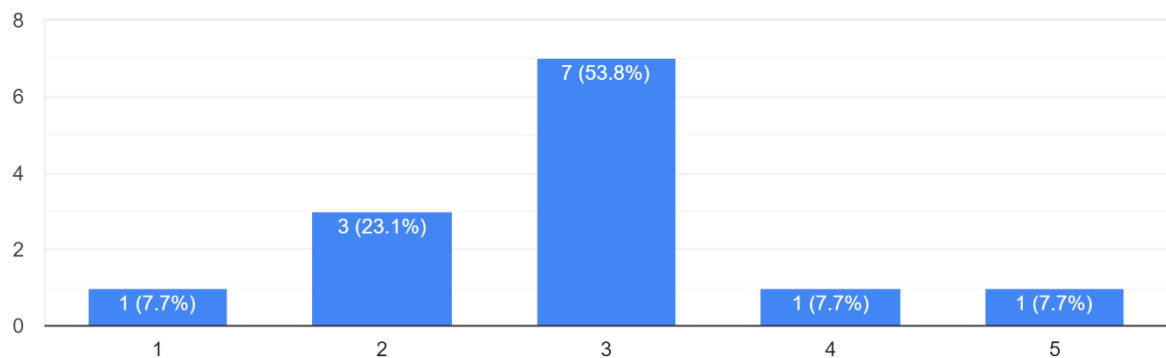
I feel that students with learning disabilities learn math best when in an inclusion environment.

13 responses



I feel that students without learning disabilities learn math best when in an inclusion environment.

13 responses



Section III Question 4 asks for teachers' general feelings on math inclusion settings versus small group settings for students with learning disabilities. The most common response

was that it depends on the student, with 4 people having a response like this (i.e. some students learn well in inclusion classes while some do not). One teacher said, “I think depending on the students’ ability level, some students can function well in the inclusion setting. However, some students need a truly smaller group setting.” However, 3 participants felt small group settings were better: “Smaller environments help more than larger ones,” and there were 2 people that felt inclusion was better: “It is better to educate in the general education classroom. It helps build self-esteem for students with disabilities. It also gives the student access to a trained math teacher. Sped teachers don't usually have a degree in mathematics.” There was no consensus on how teachers feel about inclusion versus small group settings.

Section III Question 6 asks teachers about topics they have found to be particularly easier or harder to teach to students with learning disabilities. Respondents only seemed to say topics that were more difficult. Three respondents mentioned word problems as being the most difficult and two of these respondents specified that any problem with multi-steps is hard, especially multi-step word problems. One respondent said, “Word problems with multiple steps are always a struggle with my students with disabilities, weaknesses in reading comprehension, math reasoning, and basic skills to analyze given problems.” Two respondents mentioned division as being particularly difficult. Otherwise, teachers mentioned varying things as being difficult for students with learning disabilities such as equations with variables on both sides, radius and diameter, and converting metrics to standard units.

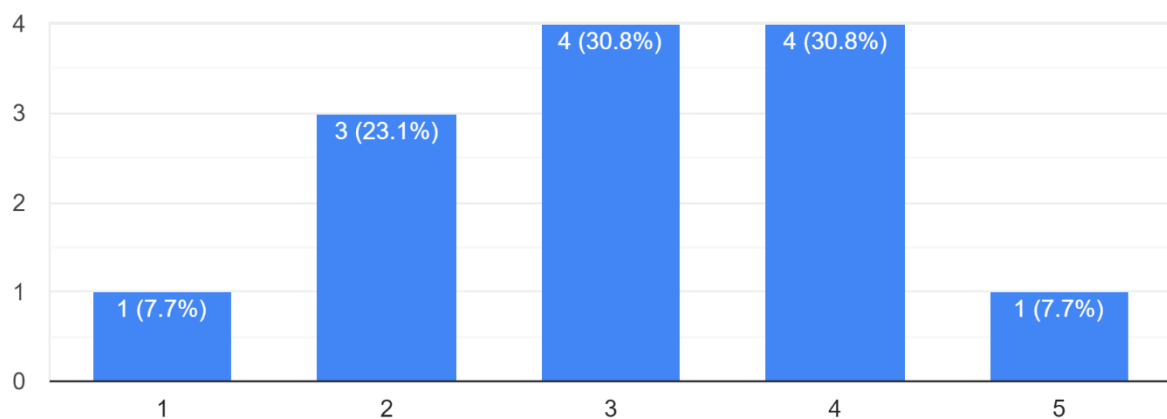
Research Question 2: Are general education math teachers and special education teachers equipped to properly facilitate a math inclusion class?

Section II Question 1 asks participants to rate the degree to which they feel they have received adequate training on methods for teaching math to students with learning disabilities.

The mode is a tie between a rating of 3 and 4 with four teachers selecting each. Only one participant selected a rating of 5. This means 38.5% of respondents rated a 4 or 5, meaning they felt strongly that they had received adequate training. In contrast, 30.8%, or 4 respondents, rated a 1 or 2, meaning they felt strongly that they have not received adequate training. This is problematic because it means a significant number of teachers are teaching students with learning disabilities without feeling confident that they have been properly trained.

I have received adequate training on methods for teaching math to students with learning disabilities.

13 responses

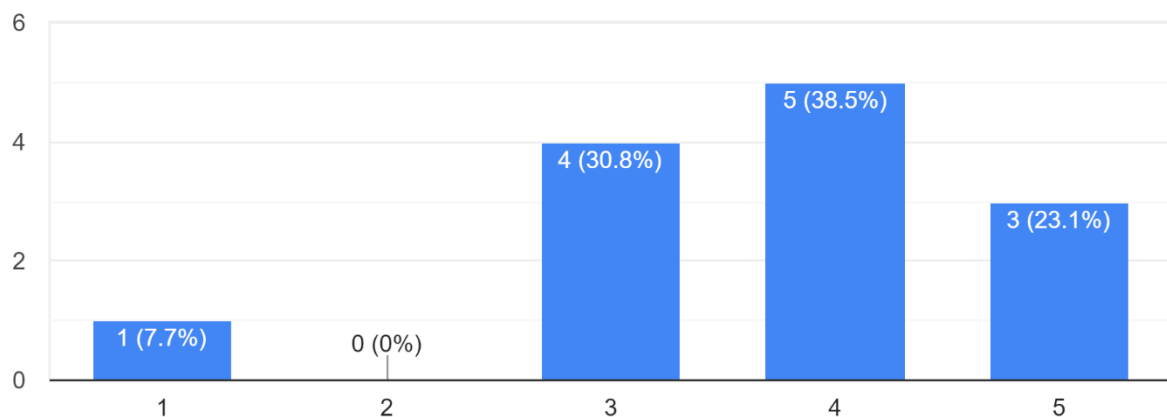


Section II Question 2 asks participants to rate the degree to which they feel they have received adequate training on methods for teaching math to students without learning disabilities. The mode is a rating of 4, with five teachers selecting it. A total of eight respondents, or 61.6%, rated a 4 or 5, meaning they feel strongly that they have received adequate training. This is a big difference compared to the 38.8% of respondents who rated a 4 or 5 for the previous question. Only 1 respondent, or 7.7%, rated a 1 or 2, meaning they feel strongly that they have not received adequate training. Again, this is quite a difference compared to the 30.8% of

respondents who rated a 1 or 2 in the previous question. These differences reveal that teachers feel much more confident that they have received adequate training on methods to teach students without learning disabilities than students with them.

I have received adequate training on methods for teaching math to students without learning disabilities.

13 responses

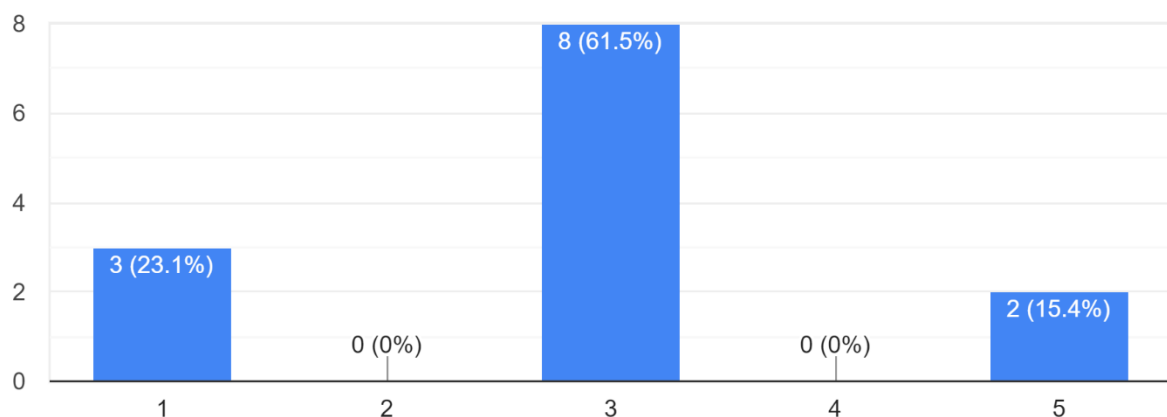


Section III Question 5 asks teachers to describe some of the trainings they have had for teaching an inclusion class or teaching students with learning disabilities. It is worth noting that the above two Likert scale questions had 13 respondents, but this question only had 8. This may be an indication that the individuals who did not respond did not have any trainings to describe. Two of the eight respondents described trainings which had to do with teaching inclusion classes in general, not specific to math. One of them said, “General co-teaching strategy trainings, nothing math specific for co-teaching.” Four of the teachers described trainings for teaching math not specific to inclusion classes. One respondent said, “Most of the trainings are designed for general ed and then adapted by the SPED teacher.” Only one respondent mentioned trainings that specifically deal with math inclusion. This individual said, “We have 2 training days a year

to catch us up on the newest techniques on teaching inclusion math.” The remaining respondent simply said they could not recall any trainings.

Section II Question 14 asks respondents to rate how much they feel college properly prepared them to teach in a math inclusion class. The mode was a rating of 3 with eight respondents, 61.5%, choosing this. Other than that, two respondents selected 5 and three selected 1. No respondents selected 2 or 4. This reveals that there is no consensus among teachers as to whether they feel college properly prepared them. Most teachers feel neutral while some feel strongly that college did not prepare them and some felt strongly that it did.

College properly prepared me to teach math to students with learning disabilities.
13 responses



Research Question 3: What types of teaching strategies are most effective when teaching in a math inclusion class?

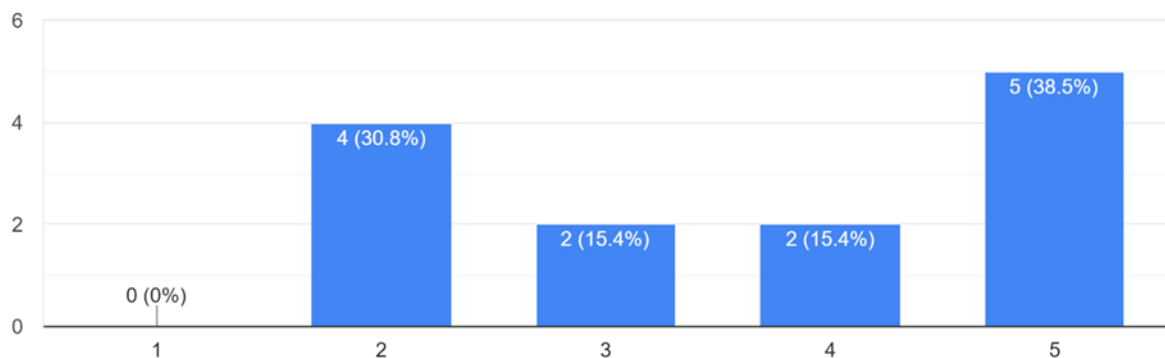
Section III Question 1 asks participants about teaching strategies they like to use often when teaching a math inclusion class and whether these strategies are effective. For this question, responses were analyzed to see if they lined up with the three strategies emphasized in Witzell and Allsopp’s study. Applying multisensory cueing was mentioned most frequently out

of the three, with 3 respondents mentioning something related. Participants mentioned the use of manipulatives to help students learn and a few mentioned very interactive methods of teaching like “interactive low-stress games,” “white boards and markers to practice,” and even “teaching songs.”

Perhaps one of the most important and useful tools for teaching mathematics which relates to multisensory cueing is the use of manipulatives. Section II question 5 asks participants to rate how often they use manipulatives to help students learn. Some positives are that no one rated 1 as their response, and the most selected rating (38.5%) was a 5. However, the second most selected rating (30.8%) was 2, with everyone else (30.8%) rating a 3 or a 4. Only about half of respondents (53.9%) rated a 4 or 5.

I frequently use manipulatives to help students learn.

13 responses

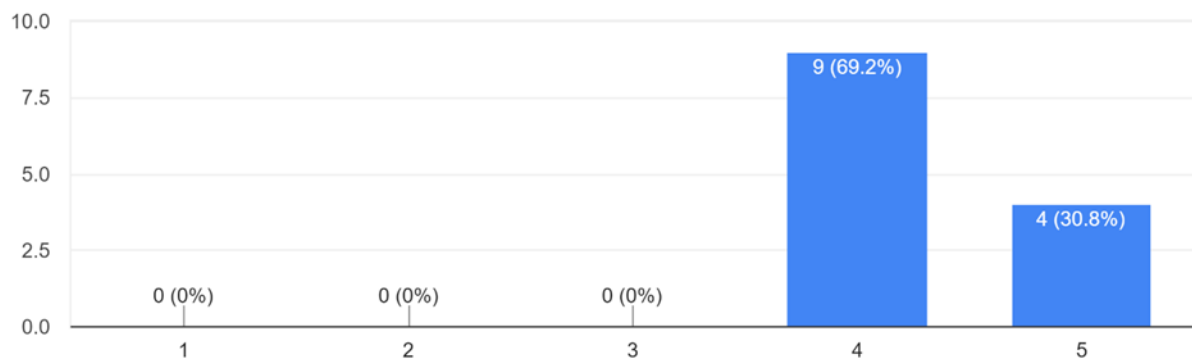


Emphasizing thinking-aloud modeling was also common, with two participants mentioning something related to this. The two participants mentioned think pair share, where students think about a concept on their own, then discuss it with a partner, and finally share with the entire class. Another teacher mentions teach/reteach, when a teacher teaches a concept and then students must “teach” it back to the teacher. Section II Questions 6 and 7 ask teachers if

they ask students with and without learning disabilities to explain their work often, emphasizing thinking-aloud modeling. The results for these two statements are roughly the same with a 4 response being the top answer for both. This is good in that it means students with and without learning disabilities are being treated equally in the classroom.

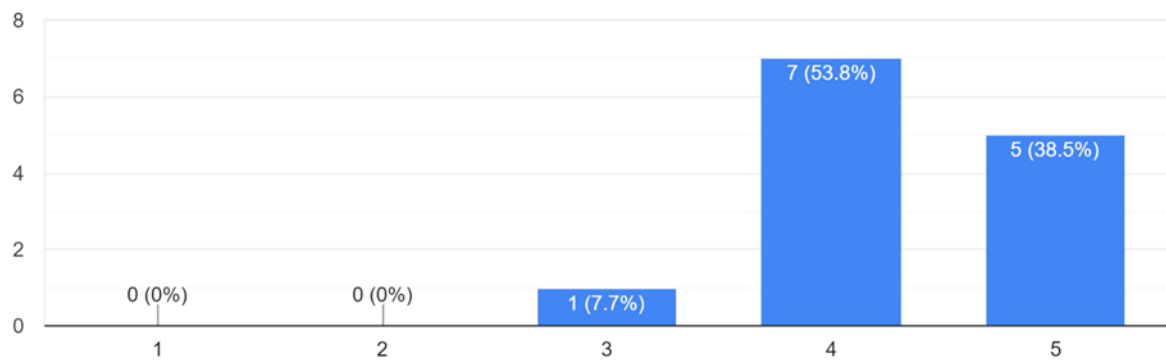
I ask the students with learning disabilities to explain their work to me often.

13 responses



I ask the students without learning disabilities to explain their work to me often.

13 responses



The most disappointing thing from this question is that the last strategy, linking prior knowledge to new concepts, was not mentioned at all. This presents a major problem, as material

should build on each other in math courses. Of course, it is worth noting that just because no participants mentioned linking prior knowledge to new concepts, that does not mean that teachers are not doing it. It is also worth noting that teachers mentioned strategies that do not fall into these three categories and may fall into a completely different category having to do with organization. One participant said, “Providing graphic organizers and/or printed notes that guide students through steps/processes.” Interestingly, one other teacher mentioned guided notes and another one mentioned graphic organizers. These are both excellent ways to help students with organizing material.

Chapter 5- Summary and Conclusions

The present study seeks to answer the following three research questions: Do teachers believe students, both with and without learning disabilities, are best taught math in an inclusion class? Are general education math teachers and special education teachers equipped to properly facilitate a math inclusion class? and What types of teaching strategies are most effective when teaching in a math inclusion class? Are they being used? There are plenty of studies out there concerning math education but very little which discuss math inclusion classes. One of the best studies I came across which did address math inclusion and which this study is primarily based on was that of DeSimone and Parmar. Like their study, I conducted a three-part survey, which includes background information and Likert scale questions. In place of interview questions, I asked short answer questions.

Research Question 1: Do teachers believe students, both with and without learning disabilities, are best taught math in an inclusion class?

For the most part, teachers seemed to feel neutral about whether students are best taught math in inclusion environments. Most teachers feel that it simply depends on the student. Some felt strongly that inclusion environments are helpful to students with learning disabilities while others felt that students with learning disabilities benefited more from learning in a small group setting.

Research Question 2: Are general education math teachers and special education teachers equipped to properly facilitate a math inclusion class?

For the most part, it seems that teachers either are equipped to teach a general education math class or an inclusion class in general but generally, not a math inclusion class specifically. This result does not come as a surprise as inclusion classes typically consist of two teachers, a general education teacher who specializes in a particular academic subject and a special education teacher who specializes teaching students with learning disabilities. This study may reveal that there is a greater need for teachers to have trainings specifically dealing with math inclusion classes if they are to teach in one. This also may go for other academic subjects as well.

There is also a greater need for teacher collaboration between special education and general education teachers. It appears that for the most part, general education teachers make the lesson plans and the special education teachers adapt the plan for the students with learning disabilities on their own. There is little collaboration in this process. Special education teachers should play a bigger role in the planning process.

Research Question 3: What types of teaching strategies are most effective when teaching in a math inclusion class?

As we saw in the past research, some of the most useful strategies when teaching in a math inclusion class involve manipulatives, teacher talk, linking prior knowledge to new

concepts, emphasizing think aloud modeling, and applying multisensory cueing. For the most part, teachers were using all these strategies except for linking prior knowledge to new concepts, which is a very important one because topics in mathematics are meant to build off each other. However, teachers seem to have adapted a new strategy which deals with organizing information.

Works Cited

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Appendix A: Survey

*Link to online survey: <https://forms.gle/dLZNuxWa6saWsmJc9>

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Research Questions: Do teachers believe students, both with and without learning disabilities, are best taught math in an inclusion class? Are general education math teachers and special education teachers equipped to properly facilitate a math inclusion class? What types of teaching strategies are most effective when teaching in a math inclusion class?

Capstone Survey Questions

In the mathematics inclusion classes I have taught in, I have served as a... (select all that apply)

general education teacher special education teacher paraprofessional

General Information

1. Please list all your degrees and what they are in:
2. What grade level(s) do/have you teach/taught math inclusion for?
3. How many years have you been teaching?
4. How many years have you taught in a middle/high school math inclusion class?
5. What is your gender?
6. What kind of area(s) is/are the school(s) in which you have taught in (a) middle/high school math inclusion class(es) in? (Select all that apply) rural suburban urban
7. Is/are the school(s) in which you have taught in (a) middle/high school math inclusion class(es) private or public? (Select all that apply) private public

8. Is/are the school(s) in which you have taught in (a) middle/high school math inclusion class(es) charter or non-charter? (Select all that apply) (Note: Private schools are always non-charter)

charter charter non-charter

9. Approximately how many students are there typically in the middle/high school math inclusion classes you have taught in?

10. Typically, what types of learning disabilities do students in your middle/high school math inclusion class(es) have?

11. About how many trainings, if any, have you undergone to prepare for teaching math to students with learning disabilities?

Beliefs

For each statement, circle the number beside it which best describes how much you agree with it according to the following scale:

1= Strongly disagree, 2= Disagree, 3= Undecided, 4= Agree, 5= Strongly agree

1. I have received adequate training on methods for teaching math to students with learning disabilities.	1	2	3	4	5
2. I have received adequate training on methods for teaching math to students without learning disabilities.	1	2	3	4	5
3. I am confident in my knowledge of the mathematics content I must cover.	1	2	3	4	5
4. My co-teacher(s) and I work together to make lesson plans.	1	2	3	4	5
5. I frequently use manipulatives to help students learn.	1	2	3	4	5

6. I ask the students with learning disabilities to explain their work to me often.	1	2	3	4	5
7. I ask the students without learning disabilities to explain their work to me often.	1	2	3	4	5
8. Teaching in an inclusion class is harder than a traditional general education class.	1	2	3	4	5
9. Teaching in an inclusion class is harder than a teaching students with learning disabilities in a small group setting.	1	2	3	4	5
10. I feel that students with learning disabilities learn math best when in an inclusion environment.	1	2	3	4	5
11. I feel that students without learning disabilities learn math best when in an inclusion environment.	1	2	3	4	5
12. I am confident in my ability to teach math to students with learning disabilities.	1	2	3	4	5
13. I have benefitted and grown as a teacher from teaching a math inclusion class.	1	2	3	4	5
14. College properly prepared me to teach math to students with learning disabilities.	1	2	3	4	5

Open-ended Questions

1. Are there any teaching strategies you like to use often when teaching math to an entire inclusion class (whole class setting)? What are they? Are they effective?

2. Are there any specific teaching strategies you use when teaching math to students with learning disabilities in a small group or one on one setting? What are they? Are they effective?

3. Are there any specific teaching strategies you have tried which have shown to be ineffective when teaching math to students with learning disabilities in a small group or one on one setting? What are they?

4. What are your thoughts on math inclusion classes versus small classes just for students with learning disabilities? Do you have any opinions?

5. Can you describe some of the trainings you have had, if any, for teaching an inclusion class or teaching students with learning disabilities?

6. Are there any specific topics you have found to be particularly easier or harder compared to other topics to teach to students with learning disabilities?

7. Can you describe your lesson planning process? Do you and your co-teacher work together to write lesson plans?