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Effective Strategies for Teaching Students with Learning Disabilities

By.

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a project entitled "Effective Strategies for Teaching Students with Learning Disabilities" submitted by Bridget Ainsworth Bowen in partial fulfillment of the requirements of the degree of Master of Science in Education.

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Effective Strategies for Teaching Students

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Abstract-

This project examined: (1) the difficulty that general and special needs students have in understanding mathematics, (2) a breakdown of different learning disabilities, (3) different teaching strategies for success in mathematics, and (4) how to implement these teaching strategies. A survey was given to high school students from ninth to twelfth grade with and without learning disabilities to determine how they perceive their own mathematical disabilities and how they feel they best learn material. With this information, a variety of lessons were created that integrated different teaching strategies and were then piloted with different groups of students that learn best from that strategy. The results of using those lessons are discussed.

I. Introduction

In our school systems today, every classroom has the possibility of having students with special needs and Individualized Education Plans. It is the responsibility of the teacher to meet these needs of the students to ensure their success in the classroom. There are many disabilities the students could have such as learning disabilities, being emotionally disturbed, being hearing impaired, visually impaired, or having speech impairments among others. The classroom may also have students who have been declassified so that they no longer have an Individualized Education Plan but still must be monitored to ensure they are staying on track with the rest of the class. Finally, the remainder of the class may not have a learning disability but some students may still have difficultly understanding specific subject matters or topics. Many times when students have difficulty understanding a specific topic, it is due to them having years of low educational achievement and understanding but continuing to be moved to the next level regardless of understanding. In addition to already listed deterrents, being in a mathematics classroom increases the struggles that students have in learning mathematics. This is partially due to the fact that at some point it became acceptable to not like or understand mathematics.

This project was created to given teachers better strategies for teaching to students with learning disabilities. First there was a review of the literature to gain a greater understanding of learning disabilities and mathematics anxiety. Next a survey was created to see if the students' ideas were inline with what the literature had said. Finally, based on both of these new lessons were created to illustrate these new strategies.

II. Background Research

II. 1 Difficulties of General and Special Needs Students in Mathematics

In our society, it is has become socially acceptable to dislike mathematics due to its level of difficulty. Thus, it is socially acceptable to not excel or do well in mathematics. "Research by Jackson and Leffingwell (1999) has shown only about 7% of Americans have had positive experiences with mathematics from kindergarten though college" (Furner and Duffy, 2002, p.68). This problem is perpetuated by the fact that students are "passed along" to the next grade without understanding the material and because they are the correct age. If this cycle is repeated by the time a student reaches high school the student is missing major concepts that are needed for higher understanding. These problems often show up in high school because all students are required to pass state exams before being allowed to graduate.

One of the major problems in mathematics is the gaps in material. Mathematics, unlike many other core subjects, is cumulative. It is impossible to believe that, if a student was unable to comprehend topic A, they will be successful in topic B. Unfortunately, many students with special needs are not expected to have full understanding of the material; before they move on to the next level. This leads to students not addressing their problem areas and it continues to be a weakness for that student.

Many students dislike mathematics because they suffer from mathematics anxiety. The lack of mathematics popularity most likely comes from, not a hatred of mathematics, but merely mathematics anxiety, referred to as mathematics anxiety. Mathematics anxiety is defined as "inconceivable dread of mathematics that can interfere with

manipulating numbers and solving mathematical problems within a variety of everyday life and academic situations" (Furner and Duffy, 2002, p. 68). Math anxiety can be caused by a broad spectrum, such as gender, parental background, or socioeconomic status. Often, students and parents believe, because the older generation was not successful in mathematics; there will be no hope for the younger generation. "Indeed, some educators believe that their teachers and parents who are afraid of math can pass that anxiety on to the next generation by modeling behaviors of their own discomfort with the subject" (Furner and Duffy, 2002, p. 69). This is simply not true. Often, the math anxiety is really test anxiety. There is great pressure because there is only one correct answer. Research suggests, "Teachers need to consider other alternative forms of assessment that can help students gain confidence," (Furner and Duffy, 2002, p. 69). Alternative assessments allow the students to be more creative and, as many of our students need, the feeling of control over the work. If the students understand the beauty of mathematics and are able to feel success, they may be able to conquer their fears of mathematics. The only problem of alternative assessments is, while states are beginning to explore alternative assessments, most high school classes culminate by having one large standardized test.

II.2 Breakdown of different Learning Disabilities

A learning disability is any block that may prevent a student from being as successful as a student without this condition. "Historically, special education for students with learning disabilities has been approached by identifying students' processing deficit and matching treatment practices to these deficits" (Vaughn and Linan – Thompson, 2003, p.145). The goal of the modifications is merely a way to place all

students on a level playing field. These modifications are not intended to change the curriculum but change how the student receives the message. Less than ten percent of school-age children have some form of memory or cognitive deficit, which interferes with their ability to learn concepts in mathematics. A learning disability can result from deficits in the ability to represent or process information in mathematics. Watkins discusses the Learning Disability Index (LDI) in order to identify a student's specific learning disability (Watkins, Kush, and Schaefer 2002). The LDI is one of many diagnostic indicators to identify students with learning disabilities, which relate to performance on cognitive tests (Watkins et al., 2002). Although, specific measures to diagnose children with Mathematics and Learning Disabilities (MLD) are not available and thus, most researchers will rely on standardized tests and intelligence testing to diagnose a child with MLD. However, many children who score low on standardized tests in one school year, score average or higher in another school year and thus, are oftentimes improperly diagnosed as having MLD. If a student scores low over many school years on standardized tests, then the student's performance may be a result of some form of memory or cognitive deficit, which may lead to a diagnosis of MLD (Geary, 2004).

There are many different titles for students with special needs and many of the characteristics overlap. "The students with learning problems that will most likely be taking general education algebra I, algebra II, and geometry classes have labels such as learning disabilities (LD), behavior disorders (BD), communication disorders (CD), and attention deficit/hyperactivity (ADHD)" (Steele, 2006, p. 32). Table 1 (Steele, 2006, p.

34) addresses different deficits and provides examples of how this deficit could cause problems for the students in using a graphing calculator.

Table 1. Characteristics of students with learning problems and related difficulties using the graphing calculator

Characteristics of Students with Learning Problems	**Related Difficulties Using the Graphing Calculator**
Visual Processing Deficits	• Difficulty remembering functions of graphing calculator keys • Problems pressing the keys in the correct order for multi step problems • Difficulty interpreting graphs produced on the calculator.
Auditory Processing Deficits	• Difficulty understanding lectures on calculator use • Problems with oral presentation of multistep problems
Motor Processing Deficits	• Difficulty pressing keys correctly • Problems using the calculator with precision and accuracy
Reading Deficits	• Trouble comprehending the manuals and textbook explanations involving procedures for using the graphing calculator • Difficulty understanding the textbook explanation of steps for a graphing calculator problem
Writing Deficits	• Difficulty keeping clear notes in mathematics class related to using the calculator • Difficulty following directions steps and directions in their notebooks
Behavior Deficits	• Problems with concentration when working long graphing calculator problems • Problems staying on task and attending to lesson instead of playing with the calculator
Language Deficits	• Confusion with class presentations of steps and directions for using graphing calculators • Difficulty asking for assistance when needed

With the given examples that relate to the mathematics classroom it is easy to see why the LD student could have more difficulty in mathematics even when there are technological advancements that are in place to make the lesson easier. This is why there must be many different strategies to help each student comprehend not only the questions but also the tools to get to the answer.

II.3 Different Teaching Strategies for Success in Mathematics

Few people can deny the fact that no matter the age, people learn to think and process information differently. Teachers, who acknowledge, honor, cultivate support, and build on the premise that learners differ in many ways such as learning styles, will enhance the students' educational process (Farkas, 2003). Research suggests that students need drill practice to master skills in mathematics, however, many students lack pre-requisite skills in order to be successful (Burns, 2005). Students struggle in mathematics because they have gaps in their knowledge and understanding for the subject area. It is the responsibility of an educator to ensure the gaps between grade levels are diminished in order to ensure the student is successful in school. Educators must know and understand the specific learning styles of each student in their classroom. Once a teacher is able to identify the specific learning styles of their students, they must then begin to incorporate each style into their lesson delivery. Understanding that every student learns in a different way makes it imperative to implement different teaching strategies. "Effective learning strategies are an important tool for educators to use in the classroom for all students, in particular those with learning disabilities" (Parker, 2006, p.58). Specifically, realizing this will not only help our special needs students but will also give support to all our students. "Recently, an instructional technique known as K-W-L, created by Ogle was introduced into classrooms (2007). It is used to help students have a better understanding of what they will need to know before they start a new topic.

The KWL is broken into three pieces.

1. What do I KNOW? (K)
2. What do I WANT to know? (W)

3. What did I LEARN? (L)

The first branch is done before the new material is taught. The second is done immediately after the new material is taught. The third piece is done after the students have practiced the new material and can reflect on their success.

The KWL gives the students an opportunity to be able to process their thoughts before having to interact with the class. For a student with any type of processing disorder, having previous time to work gives the student control of the situation and also allows the student to feel successful. In a study by Parker (2006), it was found in a survey of mathematics teachers that one teacher was able to find great success with the use of the KWL.

> "In using the KWL in a math class, one participant reported that is was a 'great way for students to organize their understanding.' He stated that it made it easier for his students with learning disabilities to ask questions in class and ask for help. There seemed to be two distinct reasons for this: (a) the students were not embarrassed to ask questions that would make them 'look stupid' in front of the class because other students were asking questions and (b) the students had not forgotten their questions because they had written them down" (p. 57).

Organization may seem obvious to many as a good strategy to have but for many LD students this is their largest hurdle. "The true talent of the student with LD can be masked by his ability to produce work that reflects his abilities" (Finstein, Yang, & Jones, 2007, p. 174). For a student who is unaware of how to create this structure, it is important to show the student simple ways to be successful. In a study by Finstein, Yang and Jones (2007) they suggest:

1. Encourage students to believe that they can do what is asked.
2. Work cooperatively with parents.
3. Posting needed information on a bulletin board.
4. Use checklist to track activities.
5. Make and update a calendar.
6. Follow daily agenda.

7. Use an organizer/planner.
8. Pair with general education student.
9. Carry scripts/how–to–cards.
10. Post reminders.
11. Keep everything where it belongs.
12. Determine what to carry.
13. Know teachers routine.
14. Carry an efficient and orderly notebook.
15. Wear a rubber band bracelet.
16. Date and title assignments.
17. Engage in guided practice.
18. Communicate with teachers when assignments seem overwhelming.
19. Engage in mentoring programs.
20. Have an Individualized Education Program (IEP) that addresses organization skills.

One of the most commonly taught and used strategies is Modality – Matched instruction. This strategy is based on the idea that each student has specific modalities, which the student learns best. The teacher then matches how the lesson is taught to how the students learn best. An example of this strategy is when a student must visually see the lecture as it is spoken to be able to comprehend it. The teacher has a copy of the lesson and displays it during the lecture. It is important to note that one of the toughest challenges faced by educators of students with LD there is not one correct way. "These techniques are part of many pre-service and in-service programs for teachers, appear to have widespread use, and are fundamentally unsupported by empirical evidence" (Vaughn & Linan – Thompson, 2003, p.142). A strategy may be successful for one student, may not be effective for another student.

One of the largest problem areas for students struggling with mathematics is a word problem. This element of mathematics combines not only the computational aspect of mathematics but also involves comprehensive reading skills. This combination makes word problems a double threat for many of our LD students to accomplish. There are many ideas already being used to help student with word problems. One commonly used

instructional approach is the "key word" strategy, in which students are taught key words that cue them as to what operation to use in solving problems (Xin, Jitendra, Deatline-Buchman, 2005). This allows the students to have specific word translations but does not lead to a total understanding of the material. The Schema-Based Instructions (SBI) strategy aim is to give the students total understanding. It is not far from the general strategy but does have added parts to the steps so students will take away more from the problem than just word associations. Table 2 (Xin, Jitendra, Deatline-Buchman 2005, p. 184) shows a comparison of the problem solving steps employed by the schema –based instruction and general strategy instruction.

Table 2. General Problem Solving Steps Employed in the SBI and GSI Conditions

Schema – based instructions (SBI)	General strategy instruction (GSI)
• Read to understand	• Read to understand
• Identify the problem type, and use the schema diagram to represent the problem	• Draw a picture to represent the problem
• Transform the diagram to a math sentence, and solve the problem	• Solve the problem
• Look back to check	• Look back to check

Using this process, the students are better able to conceptually understand how the problem works opposed to a set up for a problem type. The study used a schema-based instruction to systematically teach the structure of different problem types and directly show the linkage of the schematic diagram in order to problem solve. It also illustrates that schema-based instruction is an effective method for teaching students with disabilities in a general education classroom.

III. Design of Project

After reviewing the literature on learning disabilities, mathematics learning disabilities, and mathematics anxiety specific learning strategies that created the most success were identified. Based on these findings, a survey was created to test these learning strategies on four different student groups: Math Application I students (behind track), Math 10 (on track), Math 10 Honors (advanced), Individualized Education Students (all in different classes). With the results of the survey four lessons were created to be piloted in these mathematics classes to see how well the modifications worked.

III.1 Purpose of Survey

With an understanding of the research on learning disabilities and the struggles students face with mathematics, a survey was created to look at how mathematics students in a high school in Central New York believe they learn. The survey was given to 50 students ranging from grades 9-12. In the survey students were asked:

- How they take information in best.
- How they learned new math concepts best.
- Where their fears of mathematics come from.
- How they feel about mathematics.

A copy of the survey that was distributed to the high school students is provided in Appendix A.

III.2 Modifying lessons plans

Four lessons were created for two different curriculums – two lesson for each curriculum. The first modification is part of all four lessons and consists of providing

students with a menu that outlines the day's lesson. This modification is helpful to all students, not just for LD students. Giving students a menu or order of events helps the students follow along during the lesson so that they can be aware of what is coming up to help decrease anxiety. Making the menu part of every lesson allows students to find a routine, lower their anxiety and help them to be more prepared. If the students are able to anticipate what is going to happen, they will not have as much anxiety and be able to concentrate their time on learning the new materials. For example, students will be able to come to class, take out their homework, and start work on the "do it now," instead of missing important information because they were looking for their homework.

The first two lessons were created for Math Application Classes. These classes are on track to receive a Regents Diploma but will do it at a slower pace. Many students in this class have IEP's or 504's and have had a difficult time with mathematics over the years. These students need a lot of praise and motivation.

Mathematics Applications Lessons

1. Relation of the length of sides of a Triangle lesson

This lesson allows students to have a hands-on approach and actually "see the mathematics." The students first work to discover the law of triangles on their own. This also allows students to discover the law at their own pace. The advantages of this lesson are that it first gives the students a tactical approach and leads to problems that need more of a mathematical understanding and it then leads to direct instruction. Using all three techniques will give all students with different learning styles the ability to find success in this lesson. A copy of this lesson can be found in Appendix B.

2. Surface Area

This lesson starts with direct instruction to show the students how surface area is really only finding area multiple times. By breaking down what surface area is, it allows the students to see the new concept is, in reality, just an old topic with a new step. The students are then asked to find the surface area of their own object. Again, this allows the students to have a hands-on approach instead of having to visualize what the teacher is saying. These objects have been predetermined for every student. Allowing higher-level thinkers to have harder problems and LD students to have a problem at which they can be successful. From an outsider's point of view, one would never know who is an advanced student who is a learning disabled student. A copy of this lesson can be found in Appendix C.

The next two lessons were created for Math 10 classes. These classes are on track by New York State standards to gain their Regents Diploma. Even though they are on track there are still students with IEP's and 504's that have modifications that need to be addressed.

Math 10

1. Euclidean Proofs

   The Euclidean proof unit creates disaster for many students, learning disabled or not. Students, again, feel overwhelmed by how different the problems are from the arithmetic problems. This topic also involves much more writing. Students, who are not specifically MLD but LD, in general, might now have greater struggles with this topic than those students who are not regularly affected by their LD in mathematics. One problem students experience with two-column proofs is not knowing how to fill in the reasons or what reasons they need. The first way to modify this unit is using

proofs that are nearly completed but have certain statements or reasons missing. This allows the students to see how the proof will work but not be responsible for all the steps. Working with broken proofs will allow students to feel more confident with how the logic is formulated in a two-column proof. Including a list of reasons from which the students may choose is another modification that can be made to aid in understanding a two-column proof.

Another way to modify the proof is to work with a Cut out Proof. The Cut out Proof is basically a puzzle that allows the students to have all the statements and reasons, but the student must put it in order. This modification allows students with short-term memory to have the correct definitions and allows the students to complete the proof without having to know definitions. This also allows students, who are unable to write and process well, to have all the information and not have to worry about missing a step or worrying about whether the proof is complete.

2. KWL for equations

An important Math B topic is solving advanced equations and inequalities, such radical equations and quadratic inequalities. Interestingly, the reason some students are not successful with this topic is not because they do not understand the new steps of the radical removal but students are unsuccessful at factoring. Factoring is actually a pre-requisite Math A topic. To help students overcome the lack of pre-requisite knowledge, a KWL can be used before starting the new topic. The K stands for "what do you KNOW?" This allows students to reflect on their understanding of quadratics. The W stands for "what do you WANT to learn?" When the students formalize what they need to know, then a teacher can create mini lessons to fill in the

gaps before overwhelming the students with new material. Finally, the L can be used for positive reflections for the students to state, "what did they LEARN?"

IV. Results and Discussion of Survey and Lessons

After the surveys were completed I organized the data to look at the numbers of each group and the overall population. I then found the percentage of every group so I could compare and contrast this information. With the findings of the surveys I wrote lessons that would best suit the way our students learn.

IV. 1 Survey Results and Observations

The results of the survey given in each of the three classes are provided in tables 3, 4, and 5. Table 3 shows the results of the survey given to students in the Math Applications I course. Students who are in the Math Applications I course at the high school level are students who struggle with mathematics. These students failed the course at least once and have not felt success in mathematics in a long time. Some of the students in the class have IEP's or 504's but there are also students that are not designated at all. Students in this classroom are easily frustrated and are very vocal about their dislike of mathematics.

Table 3. Survey Results for Math Applications I Students

Question	Yes	No	Percent Yes	Percent No
1	19	9	68	32
2	14	14	50	50
3	19	9	68	32
4	15	13	54	46
5	18	10	64	36
6	20	8	71	29
7	18	10	64	36
8	21	7	75	25
9	22	6	79	21
10	19	9	68	32
11	19	10	64	36

The results of the survey indicate that student understanding of a problem is roughly a 50/50 split. This is an interesting result because many students not only have difficulties with mathematics but also difficulties with English. The strongest percentages came from the group of students feeling overwhelmed by new material. Sixty-eight percent of the students stated they did not understand a new topic because there are too many steps at once. This may suggest that educators should break down new topics to show students how new concepts connect to previously learned material and also praise students for the success they have already had in learning the material. The last interesting observation that can be made from this group of students is that 79% of students feel they learn best from direct instruction compared to working with their peers to find the answer themselves.

Table 4 shows the results of the survey for the Math 10 Regent's students. The Math 10 Regent's students are on track for graduation, however, students with IEP's can be in Math 10, but for the purpose of the survey a class with no IEP's was chosen. The table indicates that even though 63% of students felt they better understood a question if they read it themselves, 50% also believed they would benefit from having the question read to them. Seventy seven percent of this population believed that they also could not understand a problem because of the many steps. Seventy three percent believed that they could not do a problem because of a problem with an earlier topic. The positive point to note about this group is that 73% of the students felt confident that, if they could find another problem of the same type, they could work from the example to find the answer.

Table 4. Survey Results for Math 10 Regent's Students

Question	Yes	No	Percent Yes	Percent No
1	19	11	63	37
2	15	15	50	50
3	23	7	77	23
4	22	8	73	27
5	20	10	67	33
6	17	13	57	43
7	17	13	57	43
8	22	8	73	27
9	17	13	57	43
10	16	14	53	47
11	19	11	63	37

Table 5. Survey Results for Math 10 Honors Students

Question	Yes	No	Percent Yes	Percent No
1.	28	2	93	7
2.	6	24	20	80
3.	12	18	40	60
4.	19	11	63	37
5.	13	17	43	57
6.	7	23	23	77
7.	6	24	20	80
8.	26	4	87	13
9.	22	8	73	27
10.	19	11	37	37
11.	17	13	43	43

Table 5 shows the results of the survey for the Math 10 Honors students. These students are on track to graduate or may be a year ahead of where they would typically be placed. These students' raised two strong points from the survey. Ninety three percent of the students felt it would be better to read the question on their own rather than having someone read the question to them. Even in the honors group, 63% indicated that they could not do a problem because of a lack of understanding of an earlier topic. This group

of students also felt confident that they could solve the problem if they were given another example.

Table 6 shows the results of the survey for students who have an IEP. The students in this survey came from all different resource rooms and could have come from any of the math classes.

Table 6. Survey Results for Individualized Education Plan Students

Question	Yes	No	Percent Yes	Percent No
1.	13	12	52	48
2.	16	9	64	36
3.	16	9	64	35
4.	14	11	56	44
5.	17	8	68	32
6.	18	7	72	28
7.	8	17	32	32
8.	18	7	72	28
9.	21	4	84	16
10.	17	8	68	32
11.	17	8	68	32

The survey results show that sixty four percent of the population felt it was important to have questions read to them. Seventy two percent of the students felt they could be successful if they had another example to work from. Eighty four percent of the population felt that they learned best from direct instruction. These results are not surprising because many of these students lack structure and by using direct instruction they are given the structure they need. Seventy two percent also felt that they were unsuccessful at times because they were unsure of the type of problem it was that they were reading.

Table 7 shows the overall results of the survey. This combines the information of all the different groups. Due to this it creates some interesting results.

Table 7. Overall Results of the Survey

Question	Yes	No	Percent Yes	Percent No
1.	79	34	70	30
2.	51	62	45	55
3.	70	43	62	38
4.	70	43	62	38
5.	68	45	60	40
6.	62	51	55	45
7.	49	64	43	57
8.	87	26	77	23
9.	82	31	73	27
10.	71	42	63	37
11.	71	42	63	37

Even though more of the students felt that they would be more successful reading the questions to themselves, it is very important to note the amount of students that find it helpful to have the problem read to them. In terms of helping students be successful, if almost half the overall population benefits from this strategy, it may be useful to implement all the time when teaching concepts. It is important to compare the difference between honors students and low-level students confidence levels in their ability to do work at home. This, unfortunately, confirms the ideas of mathematics anxiety. These students have so little confidence in their mathematics skills that they do not trust they can do the work correctly if they are not in an environment where they can be checked throughout the process. However, 77% of all students felt confident that they could be successful if they followed along another example.

IV.2 Lesson Reflections

The Triangle sides' lesson was very successful; students are more excited about learning when they can be actively engaged in the material. Some students understood the concept immediately, while it took other students longer to understand. The students who took longer to understand the concept were not able to fully grasp the concept until it was explained to the entire class. There was some resistance from students who expected to just be given the rule and not having to understand the concept. By allowing students to spend time writing the rule themselves rather than stating it for them, helped the students to remember it.

The surface area lesson again gave students hands on manipulates to be able to see how the shapes were made up. Due to the predetermined objects being given to students, all had the opportunity to feel successful and were able to gain some confidence in their mathematics skills. By allowing the students to teach each other, the students hear the information in a different way than how the teacher would explain it, which may help the students better, understand the concept.

The fill-in proofs were very successful. Students only had to focus on knowing why one specific statement had been written rather than attempting to logically complete the entire proof on their own. This allowed students to become more confident with definitions. The puzzle proof allowed many of the students to understand the flow of proofs. It was obvious from observations while the students were working that they could understand the underlying concept of the proof process. They knew that they had all the pieces and could just focus on the order.

At this time, the KWL for Radical and Quadratic Inequality lesson had not been implemented. This lesson will be taught during the functions unit in May.

Overall, the survey reminded me that there really is no one-way to teach our students. As an educator, it is known that our lower level students learn best when instructional material is presented in order to best fit their learning needs. In fact many of our students do not learn from direct instruction and we must incorporate specific activities to best educator our students. When I write lessons for the future I believe it is important to use differentiated instruction as much as possible. It is important to teach the same idea multiple times but to do it in multiple ways. As educators, our ultimate goal is to help all our students learn and we must always remember we need to continue to look for new ideas and techniques rather than being satisfied with the knowledge and strategies we already use in our classroom.

Appendix A

How do you best Learn Mathematics?

Read each question carefully, if you believe that a sentence is describing you place an X in the (Yes) box and if you feel the sentence does not describe you then place your X in the (No) box. Remember to answer honestly. Thank you for your time.

I

	Question	Yes	No
1.	I will understand a question better if I read it myself.		
2.	I will understand a question better if it is read to me.		
3.	If I do not understand a new Mathematics topic it is because there are too many new steps.		
4.	If I do not understand a new Mathematics topic it is because one of the steps involves an older topic I still do not understand.		
5.	If I do not understand a new Mathematics topic it is because I cannot remember the formulas.		
6.	If I do not understand a new Mathematics topic it is because I am not able to decide which type of problem to use it for.		
7.	I can understand the Mathematical topic in class but I am not able to do the work by myself at home.		
8.	I can understand the Mathematical topic in class and I can do it by myself if I look at another example.		
9.	I learn best being told how the rules of the new Mathematics topic.		
10.	I learn best being guided from an older topic I understand and see how it relates to the new topic.		
11.	I learn best working in a group of my peers to discover the new rule.		

APPENDIX B

I. Pre- Instruction Phase

1. Goals:
   - Student will be able to use mathematical operations and relationships among them to understand mathematics.
   - Student will be able to use number sense and numeration to develop an understanding of the multiple uses of numbers in the real world, the use of numbers to communicate mathematically, and the use of numbers in the development of mathematical ideas.
   - Students will demonstrate the knowledge and skills necessary for interdisciplinary problem solving.

2. Objectives:
   - Students will be able to incorporate all the new skills learned during this chapter to succeed.
   - Students will be able to relate the new material to the old skills that the student already knows.
   - Students will be able to recall information from all the sections of the chapter.

3. Content:

   Vocabulary: All terms of this chapter.

   Task Analysis
   - Students will be able to ask questions with out disrupting the class.
   - Students will be able to understand the vocabulary.
   - Students will be able to listen to the teacher and their peers.
   - Students will be able to come in to class ready to display their knowledge.
   - Students will be able to perform all the skills asked of them.
   - Students will be able to understand all the directions asked of them.

4. Instructional Aids/ Resources:
   - Chalk
   - Whiteboard markers
   - Note book
   - Overheads
   - Overhead pens
   - Prepared Packet
   - Graphing Calculator

5. Student Modifications:

- Teacher will have all directions written as well as given verbally.
- Teacher will allow students extra time to complete quizzes if they run out of time.
- Arrangements can be made for students to have a copy of my notes if they are unsure of what was said during class.
- Yellow post it notes for students too shy to ask question in class to write down problems.

II. Implementation

Set/Focusing Event

As students walk in greet them with today's DIN, containing problems requiring understanding of inequalities. Having students place the correct inequality between terms and practicing writing out what an expression says. Remind the students to get out their homework.

Activity One

Go over the Menu with the class, highlighting the specific events of today's class. Then give students several more minutes to work on their DIN. Once completed, go over answers of to DIN and answer any questions. Next give answers to homework and again go over any problems.

Activity Two

Give all students a card with a math problem to solve on it. Ask the students to work out the problem and then find the person in the room with the same answer. This will be their partner for the next activity. Remind the students to try the problem on their own but to ask for help if they need it. This activity can be done so the partners are found at random or can be preset by the teacher.

Activity Three

With the students now with their partner, each child will receive the lab. The lab has three sections. Section one involves a standard die and pipe cleaners cut from one inch up to six inches. The pair will roll three different numbers, record them, and then using the piper cleaners without bending them see if they can create a triangle and record their results. Students are asked to pay close attention to when it works and when it does not. The students are also asked to set up the inequality of the sum of the two smaller sides and see its relation to the third. The second section starts with manageable numbers from 1-6 but then jumps to higher multiples of these that can not be created by the pipe cleaners. This makes the students think about what they learned in the first page to see if these three sides would create a triangle. Finally, the students are asked to reflect on what they have learned by writing down what they feel is the rule. The students are told that they will not be graded on their grammar but their math understanding so the student does not need to worry about making a grammatical mistake. As the

students are finding the rule for themselves the teacher is circulating to answer any questions and help move students towards the rule.

Closure

In what could be considered backwards the teacher now asks students to volunteer what they believe the rule is. This allows students who might not have been confident to have already checked with the teacher to feel confident in talking in front of the class. This allows students who learn better from direct instruction to have that structure again. After several students have shared their answers have been given the teacher and students can work together to come up with the best definition for the Inequality of the sides of a triangle.

Extending Activity

Students will work on deciding if 15 different sets of sides could be triangles. Students are also allowed to borrow the pipe cleaners if they feel they need them.

III. Post – Instructional Phase

Evaluation

- Pay close attention to how students have dealt with new material.
- Watch how the students acted in their pairs, who worked well together and who needs to be in pairs groups for next time.
- Did the student participate, ask questions or were the students too lost to ask any question.

Reflection

- What did the students really take away from today's lesson?
- How could I change my lesson to better reach the students for next time?

Appendix C

I. Pre- Instruction Phase

1. Goals:
   - Student will be able to use mathematical operations and relationships among them to understand mathematics.
   - Student will be able to use number sense and numeration to develop an understanding of the multiple uses of numbers in the real world, the use of numbers to communicate mathematically, and the use of numbers in the development of mathematical ideas.
   - Students will demonstrate the knowledge and skills necessary for interdisciplinary problem solving.

2. Objectives:
   - Students will be able to incorporate all the new skills learned during this chapter to succeed.
   - Students will be able to relate the new material to the old skills that the student already knows.
   - Students will be able to recall information from all the sections of the chapter.

3. Content:

   Vocabulary: All terms of this chapter.

   Task Analysis

   * Students will be able to ask questions with out disrupting the class.
   * Students will be able to understand the vocabulary.
   * Students will be able to listen to the teacher and their peers.
   *Students will be able to come in to class ready to display their knowledge.
   Students will be able to perform all the skills asked of them.
   *Students will be able to understand all the directions asked of them.

4. Instructional Aids/ Resources:

   Chalk
   Whiteboard markers
   Note book
   Overheads
   Overhead pens
   Prepared Packet
   Graphing Calculator

5. Student Modifications:
   - Teacher will have all directions written as well as given verbally.
   - Teacher will allow students extra time to complete quizzes if they run out of time.
   - Arrangements can be made for students to have a copy of my notes if they are unsure of what was said during class.
   - Yellow post it notes for students too shy to ask question in class to write down problems.

II. Implementation

Set/Focusing Event

As students walk in greet them with today's DIN, containing problems using Area of different shapes. Remind the students to get out their homework.

Activity One

Go over the Menu with the class, highlighting the specific events of today's class. Then give students several more minutes to work on their DIN. Once completed, go over answers of to DIN and answer any questions. Next give answers to homework and again go over any problems.

Activity Two

Start a conversation to discuss the different uses of perimeter, area, and volume (topics all students are familiar with). Begin by using the example of building a pool in the backyard. First by law there will need to be a fence around the pool, have students draw what their pool will look like. Explain there can be different kinds of pools but the fence would always be found by using perimeter or circumference. Then talk about clearing the space for the pool so it would be on level surface. Prompt the student that this would be area. Allow students to shade this space. Finally, talk about filling the pool and let the students tell you this would be area and discuss the formulas for this. Finally, tell the student the pool is going to be a surprise for someone and needs to be wrapped. How would you measure the amount of wrapping paper needed? This helps the students to see the relation between area, volume and surface area.

For lower level students it is very important to remind the students that area formulas is something they have already been successful at. There is only one new step the students have to concentrate on.

Activity Three

Now present each student with own object to find the surface area of. This allows the students to see the objects and understand the different shapes it is created from. By handing out the objects, I am able to hand the more complicated objects to higher level thinkers and my low level students can work with an object that they can be successful at. After all the students have completed their surface area,

the students can now switch with someone and that person becomes their partner so they can help each other solve the problem.

Closure

Bring the pairs back to a class discussion and ask them to point out objects in the room they would like to find the surface area of. Then as a class work out several of these problems together.

Extending Activity

Student will bring home a worksheet with surface area problems and also be asked to bring in two objects from their house that they found the surface area of.

III. Post – Instructional Phase

Evaluation

- Pay close attention to how students have dealt with new material.
    - Watch how the students acted in their pairs, who worked well together and who needs to be in pairs groups for next time.
    - Did the student participate, ask questions or were the students too lost to ask any question.

Reflection

- What did the students really take away from today's lesson?
- How could I change my lesson to better reach the students for next time?

Appendix D

I. Pre- Instruction Phase

1. Goals:
   - Student will be able to use mathematical operations and relationships among them to understand mathematics.
   - Student will be able to use number sense and numeration to develop an understanding of the multiple uses of numbers in the real world, the use of numbers to communicate mathematically, and the use of numbers in the development of mathematical ideas.
   - Students will demonstrate the knowledge and skills necessary for interdisciplinary problem solving.
2. Objectives:
   - Students will be able to incorporate all the new skills learned during this chapter to succeed.
   - Students will be able to relate the new material to the old skills that the student already knows.
   - Students will be able to recall information from all the sections of the chapter.
3. Content:

   Vocabulary: All terms of this chapter.

   Task Analysis

   * Students will be able to ask questions with out disrupting the class.
   * Students will be able to understand the vocabulary.
   * Students will be able to listen to the teacher and their peers.
   * Students will be able to come in to class ready to display their knowledge.
   *Students will be able to perform all the skills asked of them.
   *Students will be able to understand all the directions asked of them.

4. Instructional Aids/ Resources:
   - Chalk
   - Whiteboard markers
   - Note book
   - Overheads
   - Overhead pens
   - Prepared Packet
   - Graphing Calculator

5. Student Modifications:
   - Teacher will have all directions written as well as given verbally.
   - Teacher will allow students extra time to complete quizzes if they run out of time.
   - Arrangements can be made for students to have a copy of my notes if they are unsure of what was said during class.

- Yellow post it notes for students too shy to ask question in class to write down problems.

II. Implementation

Set/Focusing Event

As students walk in greet them with today's DIN, containing fill in proofs. These proofs give students a chance to get back into math without having the difficulty of a full proof. Remind the students to get out their homework.

Activity One

Go over the Menu with the class, highlighting the specific events of today's class. Then give students several more minutes to work on their DIN. Once completed, go over the proofs on the DIN and answer any questions. Next have students get into their homework pairs and talk about the homework. Go over any problems they class had difficulty with.

Activity Two

As a class, two proofs will be picked from the practice section of the packet. We will start each proof by looking at the given and understanding what that allows us to do. We will also look at the picture and see if we can find anything else out, (i.e. Reflexive Property or Vertical Angles). Finally, we will look to see what our game plan is for the proof. After all that is done we will complete the proof. When the two proofs are done we will discuss any problems.

Activity Three

The students will now work with the proof cut outs. The students will be given all the necessary statements and reasons and will have to put the proofs in order. The students will be asked to work individually but know that they can ask their homework buddy or the teacher for help if they are stuck. This allows student to not worry about definition but to better see the flow of the proofs.

Closure

After the cut out are done – students will be asked to reflect in writing or orally if the cut out proofs were easier then the proofs with no assistance or if it was too confusing. We will then attempt to come up with more ways to attack the proofs.

Extending Activity

Students will work on three proofs for homework. One fill-in proof, one cut out proof and one proof they will need to do all the steps.

III. Post – Instructional Phase

Evaluation:

- Pay close attention to how students have dealt with new material.
- Watch how the students acted in their pairs, who worked well together and who needs to be in pairs groups for next time.
- Did the student participate, ask questions or were the students too lost to ask any question.

Reflection

- What did the students really take away from today's lesson?
- How could I change my lesson to better reach the students for next time?

Appendix E

I. Pre- Instruction Phase

1. Goals:
   - Student will be able to use mathematical operations and relationships among them to understand mathematics.
   - Student will be able to use number sense and numeration to develop an understanding of the multiple uses of numbers in the real world, the use of numbers to communicate mathematically, and the use of numbers in the development of mathematical ideas.
   - Students will demonstrate the knowledge and skills necessary for interdisciplinary problem solving.

2. Objectives:
   - Students will be able to incorporate all the new skills learned during this chapter to succeed.
   - Students will be able to relate the new material to the old skills that the student already knows.
   - Students will be able to recall information from all the sections of the chapter.

3. Content:

   Vocabulary: All terms of this chapter.

   Task Analysis
   * Students will be able to ask questions with out disrupting the class.
   * Students will be able to understand the vocabulary.
   * Students will be able to listen to the teacher and their peers.
   * Students will be able to come in to class ready to display their knowledge.
   *Students will be able to perform all the skills asked of them.
   *Students will be able to understand all the directions asked of them.

4. Instructional Aids/ Resources:
   - Chalk
   - Whiteboard markers
   - Notebook
   - Overheads
   - Overhead pens
   - Prepared Packet
   - Graphing Calculator

5. Student Modifications:
   - Teacher will have all directions written as well as given verbally.

- Teacher will allow students extra time to complete quizzes if they run out of time.
- Arrangements can be made for students to have a copy of my notes if they are unsure of what was said during class.
- Yellow post it notes for students too shy to ask question in class to write down problems.

II. Implementation

Set/Focusing Event

As students walk in greet them with today's DIN, containing problems solving linear inequalities. Remind the students to get out their homework.

Activity One

Go over the Menu with the class, highlighting the specific events of today's class. Then give students several more minutes to work on their DIN. Once completed, go over answers of to DIN and answer any questions. Next have students get into their homework pairs and talk about the homework. Go over any problems they class had difficulty with.

Activity Two

The class will now work on a KWL; students will be reminded the K stands for What do I KNOW? (K), the W is for What do I WANT to know? (W), and the L is for What did I LEARN? (L). Today's KWL will first be based on the word Inequality (which they will be prepared for from the DIN. Then students will work on the word Quadratic. For the KWL students will first brainstorm on their own about what they know and then will share with the class to make a master list. From this we will generate the master list of what they WANT to know. The L is saved for after the lesson.

Activity Three

Now based on the problem areas that arise from the KWL, students will be broken up into groups of students with like problems. The group will then work on a mini refresher of their problem area. The teacher will be around to help with any additional problems.

Activity Four

Now that students feel successful with all old material the class would start to look at quadratic inequalities. The teacher would make sure to point out all the parts of the problem that the students are already successful at. This part of the lesson would continue into the next class.

Closure

Students would be asked to make a list of the steps of today's newest problems. The students would then be asked to star all areas they already feel they have mastered.

Extending Activity

Students would have a worksheet with linear inequalities and also several quadratic inequalities to see where students' understanding of the topic is.

III. Post – Instructional Phase

Evaluation:

- Pay close attention to how students have dealt with new material.
- Watch how the students acted in their pairs, who worked well together and who needs to be in pairs groups for next time.
- Did the student participate, ask questions or were the students too lost to ask any question.

Reflection

- What did the students really take away from today's lesson?
- How could I change my lesson to better reach the students for next time?

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