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Math Problem Solving Discussions: Increasing Communication for Students with Autism

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Math Problem Solving Discussions:

Increasing Communication for Students with Autism

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By

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Abstract

The purpose of this research study was to report the effect social scripts have on the ability to increase communication and understanding during partner work in math for students with autism. The study was made up of 9 participants, all of whom were enrolled in the same special education pull out math class. Data was collected through observations to identify the frequency of scripted and unscripted communicative questions and responses, along with understanding of the math activity. Data was also collected through a survey at the beginning and end of the study to obtain student feedback on social scripts and identify student understanding of the benefits of communicating with peers during partner work. However, due to the Covid-19 school closure this research was not able to be completed.

With the unexpected closing of schools due to Covid-19 the purpose of this research study became to document the experience of a teacher during the Covid-19 school closure through an autoethnographical qualitative research design. The researcher selected this form of data collection because it allowed them to collect a self-narrative of their experience during a national crisis. The research was conducted through daily journal entries. Once the data had been collected the researched analyzed the information and formed common themes that occurred during the experience. The results of this research will provide a platform for the researcher to approach any future crisis as a teacher.

Chapter One: Introduction

General Problem

While working with high school students who have autism and other learning disabilities, a consistent problem has been increasing communication skills in the classroom. Communication is a critical part of life and helping students generalize skills learned in the social skills classroom to other parts of their day is a goal I am constantly working towards. Specifically, I hope to increase communication during problem solving activities with a partner in the math classroom. Many of my students have functional goals they are working towards, which will hopefully help them maintain employment at a job they enjoy and live as independently as possible after high school. An integral part of maintaining a job is developing social skills and problem-solving skills; "Vygotsky's theory suggests that social interaction is a necessary element of learning, particularly for students with special needs" (Malmgren, Causton-Theoharis, & Trezek, 2005, p. 1). By providing a structured environment to practice these communication skills during problem solving activities I hope students will be able to increase their communication skills.

Subjects

Participants in this study include nine students. Students are made up of different races, ethnicity, socio-economic backgrounds, and gender. All students are on an individualized education plan and have needs in the area of math and social skills. Students on individualized education plans have disabilities in the areas of developmental cognitive disabilities, autism spectrum disorder, and speech and language disabilities. Students age range from 15 to 17 years old. Over half of the students have been provided direct speech and language instruction over the course of their life and continue to receive indirect support from our speech language

pathologist in the building. Three students have also received English Language Learning instruction in the past.

Selection

These students are in two of my life skills math classes during the 2019-2020 school year. Students were selected to be in this class based on their individual education needs in math based on recent comprehensive evaluation reports. Students in these classes are working towards 9th grade Minnesota state standards in math, along with functional math skills. Students are also working on social skills in the areas of communication, self-regulation, and problem-solving skills.

Setting

This study took place at a high school near Minneapolis, Minnesota. The school population is currently 1,670, with a special education population at 11.7 percent. The classroom setting for this study consists of one teacher, one para, and four to five students per class. Students are seated at tables with one to two peers per table. Students are presented a familiar agenda at the beginning of every class, and are supported with visuals, calculators, and manipulatives during activities.

Informed Consent

Permission was received from the Institutional Review Board and the school's principal in order to conduct this study. Permission was obtained from students' parents and assent from students themselves will be collected. Participation in the study was clearly stated as voluntary and students were able to withdraw at any time. The risks to students were minimal since the intervention proposed is in the norms of the education setting. Confidentiality is protected using pseudonyms throughout the study.

Chapter Two: Review

Increasing communication skills in the classroom is a constant problem when working with high school students who have autism and other learning disabilities. Communication is an important part of life and helping students generalize skills learned in the social skills classroom to other parts of their day is a goal I am constantly working towards. Currently I am striving to help students improve their communication with a partner during problem solving activities in the math classroom. Many of my students have functional goals they are working towards, which will hopefully help them maintain employment at a job they enjoy and live as independently as possible after high school. In order to be successful on the job students need to possess the social skills necessary to communicate with their co-workers and solve problems as they arise. By providing a structured environment to practice these communication skills during problem solving activities I hope students will be able to increase their communication skills.

Review

Discussion During Math Problem Solving. Rachel Lambert and Trisha Sugita state, "Engagement in problem-solving and mathematical discussion is critical for learning mathematics" (2016, p.347). According to the Common Core Standards for Mathematics, the first three practices in math include "student's perseverance in problem solving, engaging in quantitative reasoning, and critiquing the mathematical thinking of others" (Lambert, Sugita, 2016, p.350). Students who can engage in problem solving skills during their own work and while working with others demonstrate a deeper understanding of math concepts. However, students with developmental delays, learning disabilities, and autism often perform below grade level in their math abilities and are not exposed to the same level of discussion during math activities as their peers.

Students in my class continue to work towards state standards in math at a modified level, but the strategies I use to teach these skills do not always include discussions and critiquing the mathematical thinking of others. The reason for this is because students with autism often struggle with executive functioning skills, which impacts their ability to organize and consolidate their mathematical process through communication with peers. However, this does not mean students with autism should be excluded from activities that give them the opportunity to discuss and deepen their problem-solving abilities. According to Lambert, "developing routines for complex cognitive behavior such as problem solving is beneficial for learners as it creates an external scaffold for internal processes" (2016, p. 352). By creating routines and expectations around discussions in math hopefully my students with autism will be able to increase their communication during these activities and deepen their understanding of math concepts.

Communication and Autism. Autism is defined, "by a certain set of behaviors and is a 'spectrum disorder' that affects individuals differently and to varying degrees" (Crissey, 2009, p. 7). This disorder can be characterized by three distinctive behaviors, which include impaired social interaction, delayed communication skills, and restricted or repetitive behaviors or interests. Children can be diagnosed as early as three years old, and studies have shown early intervention and targeted therapies can lead to improvements. Currently scientists still do not have an exact cause for autism, but research points to factors involving genetics and environmental components either before, during, or after birth.

When communicating with others, "autism impacts the ability to communicate and interact with others" (Crissey, 2009, p. 7). Communication is the exchange of ideas between two or more people, but when broken down there are so many factors that play a role in how communication takes place in everyday life. Communication depends on one person expressing

their ideas, while another person receives and understands the information. This interaction also requires the conversation partner's ability to comprehend gestures, facial expressions, tone of voice, and body postures.

According to Crissey (2009), how communication is affected in children with autism also varies notably. These problems can range from children who only use non-verbal language, unusual speech patterns such as echolalia to an absence of spontaneous speech (Forde, Holloway, Healy, & Brosnan, 2011, p. 1). In the study by Ford, Holloway, Healy, and Brosnan (2011) they also stated without intervention 21-66% of children with autism would not develop communicative speech. However, with interventions most children are able to develop functional communication but rarely initiate conversations or engage in typical social situations. Additionally, Ford, Holloway, Healy, and Brosnan (2011) stated when children with autism do seek to engage in conversation they typically will find an adult instead of a peer to interact with.

The students in my math class vary widely in their ability to communicate. Most students are able to engage in verbal conversation but lack the social skills to decipher when and how to interact with peers in the classroom. Typically, students will also engage with the teacher before asking for help or talking to a peer. When participating in partner activities students will often complete work side by side, instead of engaging in a discussion about how they should solve the problem together.

Social Scripts. According to Caballero & Connell (2010), "Research has demonstrated that when children with ASD are taught social scripts through modeling, prompting, and reinforcement, their social interactions with adults and peers increase" (p. 26). Social scripts are used to facilitate communication by coming up with a premade list initiating phrases, comments

that are on topic, and phrases to end the interaction. Each script can be tailored to meet the needs of the student and social situation. Caballero & Connell (2010), also stated the use of social scripts proves to be less socially stigmatizing than verbal prompts or reminders in the classroom.

In studies done by Wichnick-Gills, Vener, and Poulson (2016) the use of social scripts has proven to also help increase non scripted social interactions. During these studies researches embedded scripts on students' everyday items that would serve as a visual reminder to assist in peer interactions. Over a systematic timeline the scripts were faded one word at a time from end to beginning. By the end of the studies students were able to rely on their personal visual reminder without the use of the script. "The script fading procedure resulted in a systematic increase in the number of unscripted initiations to peers. Moreover, the participants emitted unscripted initiations in the presence of stimuli that were not used during teaching" (Wichnick-Gills, Vener, and Poulson, 2016, p. 291). Providing talking points in the math classroom is a common practice in order to foster a language rich math environment. Some researchers have described the academic vocabulary in math as a type of foreign language. Studies have also proved that all students benefit from the same talking point visuals used for students who are learning English a second language in the classroom.

In order to foster conversation in math teachers need to give students time to discuss one problem, provide talking points, and visuals for students. In an article by O'Connell (2018), she outlined questions such as, "How, Why, How does this compare, What do you notice, What's the big idea, and What did you learn?" Another article by Curtis (2017), strategies such as, think, pair, and share are useful to encourage conversation in math. Other authors have also noted simple strategies such as having students turn towards one another when communicating in the

classroom is helpful and also a common tool when teaching students with autism appropriate body language during social interactions.

Definition of Terms

-Social Scripts: Scripting is a visual or auditory cue that supports learners to initiate or sustain communication with others (Griffin, & AFFIRM team, 2017). Students will be given a script with question and comment prompts during the word problem of the day activity.

-Communication: Communication is the exchange of messages, thoughts, feelings, and information from one person to another (Crissey, 2009, p. 6). Students will be measured on their ability to ask scripted/ unscripted questions and make scripted/ unscripted on topic comments during partner talk.

-Unscripted response: An unscripted response is a statement that differs from the provided script (Wichnick-Gills, Vener, and Poulson, 2016, p. 2).

-Understanding: Receptive language involves receiving and decoding or interpreting language (Mcintyre, Hellsten, Bidonde, Boden, & Doi, 2017). Students will demonstrate understanding by getting the correct answer on their word problem.

Hypothesis

Social scripts have been proven to increase communication for students with autism. Researchers have also determined that discussion and group work is important to foster a deeper understanding of math concepts for students in both general education settings and special education settings. Therefore, it is hypothesized that social scripts increase communication and understanding during partner work in math for students with autism.

Chapter Three: Methods

Research Questions

As a special education teacher, we have limited time with students who have multiple needs in every setting. Students often have social skill deficits along with other academic needs. I developed the following research questions in order to address communication goals in the math classroom.

1. What impact do social scripts have on students with autism's communication skills during partner work in a special education math setting?
2. What impact do partner discussions have on students with autism's ability to solve math problems?
3. Will students with autism understand the importance of being able to communicate with a partner?

Research Plan

In order to effectively answer the above questions, I implemented group norms during partner discussions when we complete our classroom word problem of the day. Social scripts were provided during this time to help guide students through the discussion points. Each week a different job was highlighted to emphasize the importance of working together to solve problems. By following these interventions to answer the above questions, I was able to better understand effective communication strategies for students with autism in the math classroom.

Methods

Action research is "empowering and professional research done by teachers to inform and improve their own practices" (Katie Lynn Milton-Brkich, Kristen Shumbera, and Becky Beran,

2010). Mills states, throughout the research process information is gathered to gain insight into a particular problem in order to develop reflective practices and affect positive change in school environments or student learning outcomes (2018). These reasons demonstrate why action research is an appropriate method for this study, which is to increase communication during partner activities in math for students with autism.

Schedule

1. Throughout this study data was collected in two separate ways. First, data was collected at the beginning and end of the study through a student survey. The survey was administered through the use of technology, and adult support was given to ensure comprehension. This survey asked students questions around communication, problem solving, and the use of visuals with a rating scale. This survey also utilized an open-ended question to gauge students' knowledge of different jobs when communicating with a partner is necessary.
2. The second set of data was collected through observations during partner activities. Data was taken on the student's ability to communicate (initiating questions and making on topic comments) with their peer. Partner activities mainly included students discussing their strategy to solve the daily word problem. To ensure privacy on observation forms students were given a number 1-9, and data kept in a secure location once it was recorded.
3. Once data was collected, I analyzed the frequency at which students were able to ask initiating questions and make on topic comments during partner work in math. This data then determined the benefits of the use of social scripts during partner activities in math.

Ethical Considerations

Some ethical issues that may arise during this study are students varying stress levels with talking to others. Other considerations are students state of mind when walking into the classroom. All student needs were considered during this study and were not forced to participate in anything made them feel uncomfortable.

Chapter Four

This study utilized an autoethnographic research design to document my experience as a high school special education teacher through the Covid-19 school closure. The overall purpose of this study was to document my experiences daily in order to better prepare educators in similar situations for future pandemics. During this experience a detailed journal log was kept documenting daily events occurring in my life as I prepared for a new way of teaching.

Research Question

What was my experience as a teacher during the Covid19 school closure?

My journal logs were analyzed to find common themes amongst the data sets. After being analyzed three major themes emerged from my journals logs. The themes included: supporting families and students, planning and teaching during distant learning, and logistics of distant learning.

Table 1

Common themes and sub themes found in my journal logs and the number of situational occurrences of each theme.

Themes	**Sub themes**	**Number of situational Occurrences**
Supporting families and students	Supporting students	26
	Supporting parents	42
	Emotions during distant learning	40
Planning and teaching during distant learning	Meeting with teachers	15
	Lesson planning and instruction	29
	Student participation	32

Logistics of distant learning	Information from administrators	18
	Paraprofessionals	17
	Due process	11

Supporting families and students

The first common theme that emerged was supporting families and students. Helping families and students cope with the changes that have occurred with the Covid-19 crisis and distant learning has been the biggest part of my job. Throughout my journal logs I discovered countless times throughout my day were spent helping families, students, and documenting the emotional turmoil everyone, including myself, was going through. The following are examples from theme one.

- Supporting Parents
    - "After my last meeting was over I got a call from a parent saying the school could not find her daughter's binder we had put together. I tried to have someone helping with distribution find it, but they could not. I ended up having to drive in and find it for her. It was very frustrating."
    - "I met with my Amharic family and talked them through what to expect for distant learning. I was able to show them the schedule I had made for their daughter and shared my screen to show them what google classroom would look like."

    - "One parent asked if their child could stop doing IXL because he does not like it when he gets an answer wrong. I always tell families absolutely, do what makes sense for your child right now"
    - "I also talked with two other families whose chrome books are not working, so I am trying to help them figure out what the next step is."
- Supporting Students
    - "This student is VERY social, and his parents want him to have as much social interaction as possible, so I am trying to set up more google meets for him."
    - "I have helped him now three times learning how to navigate through google classroom, but he is not retaining the information and still does not understand"
    - "I told him we could work in silence and he gave me a smile and thumbs up. Then he started his assignment and I was able to look at what he was doing while he did it, and I could type notes of encouragement the whole time. I could still see his face and he smiled every time I gave him feedback."
    - "I did not have any scheduled meeting times with students for my classes, but did meet with a student at 1pm just to check in. This student said she has had a really hard week and has been crying a lot. During our meeting we talked about our dogs and just hung out for a while. I encouraged her to come to our class google meets because one of her good friends has been coming every day and it would be fun to see them."
- Emotions during distant learning
    - "The families I was able to get a hold of today say their children are confused, and sad that they are not in school"

- "I am very nervous how this student is going to be able to continue learning at home when her mother is also learning English, and unfamiliar with chrome books and google classroom."
- "The mom in the meeting continuously lashed out at the educators and administration because she feels we should not be paid during distant learning because she is doing all the work, and that it is not right that lunches are not being delivered straight to her doorstep. "
- I could tell his mom was stressed, and still does not seem to understand how google classroom works.

Planning and teaching during distant learning

The second common theme that emerged was planning and teaching during distant learning. Preparing lessons and materials that could be delivered online and figuring out how to continue teaching during distant learning were the second most documented topics in my journal logs. A significant amount of time was spent discovering new technology, organizing my google classrooms, and collaborating with other teachers. The following are examples from theme two.

- Meeting with teachers
  - "I had started talking with my PLC and we had decided that our content would be mostly review and easy for these first couple weeks because students and parents are going to struggle."
  - "Most of the students we work with typically need direct support and reminders to stay on task when learning new material, so we really had to think about what/ how much we are assigning students."

    - "My team and I are also thinking about how many google meets we are asking students to attend, and what times our office hours are."
- Lesson planning and instruction
    - "Today I worked on making schedules for students to follow at home, with times for google meets, google class names, and any class codes they might need for a mainstream class."
    - "I did send a lot of paper copies, books, and manipulatives in this student's binder"
    - "The paras and I have also been successful going through work with kids one on one after a google meet"
    - "I am keeping my classroom organized by weekly headings and each day is a new assignment"
    - "I attended a google classroom meeting, which included more detailed tricks with how to navigate and use google classroom most efficiently."
- Student participation
    - "I had my second set of one on one sessions today. I had 3 out of 4 students show up because my one student just got her new Chromebook since her first one ended up not working. Students were excited to see us, and I was surprised how long I was able to hold their attention and do an activity together.
    - "Today my meetings were not as well attended, and second hour I only had two students"

Logistics of distant learning

The third common theme that emerged was logistics of distant learning. There were a lot of topics focused around meetings with administrators, grading, due process, and paraprofessional roles in my journal logs. The following are examples from theme three.

- Information from administrators
    - "Today was our first staff meeting and planning day around distant learning because we had been on spring break from 3/12-3/22. The very first email and virtual meeting I had was with the superintendent around the fact that our principal had stepped down due to family matters.
    - "They shared some logistics like we needed to have a google classroom, we are expected to provide 20 min. Office hours for each class, but these times could be whenever we wanted. They also stated instruction does not have be delivered through virtual meetings each day, we just need to make sure we post something every day by 8:30. Our instruction could be presented at the beginning of the week though, and we can deliver instruction through pre-recorded lessons, videos, and assignments however we see fit."
    - "This was very helpful, and included information on attendance protocols for distant learning, grading, and other aspects I had not even thought about"
- Paraprofessionals
    - "At the end of the day I also met with the four paras who work with me in my math classes, and just checked in and gave them as much info as I could about what we will do/ what the expectation will be for students.

    - "The third student/ para meeting I set up went well though. This student of mine has a mainstream biology class, and him and his para will be working together every day."
    - "Paras have been in contact with each classroom teacher they work with, emailing students, and engaged in the google classrooms. Some paras have also started to have success setting up one on one meetings with students to assist them with work too."
- Due process
    - "We were also told in this meeting that we needed to amend all students IEPs on our caseloads who would need a distant learning plan (which is all), send out a notice of team meeting, include a district representative and general ed. teacher, hold an IEP meeting for each student, and write up a PWN."
    - "I spent most of today completing the distant learning plans for students who I had already had meetings for."
    - "At the end of the day I saw an email saying we did have to complete all evals unless there was new testing that needed to be finished."

Data Analysis

After reviewing the data, I anticipated the results of supporting parents to be the most common topic but had not anticipated the results of student participation to be as high as they were. During the data collection period I was aware of the fact I was on the phone or emailing with parents every day, so it was not surprising to find the topic of supporting parents occurred the most frequent throughout the study. It did not always feel like student participation was high as it was. Overall it seems the topics that occurred the most were topics that were more

important to me during this crisis. I am sure there were more occurrences of collaborating with teachers, lesson planning, or time spent on due process, but these were not the most significant thoughts on my mind during my data entries.

Prior to the Covid-19 crisis starting I was able to collect seven days' worth of data to address my original action research questions. During this time, I administered the survey I had planned to give at the beginning and end of the study, and the results were mostly students telling me how easy they found it to communicate with others. When I was able to implement the social script during a partner activity students often did not actually use the script unless prompted, and it was difficult for some students to determine who was going to talk first. Some students did not engage with others at all and just wanted to do the work by themselves.

Conclusion

In conclusion, it was a combination of all of these themes that were a necessary part of survival as a teacher during the Covid19 school closure. As an educator I would not have been able to live with myself if supporting families and students had not been at the top of my priority list. This teaching experience also would not have been successful without collaboration between teachers, guidance on logistics from administrators, time to plan lessons and materials, and student participation. Overall, I feel my experience as a teacher through the Covid-19 school closure has been adequate, but I know even with the success I have had with some students and families there are still more I want to do.

Chapter Five

Action Plan

Before the Covid-19 school closure my original plan was to implement a social script during partner discussions. The goal of this intervention was to increase communication skills during problem solving activities in the math classroom. Students in special education are not typically exposed to the same level of discussion during math activities as their peers, and students who can engage in the process are able to demonstrate a deeper understanding of math concepts. Studies have also shown that by providing a structured approach to problem solving activities students with disabilities are more likely to engage in the process.

When faced with the Covid-19 school closure common teaching practices I had become used to had to change very quickly. Teachers everywhere had to adapt and develop new materials and platforms from which they could deliver instruction. Overnight words like zoom, google meets, screencasts, and flip grid had made their way into my vocabulary. While I was learning these new technologies, I was also learning how to teach students and families how to use them as well. As a teacher I wanted to continue providing students with the same level of care and instruction as usual, but I also had to remember where each child and family were at in their personal lives and what level of instruction they could manage while dealing with a national pandemic. I felt it was important to continue reminding parents and students their well being came first, and distant learning came second. I would recommend teachers in the future make these same priorities for themselves. During a crisis of this magnitude teachers need to remind themselves they can only do so much. It is important to give yourself grace.

Once school is back in session and I am able to work with students face to face, I plan to continue implementing social scripts into routine activities to increase communication in my

math classroom. A change I plan to make to my social script is adding an open ended question prompt at the beginning to assist with getting the conversation started. I look forward to the time when we are all back in school, and I get to work with students in person again.

Plan for Sharing

The common themes that emerged throughout my data were themes any special education teacher would experience in a similar crisis. I would be willing to share any insight that might help them in a future national crisis. Moving forward I plan to continue incorporating technology more consistently into my classroom once we are back at school. It is important to keep students familiar with these teaching platforms in case there is ever a similar crisis.

References

Association for Science and Autism Treatment (2019). *What We Know about the Causes of Autism*. (2019). Retrieved from https://asatonline.org/for-parents/what-is-autism/what-we-know-about-the-causes-of-autism/

Caballero, A., & Connell, J. E. (2010). Evaluation of the effects of social cue cards for preschool age children with autism spectrum disorders (ASD). *Journal of Behavior Assessment and Intervention in Children*, *1*(1), 25–42. doi: 10.1037/h0100358

Cherie Lynn Ichinose and Armando M. Martinez-Cruz Source (2018, May). Problem Solving + Problem Posing = Mathematical Practices. *National Council of Teachers of Mathematics* , Vol. 111, No. 7, pp. 504-511. Retrieved from https://www.jstor.org/stable/10.5951/mathteacher.111.7.0504

Crissey, P. (2009). *Attainments Teaching communication skills to children with autism*. Verona, WI: Attainment Company.

Curtis, J. (2017, October 31). More Talking in Math Class, Please. Retrieved from https://www.edutopia.org/article/more-talking-math-class-please

Forde, I., Holloway, J., Healy, O., & Brosnan, J. (2011). A dyadic analysis of the effects of setting and communication partner on elicited and spontaneous communication of children with Autism Spectrum Disorder and typically developing children. *Research in Autism Spectrum Disorders*, *5*(4), 1471–1478. doi: 10.1016/j.rasd.2011.02.008

Griffin, W., & AFIRM Team. (2017). Scripting. Chapel Hill, NC: National Professional Development Center on Autism Spectrum Disorders, FPG Child Development Center, University of North Carolina. Retrieved from http://afirm.fpg.unc.edu/scripting

Katie Lynn Milton-Brkich, Kristen Shumbera, and Becky Beran (2010, June 1). How to create your own professional development experience. Science and Children, 48-51.

King, S. A., Lemons, C. J., & Davidson, K. A. (2016). Math Interventions for Students With Autism Spectrum Disorder. Exceptional Children, 82(4), 443–462. doi: 10.1177/0014402915625066

Kitchen, M. (2016, April 25). Get Them Talking . . . about Math. Retrieved from https://www.nctm.org/Publications/Mathematics-Teaching-in-Middle-School/Blog/Get-Them-Talking-_-_-_-about-Math/

Lambert, R., & Sugita, T. (2016). Increasing engagement of students with learning disabilities in mathematical problem-solving and discussion. *Support for Learning*, *31*(4), 347–366. doi: 10.1111/1467-9604.12142

Mills, G. E. (2018). *Action research a guide for the teacher researcher*. NY, NY: Pearson.

Malmgren, K. W., Causton-Theoharis, J. N., & Trezek, B. J. (2005). Increasing peer interactions for students with behavioral disorders via paraprofessional training. *Behavioral Disorders*, *31*(1), 95–106. doi: 10.1177/019874290503100105

O'Connell, S. (2018, July 26). Questioning and vocabulary supports that inspire language-rich mathematics. Retrieved from http://www.ascd.org/ascd-express/vol13/1322-oconnell.aspx

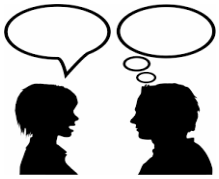
Wichnick-Gillis, A. M., Vener, S. M., & Poulson, C. L. (2016). The effect of a script-fading procedure on social interactions among young children with autism. *Research in Autism Spectrum Disorders*, *26*, 1–9. doi: 10.1016/j.rasd.2016.03.004

Wichnick, A. M., Vener, S. M., Pyrtek, M., & Poulson, C. L. (2010). The effect of a script-fading procedure on responses to peer initiations among young children with autism. *Research in Autism Spectrum Disorders*, *4*(2), 290–299. doi: 10.1016/j.rasd.2009.09.016

Mcintyre, L. J., Hellsten, L.-A. M., Bidonde, J., Boden, C., & Doi, C. (2017). Receptive and expressive English language assessments used for young children: a scoping review protocol. *Systematic Reviews*, *6*(1). doi: 10.1186/s13643-017-0471-1

Appendix

Partner Talk Visual



To **SHARE** an idea (the first to talk)

"I think we need to (add, subtract, multiply, divide) because I noticed the key word _____."

"I think we need to (add, subtract, multiply, divide) because I noticed the question is asking us to _____."

"I'm not sure how to solve this problem. What do you think?"

To **AGREE**

"I agree with you because I noticed that, too."

To **DISAGREE**

"I disagree with you because I noticed _____."

Data collection

	Student	Question SC	Question US	Comment SC	Comment US	Understanding	Other
Date:	Student 1						
	Student 2						
	Student 3						
	Student 4						
	Student 5						
	Student 6						
	Student 7						
	Student 8						
	Student 9						

SC= scripted response

US= unscripted response

Survey

Date:_____

Rate the following questions on a scale from 1 to 5, with 1 being the easiest and 5 being the hardest.

1. When working with a partner how easy do you find it to communicate?

   1 2 3 4 5

2. When working with a partner how easy is it for you to start the conversation?

   1 2 3 4 5

3. When working with a partner how easy is it for you to make comments throughout the conversation?

   1 2 3 4 5

4. How important do you think it is to communicate with others in order to solve a problem?

   Not important Kind of important Very important

5. Do you have more success solving a problem when working with a partner?

   Yes No

6. Have you used visuals to help you communicate with partners before?

   Yes No

7. Can you think of 3 jobs or activities when you would have to work with a partner in your life?

_____

_____