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Table of Contents

JAASEP Editorial Board of Reviewers

Social Skills and Students with Moderate to Severe Disabilities: Can Community Based Instruction Help?

Carissa Hernandez and Saili S. Kulkarni

Supporting Students with Disabilities During Group Activities: Five Tools Every Inclusive Mathematics Educator Needs

Benjamin S. Riden, Andrew M. Markelz, M. Kathleen Heid

Using an Alternating Treatment Design in a Co-taught Classroom to Measure Student On-task Behavior

Randa G. Keeley

A Whole Language Reading Intervention: A Case Study

Matthew Glavach and Warren Pribyl

Common Purpose, Uncommon Results: A Literacy Collaboration for a Preschooler with Down Syndrome

Chelsea T. Morris and Rachel J. Chidester

Educational Policy: Instruction and Assessment

Christina M. Sorrentino

Increasing Use of Research-Based Practices: Action Research Report on a College-School Partnership to Support Instruction Aligned to Middle School Common Core Math Standards for Students with Significant Disabilities

Katherine Trela, Wendy Gladstone-Brown, Norah Merritt, and Leah Raftis

The Impact of Assistive Technology on Autism Spectrum Disorder: A Systematic Review
Angela Bollin, Julia VanderMolen, and Taylor Bierwagen

Effects of Video Modeling and Video Modeling Plus Prompting and Reinforcement on the Daily Living Skills of a Student with Autism

Kaylee S. Wynkoop, Rachel E. Robertson and Emily E. Sobeck

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Social Skills and Students with Moderate to Severe Disabilities: Can Community Based Instruction Help?

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Abstract

The purpose of this research study was to determine how Community Based Instruction (CBI) affects the social skills of middle school students with moderate to severe disabilities. Existing literature is limited in findings related to the influence of CBI on middle school students with moderate to severe disabilities. This qualitative study was completed using interviews and observations. Participants included students, teachers, and paraprofessionals from a middle school in Southern California. The findings of this study are intended to support the use of CBI in middle school special education classrooms and to demonstrate how a functional program can improve the social skills of students with moderate to severe disabilities. Educators and administrators who may want more information on CBI and its benefits may also utilize the findings.

Keywords: Community Based Instruction (CBI), severe disabilities, Autism

Social Skills and Students with Moderate to Severe Disabilities: Can Community Based Instruction Help?

The ability to navigate throughout one's own community is essential to one's ability to thrive in the community and in life. For typical individuals, navigating the community may seem like a necessary and mundane part of life. However, for individuals with disabilities, navigating the community in a functional way can be difficult and filled with many adversities such as how to navigate public transportation, how to complete a monetary transaction or how to access one's local public library or park. Recent research indicates that children who have learning disabilities often have significant difficulty developing social skills (Siperstein, 2009). In addition, the severity of one's disability directly impacts the cultivation of those skills (deBildt, 2005). Social skills impact our quality of life so heavily that those who lack them may ultimately experience a lower quality of life if those skills are not effectively developed. A prime example of this is spending time in the community. Spending time out in the community is beneficial to students with disabilities because it aids understanding of typical social exchanges and builds social skills. It also gives students the opportunity to learn about resources available in their local neighborhoods. Examples of community living skills that may require specific instruction are: learning how to utilize the public bus system, purchasing groceries and selecting leisure activities. While some of these tasks may seem mundane for non-disabled individuals, they may require intentional instruction for many individuals with disabilities.

Community Based Instruction (CBI) may be a strategy to support those with developmental disabilities become more self-sufficient in that they too can functionally participate in social interactions within the community. There is a gap in research when it comes to the specific details of the types of influences that CBI may have on the fostering of social skills. Research

has yet to determine exactly how CBI impacts the social skills development of middle school students with moderate to severe disabilities.

The purpose of this study is to understand how CBI affects the social skills of middle school students with moderate to severe disabilities. Parents who wish to educate themselves of the benefits of CBI may utilize this research. Teachers and school administrators who may be interested in how to organize a functional CBI program or how to improve an already existing program can also utilize the information provided.

This research plans to answer the following question: how does Community Based Instruction (CBI) influence social skills among middle school students with moderate to severe disabilities.

Literature Review

This literature review discusses Community Based Instruction (CBI) and the lower expectations that educators place on students with more severe disabilities regarding their ability to participate in CBI. It examines several suggested methods of CBI implementation and various difficulties experienced when implementing a functional CBI program. This literature review also considers the advantages and reasons for CBI as well as reasons for continued research on this topic.

Low Expectations

Recent research suggests that individuals with moderate to severe disabilities are often held to lower expectations. Pickens and Dymond (2015) found that approximately 25% of special education directors interviewed in their study felt that CBI was not appropriate for students with moderate to severe disabilities (p. 301). Similarly, Roessler & Foshee (2010) found that low expectations of students with disabilities were one of the major factors negatively influencing the development of students' social skills (p. 23). Perspectives of special education directors play a pertinent role in the success of a functional CBI program and will also play a highly relevant part in the following research.

Langone, Langone & McLaughlin (2000) uncovered similar results in their study, finding that teachers held adverse beliefs regarding students with difficult behaviors being allowed to participate in CBI, indicating that negative behaviors should be completely "eliminated before participating in CBI" (p. 24). Because the following research will examine the effects that CBI has on social behavior, some negative behaviors are an essential part of the research process. According to Langone, Langone & McLaughlin (2000), teachers who had no experience with CBI held more pessimistic views of CBI and believed that students would not generalize skills learned in the community even if they participate in a functionally sound CBI program (p. 29). Are teachers thinking about students' safety and level of benefit they will receive from the program or are their lowered expectations pre-determining their students' failures? Students must first be given an opportunity to succeed in order to have any chance at doing so.

Barriers to Implementation

In addition to low expectations and negative perspectives held by teachers and special education directors, recent literature indicated other various barriers to implementing a successful CBI

program (Pederson, 2015). A major contributing factor is the predisposition towards inclusive general education placements for students with disabilities (Siperstein, Glick & Parker, 2009, p. 97). Pickens and Dymond (2015) also explain that IDEA 2004 places greater emphasis on academic achievement, rather than life, functional and social skills (p. 292). This may be a determining factor related to why directors and administrators appear less willing to approve a functional CBI program. The No Child Left Behind Act of 2001 (NCLB, 2001) similarly mandates that students receiving special education services access general education curriculum (Walker, Uphold, Richter & Test, 2010, p. 264). Because of this emphasized mandate, students with moderate to severe disabilities are less likely to participate in CBI and learn the life and social skills necessary for post-secondary life. There is an increased focus on in-class core curriculum time, making it difficult for many teachers and administrative staff to understand the relevance of CBI and the benefits it can have on students, especially when paralleled with in-class instruction time.

Walker, Uphold, Richter & Test (2010) also found that because of NCLB (2001) and IDEA (2004), present barriers to implementing a CBI program that include a lack of administrative support, lack of community resources needed to design socially applicable experiences to students and lack of staff to provide meaningful instruction (p. 264). Pickens & Dymond (2015) had similar results, finding that the most barriers to CBI establishment and implementation include “insufficient staff and inadequate public transportation” (p.290). Other concerns that burdened the implementation process include liability and scheduling (Pickens & Dymond, 2015, p. 292). Concern of possible behaviors that may occur in the community were also expressed in a study by Zion & Jenvey (2006), who reasoned that historically students with disabilities have struggled to adapt to others’ emotions and new social situations. Considering the possible positive outcomes of a consistent CBI program, these concerns are worth sorting out.

In addition to lack of administrative support, transportation and scheduling issues, teachers also find it difficult to implement CBI in an “optimal way” (Steere & DiPipi-Hoy, 2012, p. 60). If school administration is concerned about scheduling and students losing in-class time, teachers will have more difficulty executing a CBI program that is regularly and consistently scheduled. This then raises the concern that students with more severe disabilities need repetition, variety and consistency to learn in the most optimal way possible. Langone, Langone & McLaughlin (2000), determined some ways in which teachers were able to overcome the barriers of developing a CBI program (p.28). These include persistence, showing school administration positive results of other CBI programs and in one instance, a meeting with the superintendent when no progress was made at a lower level of administration (p.25). These barriers and methods used to overcome them can be great resources for educators when they find themselves struggling to implement a well-designed CBI program.

How In-Class Instruction Relates to CBI

Another topic frequently noted in the literature focused on how teachers are expected to implement the CBI instruction itself. Should teachers only teach core subjects inside the classroom and save all CBI for outside of class? Should they expose students to CBI both inside and outside of the classroom? And finally, what types of CBI activities should be implemented to ensure the best possible learning outcome for students?

Teachers with no CBI experience felt that in-class instruction needed to parallel the topics in the general education curriculum, making it difficult to leave time for instruction that would benefit skills necessary for CBI (Langone, Langone & McLaughlin, 2000, p. 24). This concern was addressed by Dukakis, Valkanos & Brinia (2013) regarding vocational training. The study emphasized the direct correlation between teaching a subject or area of concern in class before introducing it to students out in the community. Teachers in the study by Steere & DiPipi-Hoy (2012) felt that CBI trips into the community must be frequent in order for students to reap any benefits from these trips (pp. 62-63). This especially applies to students with more severe disabilities because they need repeated exposure to social situations in the community in order for learning to be most effective. Frequent CBI trips offer the repetition with variety that many students with disabilities need in order to completely grasp a concept.

Other teachers in the study believed that role-play should supplement CBI. Students who struggle with social skills can engage in role-playing activities that relate to the current social skills being focused on in class and/or in the community (p. 63). For example, if students were going on a CBI outing to the local grocery store, teachers could first model an appropriate role-play activity, underlining the social skills necessary such as greeting the cashier with a "Hello, how are you?" and saying "Thank you" when the transaction is finished. After modeling this activity, the teacher could have two students act out this transaction in front of the rest of the class or even have students complete this activity in small groups. An activity such as this could then be discussed, focusing on the students' strengths and weaknesses.

Another supplement to CBI that teachers in the study believe to be valuable for those who struggle with social skill development related to social narratives (p.63). Social narratives tell a story and focus on a particular social skill. These stories may include photos of students in that class inside to make them more engaging and to help students envision themselves using that particular social skill. Teachers who are partial to this method feel that it is best for students who understand what social skills are, but who may have difficulty with the practical steps of implementing the skills (DiPipi-Hoy, 2012, p. 62). Like any other teaching method, social narratives may be more effective for some students than others.

In addition to the above methods of supplementing and implementing CBI, Steere & DiPipi-Hoy (2012) have also suggested that teachers take notes during the CBI outings to determine students' strengths and weaknesses. This may seem difficult to some teachers with CBI experience, as the outings can be more than enough to keep a teacher busy without being concerned with note-taking. If this is not a feasible option, ask an aid who is also attending the CBI outing to take thorough notes on any strength and/or weakness she has seen and that any adult on the trip reports to her. This can then guide both school based instruction and community based instruction, allowing teachers to provide students opportunities to improve areas of weaknesses and fine-tune areas of strength.

In addition to these specific methods of implementation, Alberto, Cihak & Gama (2005) suggest that scheduling is a key factor for successful CBI implementation (p. 327). Their study suggested that CBI must be well planned and thoroughly supplemented with other instructional methods. Classroom-simulated instruction and concurrent instruction in the community and in school are some examples of the suggested methods of scheduling (Alberto, Cihak & Gama,

2005, p. 327). No matter which method an educator chooses, scheduling that is consistent and frequent is essential.

Purposes of CBI

One of the main purposes for instituting a CBI program is the lack of social and life skills training students receive post-high school. For example, if students can learn to manage their time during CBI outings, this will help prepare them to manage their time when they apply for jobs and need to report to work on time (DiPipi-Hoy, Jitendra & Kern, 2009). E.C. Bouck (2010) found that only 24% of individuals with moderate to severe disabilities in her study received life skills training or therapy after high school and only 10% of individuals with moderate to severe disabilities receive relationship skills training post-high school (p.1098-1099). This indicates that if students do not receive social and life skills training during primary and secondary school, it is highly likely that they will never receive this training. Even if individuals do receive this training post-high school, it will be more difficult to explain a concept that is brand new to someone at the age of 18, as opposed to providing this training to an individual who has been practicing these skills since their early primary grades. IDEA requires every student with an IEP to have a transition plan by age 16, which indicated the importance of students acquiring these skills early on (Williams-Diehm & Lynch, 2006).

E.C. Bouck (2010) also discovered that when social and life skills are provided to individuals after high school, they are not adequate and often do not relate to necessary training after school (p. 1093). If training does not relate to the actual skills necessary to individuals after high school, is it really doing them any good? Overall, E.C. Bouck's study (2010) suggests that students with disabilities benefit from a life skills curriculum, yet few individuals receive this type of instruction in school (p.1100). This appears to be a prime example of the impact a functionally sound CBI program can have. Without CBI, students may never be exposed to the actual environments in which they will one day need to utilize their social skills. Without CBI, students are likely to complete high school never having any social or life skills training in any setting other than a classroom.

Individuals with disabilities lag far behind peers without disabilities in terms of employment. When individuals with disabilities are employed, they are often employed with far less hours than their non-disabled peers and receive lower wages. They are more likely to be living in poverty and rarely receive medical benefits from their employers (Pickens & Dymond, 2015, p. 290). This is another reason why CBI is vital to individuals with disabilities. When exposed to the different community settings, students are more likely to form an idea of what they may want to do when they complete high school. This is more likely to happen at the high school level. According to Pickens & Dymond (2015), high school special education teachers have reported that CBI and Community Based Vocational Instruction (CBVI) helps students learn work behaviors, job skills, increased self-determination and independence. These high school teachers also reported that CBI and CBVI assisted students in "identifying vocational goals and interests and provided opportunities for socialization with typical peers" (p.291).

It has also been found that students with severe disabilities struggle to generalize skills learned (Steere & DiPipi-Hoy, 2012, p. 60). This is why teachers and administrators at school site, elementary, middle and high school, should consider implementing a CBI program that offers

frequent outings into the community. The intent of CBI is for students to learn functional skills within the most natural environments and contexts (Steere & DiPipi-Hoy, 2012, p. 60).

Methodology

This study involved qualitative data collection. Qualitative research is useful for this study because it allows in depth to expose ways in which CBI can be utilized. Qualitative research is very specific and focuses on all of the complexities of the particular group and issue being studied; in this case middle school students with moderate to severe disabilities.

Participant Selection

Participants were contacted in person on the school campus where the research took place to inform them of the intended research. A consent form detailing the study was also provided. The form explained the overall scope of the research, the research process including the research methods, what the researcher hoped to discover and whom the researcher believed could benefit from the findings. The participants were receptive to the focus of the study and quickly agreed to be part of the study. They shared the same desire as the researcher to expose how CBI can affect the social skills of students with moderate to severe disabilities. The researcher earned the necessary training certificate and approval from the Institutional Review Board (IRB) and was approved to research this group. The researcher maintained confidentiality and protected the privacy of all participants through the entirety of the study.

Participants were selected using a convenience sample. Participants were students and educators at the school site where the researcher teaches, which also makes this a purposeful sample because students at the school site were easily observed. In addition to the classroom teacher, other participants included two classroom paraeducators who work with all eight students on a daily basis. The classroom teacher is a Caucasian female in her late thirties. This was her first year as a full time teacher of record. One of the paraeducators is a Lebanese female in her fifties while the other is a Latina in her early twenties. The two paraeducators have worked at this particular school site as para-educators for a combined total of fifteen years. This also made it easy for the researcher to contact educators to schedule interviews (Creswell, 2002). Below, Table 1 provides the participants' demographic information.

Table 1*Participant Demographics*

Participant	Ethnicity	Age	Occupation	Experience	Education
R.C.	Latina	23	Para-educator	5 years as para-educator	Will complete B.A in May 2016
L.K.	Caucasian	39	Special Education Teacher	First year teaching 2 years of long-term substituting 10 years of behavioral therapy	Has completed B.A. and preliminary education specialist credential
A.K.	Lebanese	54	Para-educator	9 years as a para-educator	Some college

Research Design

The researcher chose to complete a qualitative study on this topic because of the detailed information that an in-depth interview could yield. The researcher was not trying to quantify anything or find any statistics. Conversely, she sought to gain insight and draw conclusions from the words people use when answering interview questions and the actions of students during observations that took place in various locations. Data for this study was conducted using two methods: interviews and observation. Interviews took place at a location that is not on school campus (i.e. a coffee shop or local eatery). Observations took place during times that were convenient and preferable to the teacher of the student participants. Nothing was purchased for this study. However, participants were compensated with gift cards to a coffee shop. Because this research may be valuable to participants who work with these students daily, the researcher will also offer the findings of this research to them once the research has been completed.

Interviews

Teachers and para-educators were interviewed regarding the changes they have seen in their students' social skills since participating in a comprehensive and consistent CBI program. The researcher asked questions such as "How would you describe Student A's social skills before she began participating in CBI?" and "How would you describe her social skills now that she is currently participating in CBI?" Interviews were approximately thirty minutes each. Interviews took place in a local coffee shop that was quiet enough so that the participant and researcher did not become distracted. The volume level and atmosphere was calm so that interviewees felt comfortable speaking their most true and genuine thoughts without fear of any repercussion or negative consequence. The researcher audio recorded the interviews using a mobile device with the permission of each interviewee. She then transcribed each interview in full into a Microsoft Word document.

Observation

Observations took place in the classroom where children could be observed in an environment in which teachers and students are familiar and feel comfortable. Observations also took place out in the local community during CBI outings. Before observing students, the

researcher was sure to greet them and let them know she would be visiting the classroom sporadically and joining them on their CBI outings. This way, students were well aware of the researcher's presence and not distracted by it. While observing, the researcher took notes on the actions and behaviors observed. Notes were fact-based, and attempts were made to remain unbiased and objective by taking fact-based notes without any inference of the motivation behind behaviors. Overall, this research took place in the classroom at the school site in Orange County, CA, in the lunch area where most social opportunities present themselves and in the local community where students and staff go on their CBI outings. Students, teacher, and para-educators participated. Social skills were monitored throughout the course of the research. Notes about students' social interactions were made during observations. This research addressed and explored the quality of social skills among middle school students with moderate to severe disabilities. This research also exposed how CBI influences social skills among these students.

Data Analysis

Data was collected for this research via observations and interviews. The teacher and para-educators were interviewed, answered questions about a Community Based Instruction (CBI) program that was initiated at the school site, how it was structured and what social skills they saw the students exhibiting during the CBI outings as well as on the school site campus. The researcher also observed all eight students in the special education classroom on the CBI outings, during their thirty-minute lunch period, and during their general education elective periods, which totals approximately thirty-six hours of observation. Each observation that took place inside the special education classroom was approximately thirty minutes long. Each CBI outing, including the walk to and from the destination, took approximately two hours. The observations that took place in the general education class were approximately forty minutes per session.

Data Preparation

Before arriving at these themes, the researcher audio recorded the interviews with the teacher and two para-educators. After audio recording the interviews, the researcher transcribed the interviews verbatim. Once the interviews were transcribed, the researcher read each transcription in their entirety one time through. After reading them each one time through, the researcher analyzed which themes were recurring among all three participants. Once the researcher had a reasonable idea of some recurring themes, she read through the transcriptions once again, looking for specific similarities in ideas and language. The researcher utilized first-cycle coding methods; the first method used was in vivo coding by creating a code from similar expressions spoken by the para-educator and teacher during the interviews. The researcher also used descriptive coding by summarizing each topic of interest. As the text was read through a second and third time and these similarities were found, the researcher gave each theme a code name. These codes were titled and color-coded, making it easy for the researcher to distinguish which code(s) applied in certain sections of the interview transcriptions. After creating and color-coding the themes, the researcher read through each interview transcription two more times each to be sure no relevant themes or codes were ignored. When writing about the codes, the researcher applied interpretations to the data for each portion of the coding and analysis process.

Coding

Throughout the duration of the interviews, observations and coding and analysis process, the researcher found several recurring themes. The researcher used a combination of In Vivo coding, beginning with first cycle coding (Saldana, 2009) and Descriptive Coding (Saldana, 2009). The themes that naturally arose included social norms, travel time, math skills, cooking, social skills practiced during CBI, who students socialize with and “hopes for the future.” In Vivo coding was used to create the theme “hope for the future.” Two participants stated the exact phrase “hope for the future” during their interview with the researcher when discussing the social skills they hope the students will have learned. They expressed that certain skills could aid the students in living as independently as possible once they are finished with school.

The researcher felt that this exact phrase spoken by participants spoke directly to the research question of whether or not CBI can improve the social skills of middle school students with moderate to severe disabilities. The participants expressed that their hope for the future was that the students could put the skills they learn at school and out on CBI outings into practice in their own personal lives at home with their parents now. Additionally, they expressed their hopes that the skills would carry over into their own adult personal lives so they would live independently. These themes were relevant to the research question of how CBI can affect the social skills of middle school students with moderate to severe disabilities. They were also created using descriptive coding. With descriptive coding, the researcher summarized each topic that repeatedly arose in both the interviews and observations. The following themes were revealed through the analysis: social norms, travel time, math skills, cooking, social skills practiced during CBI, and individuals with whom students socialize.

Trustworthiness/Reliability

Trust was established in several ways throughout this study. The researcher held multiple interviews with multiple participants. Multiple collection tools were used which include observations and interviews. The researcher audio recorded all interviews and transcribed each interview verbatim. The intent of the study was to show that CBI can positively affect the social skills of middle school students with moderate to severe disabilities, was made clear to the participants. The researcher also assured participants that all names and places where research took place would be kept confidential. Therefore this study involved very little risk. There was no potential risk of physical or psychological harm because students were simply being observed and teachers were interviewed only to their own personal level of comfort. All of the above factors created a trustworthy rapport between researcher and participants.

Results

The purpose of this study was to determine whether community based instruction influenced the social skills of middle school students with moderate to severe disabilities. The study was conducted at a public middle school in one of the largest school districts in Orange County, California. Students involved in the study were 7th and 8th graders who spent more than 50% of the instructional day in a self-contained special education classroom. During the study, the researcher answered the following question:

How does community based instruction influence social skills among middle school students with moderate to severe disabilities?

Chapter 4 provides the results of this study. The chapter begins with social norms, which explain the theme that recurred during the interviews. Next, the themes of travel time, math skills, cooking, social skills practiced during CBI and socialization are explored and discussed in relation to the research question. Then, the theme of “hopes for the future” and independence are discussed in detail. Finally, chapter 4 concludes with a summary of the results of the research.

Social Norms

Social norms were a repetitive concern indicated by both the special education teacher and one of the para-educators. During the interview with the special education teacher, L.K., she stated that during CBI, “students are exposed to social norms such as how to greet someone, appropriate ways to ask for help and how to handle certain unpredictable situations such as seeing a person with a dog walk by.” A situation like this has the potential to be a trigger to some students and may incite anxiety or fear. Para educator R.C. stated during the interview, “There are a lot of teachable moments for the students that come up when we are walking around the community.” This suggests that CBI offers many opportunities for students to learn social norms during the weekly CBI outings. Learning social norms appeared to be one of the top concerns of the teacher and para-educator, focusing especially on how to handle unexpected social encounters. These social encounters usually occurred during the travel time to and from the weekly CBI destination.

Travel Time

The travel time to and from the destination was another recurring theme throughout interviews with the participants. The significance of this theme was also found during the observations that took place on the CBI outings. During the time that students spent walking to and from that week’s destination, they were given a chance to converse about school, friends, family, weekend activities and anything else of interest to them. It was an opportunity to practice initiating conversation, taking turns during conversation, maintaining eye contact during conversation and working on appropriate responses to one another. The para-educator A.K. stated, “The kids have a lot of social opportunity just on the walk to and from wherever we are going. That’s kind of like their time to socialize without structure.” This statement is a representation of how important it was to the staff in this classroom that students had unstructured social opportunities where they could practice skills they had learned prior. Travel time during CBI seemed to be just as, if not more, important than the skills learned at the destination itself. The researcher also observed similar behaviors. When out on a CBI to a local eatery, student A.N. expressed to student L.H. “I’m going to order chicken strips. What are you going to get?” This gave student L.H., one of the least social students in the class, a chance to respond and continue in some peer-to-peer conversation.

Math Skills

A consistent skill that was practiced and applied at every CBI destination was math. The skill of math in this context included budgeting, totaling costs, finding the best bargains, calculating and estimating time, counting money, calculating and confirming the accuracy of change given to students by the cashier. As observed by the researcher, students utilized math skills when

estimating a budget for items needed from a particular location such as a local grocery store. In class, when estimating and budgeting, student A.V. said “I have three dollars. I think I’ll be able to buy one snack and a gift for my mom.” During the researcher’s CBI observation, students decided which brands to buy to get the most product for their money. In the store, they discussed amongst themselves about which product they should buy. For example, before making her final decision, student J.P. asked teacher L.K. “These chips are the best deal right?” They also learned and practiced how to pay for items and count money in order to be certain that correct change was given after the transaction.

The researcher noted students practicing their time skills by estimating how much time they would have at each destination. The majority of students knew what time they needed to be back to school and were prompted by staff to calculate how much time they would have at the destination and what time they should leave to give themselves enough time to walk back to school. The special education teacher also expressed the importance of this skill by saying “The kids learn to be responsible by estimating how much time they have. Some like to ask what time it is and how much time we have until we get back. Now, most students know to simply ask for the time so that they can estimate it themselves.” The researcher was surprised to see how often this is a very real-life skill that anybody with any type of schedule would use and need on a daily basis. It was clear from the observations of the researcher and the interview of the special education teacher that keeping a schedule and following it independently is a skill that is highly valued inside and outside of this classroom.

Cooking

In this research, the theme of cooking included the following: deciding what to cook, making a list of grocery items needed, calculating a budget, finding the most valuable prices at the store, navigating the store to find the necessary items, paying for the items needed for cooking, preparing the food items bought at the store, using those items in a safe and sanitary manner in the classroom, eating the food that was prepared, cleaning up and storing leftover food properly. The researcher observed students practicing all of these skills on an average of one to two times per month in combination with weekly CBI outings. Students observed in this research were not only learning the entire process of cooking for themselves, but also how to budget and shop for healthy foods at a reasonable price. The special education teacher stated how important she felt cooking was when she stated that “Cooking the ingredients we buy at the store really brings CBI and life skills full circle. It’s almost like a mini project where every week students get to choose what to cook and buy the ingredients which are skills within themselves, but then they also learn the life skill of cooking which is extremely valuable.” The para-educator shared similar views and expressed “The kids get to cook, which they love. They are having fun while learning and it doesn’t really get any better than that.” Based on observations and interviews, the researcher found that CBI did not happen in an isolated manner. Many skills were interwoven into the program and cooking was the most common skill that was practiced and applied after the CBI outing.

Social Skills Practiced During CBI

The theme of “social skills practiced during CBI” refers to the skills that are exclusively put into practice during CBI. A major common theme conveyed by participants was safety within the community. Specific examples given during the interview with the para-educator included

learning to obey the safety and community signs on the streets such as “walk,” “don’t walk,” “stop” and “beware of dog.” During observations, the researcher heard several students point out these signs while simultaneously gesturing along with it saying, “Wait, the red hand means stop” and “Look both ways first. Are there any cars? No.” Students practiced navigating their communities on a weekly basis. Another example of social skills practiced during CBI given by a para-educator was that students treated each other with more kindness while at the park engaging in structured sports games together. Teacher L.K. stated, “The students argue less during CBI outings compared to the amount of arguing that takes place here on campus.” Students appeared to understand that CBI was a privilege and behaved in a friendlier and less argumentative manner than while in the classroom.

The researcher observed that many of the students wanted to be in the front of the group when walking to their CBI destination. The skills of patience, respecting personal space and saying “excuse me” if and when a student passed by another student, were regularly demonstrated during every CBI outing. The special education teacher stated, “A lot of the kids tend to want to be in front of the group, but now they know that they will have to walk in the back of the group if they are not polite or don’t say ‘excuse me’ when passing by another student.” Once the destination was reached, options were often presented to students; whether it was the option of which game to play at the park or which section of the store they wanted to head toward first, students learned to make decisions together by discussing amongst themselves and received advice from adults when solicited. The social skills that emerged and were practiced during CBI included such activities as community safety, politeness, manners and personal space were not only noted by participants, but also observed by the researcher on multiple occasions. During CBI, students practiced these skills with one another and then practiced the same skills on campus with their typical peers as well.

Socialization

The theme “Socialization” refers to how students put their social skills into practice both on campus with their peers and off campus with other members of the community. Many of the skills practiced during CBI were not only applied on the CBI outings themselves, but also at the school site. For example, para-educator R.C. stated in an interview that she noticed students greeting friends they have made at lunch “more often than in the beginning of the year.” The researcher observed similar skills in the general education elective classes. Students with moderate to severe disabilities called on their general education peers for help in class, which was encouraged by both the general and special education teachers.

Additionally, students had the opportunity to be social with their typical peers every day during lunch as observed by the researcher. Typical students who were part of a club called the Kindness Club would sit, eat and converse with the special education students during lunch. Most of the special education students enjoyed this time and were very open and friendly, greeting their peers properly and asking friendly and appropriate questions such as “how are you?” or “how was your weekend?” The skills practiced during CBI were clearly being applied onto the school campus, which demonstrates the students’ ability to generalize the social skills they have learned. While students were improving their social skills that were being used on campus, they were also getting the chance to socialize with members of the community such as cashiers, grocery store clerks, members of the community at the park and local small

businesses. These social skills are likely to positively impact each student's independence and in turn, their futures.

Hopes for the Future/Independence

Another theme that arose during the course of this research was "hopes for the future" and independence. A common hope that was expressed by both the classroom teacher and para-educators was that all of the students would one day have the ability to live independently. Para-educator A.K. expressed that she "just hope[s] students will be able to feed and clothe themselves, shop for groceries independently, keep a clean living space and obtain and maintain a steady job." The teacher, L.K., also expressed her hopefulness by genuinely stating, "I hope so much that they will be able to wake up on their own and follow a schedule throughout the day. This schedule would include cooking breakfast, making their beds, going to work, visiting with family and doing household chores." It was made clear to the researcher that although CBI is taking place when students are in middle school, it has the accompanying educators thinking into each student's future and how it may affect their independent living skills.

Summary

Of these skills listed, scheduling and shopping for groceries and within the context of consumer math skills, were two that were consistently practiced throughout the CBI program. Students were very aware of the time they needed to be back to school and how much time that gave them to spend at the destination. Shopping for groceries happened at least once per month throughout the duration of this study, giving students ample practice with that life skill.

In addition to the hopes that were expressed during participant interviews, the researcher observed the teacher and classroom staff conversing on several occasions about possible jobs the students could maintain and what their living situation might look like after high school. Overall, it was understood that there was an emphasis on the future of each student and his/her independence was the overall long-term goal and purpose for CBI at this school site.

Discussion and Conclusion

Overall, this study focused on whether or not CBI influences the social skills of middle school students with moderate to severe disabilities. It also focused on how CBI affected their social skills, specifically in the school setting. The researcher observed the students at their school site for a total of approximately thirty-six hours. In addition to observing the students, the researcher also interviewed the special education teacher and two para-educators who work with the students daily. The researcher interviewed the educators several times to discuss student progress throughout the duration of the study as well as when CBI trips occurred throughout the school year.

As the study progressed, the researcher observed different themes that consistently arose; for example, socialization and math. These themes were frequently present because students were given both ample opportunities to socialize informally during CBI and practice their math skills, specifically time and money skills as they related to the students' CBI outings and daily schedules. Moreover, these skills were reinforced by the

adult participants who were interviewed. They informed the researcher that they felt CBI gave students an opportunity unlike many others available on campus, which are valuable and can benefit them in their post-high school and adult lives.

How does Community Based Instruction (CBI) influence social skills among middle school students with moderate to severe disabilities?

After extensive observations in various locations including the classroom and local community, the researcher gleaned that CBI increased the amount of self-initiated socialization during CBI outings. This increase was especially noticeable in comparison to the average school day on the school site campus. This socialization did not only happen among students and between students and staff, but also between students and local community members. These community members included families at the park, local store-owners, grocery store cashiers and local residents in general.

A pivotal example of student interaction with a community member took place during a monetary transaction. The student, J.C., was ready to purchase an item and looked to the teacher for help, saying “Help me, please.” Inferring that J.C. could not complete this transaction independently, the teacher turned and began to walk away from the student hoping to force him to interact with the cashier and complete the transaction. This action indeed forced what otherwise would have been a prompted interaction. J.C. responded to the cashier’s greeting and completed the transaction independently. He also waited for his change, which, as stated by his teacher, had been difficult for him to remember on past occasions.

The experience of completing monetary transactions is a prime example of a skill that can be practiced by students out in the local community. Students can hone these skills in the classroom by practicing their addition and subtraction skills, specifically with money. However, being out in the community and having real life experiences where these skills are put into practice cannot be substituted in the classroom. The teacher, L.K., later informed the researcher that when she walked away from her students during that transaction, she was trying to force the cashier to interact with her student instead of the cashier assuming that she would speak for J.C. to help him complete the transaction. The teacher, L.K., informed the researcher that this was not the first time she had done this. She said she noticed that the further away she was in proximity to both the cashier and her students, the more independent her students acted and carried out social interactions.

Practicing these skills in the community displays how valuable they are and that the environment cannot be substituted on the school campus. On the school campus, teachers and para-educators are there to facilitate and provide instruction as well as to prompt students until they are able to solve the task at hand. However, once students venture into the local community where they live, they gain the opportunity to undertake these tasks independently and more often than not, they rise to the occasion.

Similar to the research of Langone, Langone and McLaughlin, (2000) who found that 67% of teachers in their study said they saw a decrease in inappropriate behaviors during CBI outings,

this study revealed that fewer negative behaviors occurred during CBI outings. Participants in this study also stated that they noticed students' behavior was generally more positive on CBI outings when compared to their behavior inside the classroom. Para-educator A.K. stated, "I think they feel more comfortable during CBI and they know that it is a privilege. That is why I think they behave better than they tend to at school." The researcher's observations indicated the same information. Students seemed happier, more respectful and more comfortable with less pressure to perform well on assignments or obtain correct answers.

The researcher also gathered sufficient data from the interviews held with the teacher and para-educators. Much of what was observed by the researcher was reaffirmed during the interviews. For example, when asked about the social opportunities during CBI, para-educator R.C. stated, "I notice the students initiating conversation and being themselves more while we're out on our trips. It seems like they feel more comfortable in a setting that is different from the classroom." The teacher, L.K. made a similar point saying, "I don't think my students would be as social as they are here at school if it weren't for CBI." The students were presented with more social opportunities during the CBI outings. The teacher and staff reviewed what happened during the CBI outing so the skills were constantly reinforced on campus.

Limitations

Limitations for this study included duration and location. This study could have consisted of a pre and post treatment, meaning the students could have been observed and the staff interviewed prior to ever having been exposed to CBI at all. The researcher could have then observed students and interviewed staff throughout the school year as well as the following year to get a more long-term view of how CBI may have affected each student's social skills. Also, the researcher could have observed a class of middle school students with moderate to severe disabilities at more than one school site to see how the location of the school may have impacted the social skills of students. The difference in staffing may have also played a part in the outcomes.

Conclusion

In working to find an answer to this question, the researcher found that Community Based Instruction positively influences the social skills of middle school students with moderate to severe disabilities. Skills that have been practiced and improved over the course of this study include counting money and correct change, telling and estimating time, calculating the most affordable prices, following directions, making eye contact, following safety and community signs while out in the community, greeting people, taking turns, working as a team, making decisions together, using manners, respecting personal space, conversational skills with peers and adults and conflict resolution. Students appeared to enjoy the CBI outings and greatly benefited from it in terms of social skills, including grocery shopping, following a recipe and math skills. Both para-educators and the special education classroom teacher noticed improvements in student behavior, specifically in terms of group decision-making and expressing disagreement. Overall, this study has found CBI to have a positive impact on student behavior.

Implications for Practice

This study was intended to help any K-12 teachers who might be considering starting a CBI program on their campus. While this study took place on a middle school campus, the researcher recommends starting CBI at the elementary level. If students were exposed to CBI at the elementary level, even as often as once or twice per month, they may be able to focus more of the complexities of the social skills once they reached middle school. Students typically do not gain exposure to CBI until secondary school and are expected to apply the skills that are practiced out in the community as well as function independently all within four to six years. If students began CBI earlier, they may be able to cultivate their social skills at the elementary level and refine those skills once they have reached the secondary level.

In addition to beginning CBI earlier, providing professional development to teachers, para-educators and administrators, may be beneficial and lead to more administrative support. If entire districts understood the benefits, more students with disabilities would be exposed to a consistent and age-appropriate CBI program throughout the entirety of their school careers. This study may also be helpful for parents to understand the rationale for CBI programs.

Implications for Research

In order to improve future research on Community Based Instruction, researchers may focus on CBI at the elementary and high school levels. They may also interview parents regarding the social skills of students and how they feel CBI has influenced the social skills of their children. Completing a longitudinal study with students who begin CBI at the elementary level and continue it throughout secondary school may provide more in-depth results. Furthermore, researchers completing a longitudinal study may observe how their social skills progress throughout the K-12 school system and into post-high school life.

If a follow up study were to be conducted, the researcher may want to consider having a control group of middle school students with moderate to severe disabilities and a group who is participating in a consistent and functional CBI program, so that the two groups can be compared and contrasted. The researcher would observe and accompany both groups during their CBI outings and interview the teacher and staff of both groups regarding their experiences with CBI. Future researchers may want to include school administration in their study. This could provide an understanding of why some school sites do not have CBI programs.

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Supporting Students with Disabilities During Group Activities: Five Tools Every Inclusive Mathematics Educator Needs

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Abstract

Students with disabilities are increasingly taught in general education settings, including mathematics classes. Too often, math teachers confront challenging behaviors of students with disabilities in inclusive settings. The authors present five efficient tools effective teachers can add to their repertoire to combat problem behaviors during group work that impact learning for students with problem behavior. In order to lead our students to proficiency in the concepts and procedures of mathematics, it is imperative that we have the behavior management skills to support our students in less structured environments like group work activities. In this article we highlight five research-based strategies that can be used to support some of the most challenging behaviors present in inclusive classrooms. Those five tools are assigning student to roles in group work, using proximity control with redirecting (directing student to be on-task), engaging students by using interest boosting techniques, conducting frequent checks for understanding, and delivering behavior-specific praise.

Keywords: group work, mathematics, students with disabilities, inclusion

Supporting Students with Disabilities During Group Activities: Five Tools Every Inclusive Mathematics Educator Needs

In the 2013 - 2014 school year, the number of students receiving special education services in the United States was 6.5 million (NCES, 2015), with 61.1% of all students with disabilities (SWD) spending at least 80% of their time inside general education classrooms. When SWDs enter general education mathematics classes, their teachers often report SWDs struggle with concepts being introduced and present instructional challenges (Grumbine & Alden 2006). Although different categories of disabilities impact students who are placed in general education settings, commonalities across categories can impede mathematics learning (Heiman & Preceel, 2003). Group activities have assumed a central in-class role in developing conceptual understanding, yet group activities can also incubate misunderstandings, particularly for SWDs. During group activities SWDs can fall off pace from their peers preventing them from understanding critical concepts needed to solve problems thus developing misconceptions about those concepts. For example, students might confuse algorithms when multiplying fractions with those for adding fractions because they were off-task during the group activity. The off-task student, for example,

might see the generation of a common denominator as a first step in any work with fractions, even though multiplication of fractions is not necessarily facilitated with one. Similarly, the student who masters solving proportions through cross multiplication and is distracted during discussion of critical features may overgeneralize to addition of fractions because the set-up

looks the same ($\frac{1}{2} + \frac{2}{3}$ versus $\frac{1}{2} \cdot \frac{2}{3}$).

The following scenario focuses attention on a common experience for teachers when SWDs in their classes engage in group work. Ms. Rene is a mathematics teacher whose 10th grade class includes SWDs. After whole group instruction, Ms. Rene assigns her students to groups. The group task is to use coordinates of polygons and the distance formula to compute polygon perimeters and rectangle areas. At the end of the lesson, group responses to the assignments are submitted, and Ms. Rene infers that the students seemed to understand the concepts on which they were working. However, Ms. Rene is not entirely satisfied, in that, during group work, she had noticed that Billy, a student with a learning disability, seemed not to be attentive at different times during the group activity. For example, when Mr. Miller (the principal) interrupted class to announce the game-day schedule over the loudspeaker, Billy, like others, stopped his work, but, unlike others, he did not return readily to the mathematical task. His peers progressed in solving the task as Billy perseverated on the announcement. Turning her attention to Billy's group after a while, Ms. Rene observed that the group, including Billy, was again working, and discounted what Billy's short hiatus from the problem may have had on his understanding.

When Ms. Rene examined the students' work at the end of the unit, she noticed that many SWDs, including Billy, struggled to compute perimeters of polygons and areas of rectangles using the distance formula. Ms. Rene was perplexed. Her students have a variety of disabilities, and Ms. Rene needed a strategy that would address a range of disabilities. She reached out to her colleagues for ideas that might help her understand a generalizable root of the SWDs' difficulties and how she could better support her students. Her colleagues informed her that this had happened to them during their careers, and they had not come up with a strategy that would cut across the range of disabilities presented by students. They have scoured the Internet for general strategies that might be responsive to a range of SWDs, without success. After lengthy communications with her colleagues, Ms. Rene was discouraged about the prospect of general strategies for supporting SWDs.

The following presents challenges encountered with group work based on observations from research related to why some SWDs struggle working in groups, and five tools (see Figure 1) that are effective, efficient, free, and usable in the context of inclusive mathematics classrooms to help these students. These tools are even effective for novice mathematics teachers.

Students Who Struggle with Group Work

When SWDs find themselves working in less structured environments (e.g., group activities, project-based learning) where minimal feedback and supports are in place, several issues can surface. Issues SWDs face during group work may include (a) being off task during group work, causing them to fall behind their peers, (b) giving up on the problem entirely (c) being satisfied with whatever their peers propose as a solution, (d) working hard on the problem, but not arriving at correct answers while their peers do, (e) arriving at the incorrect answer and after

correction, continuing to draw from their incorrect strategy, and (f) actively struggling to make the connections but fail to do so because of time constraints may go along with the group without ever making a personal connection to the concepts.

Teachers' misconceptions about SWDs can form roadblocks to SWDs' successful learning of mathematics. Although SWDs' inability to do particular tasks is often attributed to their not paying attention, the core of the difficulty is not that they are distracted but that, after distraction, they have difficulty returning to the task at hand. Their oversensitivity to factors in their environment block their return to the task at hand. Students with disabilities can understand mathematical concepts if teachers provide purposeful individualized behavioral supports. For example, adults entering the room during classwork or announcements presented over the loudspeaker may redirect SWDs attention from the task at hand. Unlike students who notice these disruptions but continue to work in their groups, SWDs are often overly sensitive to stimuli. They may focus on disruptions, miss critical conversations, and miss a crucial step in their group's progress in solving the problem.

Five Tools to Support Students with Disabilities

Certain research-based practices have been shown to support students in inclusive mathematics classrooms, and may be especially effective for SWDs as they work in groups. These tools are minimally invasive approaches that can be employed in the context of group work in mathematics classrooms without the burden of additional planning or bulky intervention packages. Teachers can incorporate these tools into their daily practices for the benefit of all students but particularly to support SWDs.

For SWDs to be successful in mathematics, their behavioral needs must be accommodated. Not only must teachers support students' mathematics learning, they must also attend to behaviors that may negatively influence mathematics learning. Working in groups requires each member of the group to synchronize his or her thinking with that of other members of the group. If teachers are not attending to behaviors that divert student attention, that synchronization may falter as SWDs fall behind the rest of the group and struggle to make connections with mathematical concepts. When teachers encourage appropriate classroom behaviors, SWDs' mathematical understanding can be improved without the need for complex behavior intervention plans. During group work, the tools described here work especially well for SWDs who may engage in behaviors that can impede their learning (e.g., off-task, disengaged, inappropriate behaviors). These tools are (a) assigning roles to students in group work, (b) using proximity control with redirecting, (c) engaging students by boosting their interest, (d) conducting frequent checks for understanding, and (e) delivering behavior-specific praise.



Figure 1. Five tools to support students with disabilities.

Assigning Students to Roles in Group Work

There are times when SWDs are not clear on their roles in group work, leaving them to guess the intended focus of attention or resulting in a lack of engagement in the task. Assigning students to roles in group work clarifies their focus and makes them accountable in a specific way to the rest of the group. In order to be effective, group work on mathematical tasks requires that all members of the group engage and coordinate their efforts to contribute to progress on solutions. Individual roles during group work can promote students' engagement in cooperative work on mathematical tasks. SWDs can be assigned as recorders, questioners, timekeepers, and reporters (Johnson & Johnson, 2009). For example, a student who is assigned the role of the questioner ensures that all possibilities have been explored by posing questions. The questioner might provide motivation for students with other roles (including SWDs) to stay on task. The importance of individual accountability during group work is in providing students with an incentive to help each other and to encourage each other to put forth maximum effort (Slavin, 1995). In our scenario, Ms. Rene could have assigned roles for the group activity that help students, like Billy, who are often off task during group activities. Billy could have been assigned the recorder role during group work. By assigning Billy this role he now needs to keep track of the group progress, which should help him know what he needs to do during group work. This role assignment is likely to help him stay on-task and provide him with accountability during the activity.

Proximity Control with Redirecting

Every teacher knows how effective it is to stand near a child who is having difficulty. The teacher is a source of protection, strength, and identification, which helps the child control his or her impulses by her proximity (Long & Newman, 1980). Proximity control can be exercised by a teacher who moves towards a student he or she suspects might not be fully engaged in the group activity (e.g., doodling, daydreaming, talking to peers). Moving close to the student will encourage her or him to participate in the group activity rather than engaging in off-task or disruptive behavior. Proximity control helps the student refrain from actions that get in the way of learning and reengage in the academic task (Sayeski & Brown 2011). To further support students, teachers can pair proximity control with redirecting. Redirecting involves asking the student to do a task, like solving a problem or answering a question, or to refocus the student's attention on the group work. For example, during instruction, Ms. Rene notices Billy staring out the window as his group members continue to solve the problem. Ms. Rene can make it a point to casually stroll by Billy's desk and quietly ask him (so only he can hear) to catch her up on where the group is in its solution. This way Ms. Rene is encouraging Billy to stay with the group so he does not miss an important step. Teachers using proximity control and the redirecting techniques together can support SWDs during group activities without having to call the student out in front of his or her peers and potentially embarrassing the child and causing him or her to disengage further.

Interest Boosting

Interest boosting occurs when stimulating the child's interest may motivate him to continue his work (Levin & Nolan, 2013). It may be helpful for the teacher to show an interest in the student by engaging in a conversation on a topic that is of interest. Using the interest boosting technique could look something like this: When students are working in groups to find the area of an irregular figure, Ms. Rene notices Billy's interest is declining and showing signs of boredom and restlessness. Ms. Rene is aware that Billy plans to take over his family's landscaping business, and uses this to increase Billy's interest on the task. Nonchalantly, she moves over to Billy and asks him (quietly as to not draw attention to him) how he would figure out how much mulch he would need for a given garden. Ms. Rene, thus, encourages Billy to get back to thinking about the mathematics on which his group is working so he can help them find the area of an irregular shape—which he does.

Frequent Checks for Understanding

Teachers often assess student understanding through traditional formative and summative assessments. For SWDs, particularly those working in groups, frequent checks for understanding are needed. Frequent checks for understanding allow teachers to determine the extent of students' understanding before they fall behind the group's reasoning. Frequent checks also cue the teacher in to potential misconceptions and whether they need to intervene (Rosenshine, 2012). Moving between groups, the teacher can check understanding by asking students to summarize what they have done to that point, to think aloud as they solve a mathematical problem, or to explain a particular position. It is important to frequently check for understanding with SWDs to ensure that they understand the mathematical concepts; however, it is counterproductive to put a student on the spot and embarrass him or her. It is also ineffective to simply ask, "Are there any questions?" because some students with disabilities regularly encounter academic failure and are reluctant to admit that they are confused (Hartman-Hall &

Haaga, 2002). Additionally, students may not be aware of their misconceptions.

Behavior-specific Praise

Frequent checks also provide the opportunity to deliver behavior-specific praise (BSP) to students on their performance. Behavior-specific praise is an evidence-based practice with positive effects for a multitude of student behaviors (Simonsen, Fairbanks, Briesch, Myers, & Sugai, 2008). The critical component of BSP is specifically identifying the desirable behavior you are praising. Telling SWDs that they have done a good job is not specific enough to let them know what they did well. Teachers need to state explicitly why the student did a good job.

For instance, during group work activity Ms. Rene moves to Billy's group who is trying to find out the sum of the first N positive integers. Billy made the observations that: if he adds 1, 2, and 3, he gets a result of 6; if he adds the first four integers, he gets 10; and if he adds the first five integers, he gets a result of 15. He notices a pattern in the 3, 6, 10, 15. This sequence results by adding 3 the first time, 4 the second time, and 5 the third time. Now he is guessing that he needs to add a 6 to get the sum of the first six integers. At this point, Ms. Rene is pleased that Billy has come up with the correct number but recognizes the importance of checking for understanding before providing BSP for Billy's contribution and appropriate group work. After Ms. Rene checks for understanding, she provides BSP for his contribution, "Billy, I really like how you discovered the pattern in this activity by looking for differences and how your observation helped the group to come to a general way to find the sum of the first n integers. Your contribution advanced the thinking of the group. Great work!"

One of the most important keys to the success of BSP is providing it immediately after the appropriate behavior occurs, increasing the likelihood that the behavior would occur again. As a bonus, BSP may have the potential to contribute to a growth mind set (Dweck, 2008), giving students like Billy the confidence that he can learn.

Conclusion

In instructional strategies, such as group work, it is important for each group member to follow and contribute to the thinking of the group. The behaviors of SWDs can lead to students struggling to stay with the group, resulting in their falling behind in following and contributing to the work of their group (Rosenshine, 2012). The five tools provided in this article can be used separately or in combination. Assigning roles to group work, proximity control, redirecting, frequent checks for understanding, and BSP are quick, easy, and minimally intrusive tools educators can use to support SWDs during group work in mathematics classrooms. Teachers can incorporate these tools into their daily practices and use them "on the fly" to improve students' academic and behavioral success during group work.

Because group work in mathematics is replete with potential distractions, SWDs may be easily sidetracked when their instruction is configured in group work. As a consequence, behaviors in which SWDs engage in the context of group work can form roadblocks that hinder learning. Additionally, teachers may not be aware of the specific impact that these behaviors have on the success of group work. Success with SWDs in the context of group work can be facilitated using five simple tools. Using the five tools, teachers can respond in a professional manner to students

who are struggling with a range of issues that are particularly problematic in the context of group work, and they can do so without putting the student on the spot and possibly creating a more difficult situation. The tools presented in this article provide inclusive teachers a way to intervene properly when they notice issues in SWDs' group work. These tools can break through barriers that block content acquisition in mathematics. These strategies are not the only strategies available to inclusive teachers working with SWDs and certainly are not a panacea for content acquisition or managing challenging behavior. They are, however, tools that are easy to use, even by novice teachers. For additional resources on improving the educational outcomes of SWDs including additional behavior management techniques visit <https://iris.peabody.vanderbilt.edu/>.

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Using an Alternating Treatment Design in a Co-taught Classroom to Measure Student On-task Behavior

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Abstract

The purpose of this study was to determine if student on-task behavior varied when a) the One Teach/One Assist co-teaching model was applied or b) when the Team Teaching model was applied using an alternating treatment design for four students in a co-taught Algebra I classroom. Results show that participants experienced increased on-task behavior and an overall decrease in behavior variation when the One Teach/One Assist or Team Teach co-teaching model was implemented. These findings indicate that in a co-taught classroom, whether the One Teach/One Assist or Team Teaching model is implemented it will yield increased on-task behavior of students as compared to not implementing a co-teaching model.

Key words: Co-teaching, One Teach/One Assist, Team Teaching, inclusion

Using an Alternating Treatment Design in a Co-taught Classroom to Measure Student On-task Behavior

Introduction

The inclusion of students with disabilities (SWDs) in the general education classroom is on the rise. Many schools have turned to co-teaching as the answer to the growing need for an inclusive education for SWDs. Unfortunately, terms such as inclusion and co-teaching are currently tossed around by today's educator and often used interchangeably. Although at times used synonymously, these terms are quite different in their design, intention, and implementation. Co-teaching is the partnering of a special educator and general educator, who will co-plan, co-teach, and co-assess, in order to provide access to the general education curriculum for SWDs (Murawski, 2009). Whereas, an inclusive education for SWDs can be defined as the placement of children with disabilities in a general education classroom with typically developing peers while also providing those SWDs with appropriate support (Lerner, 2000; Osborne and Dimattia, 1994). To further clarify, co-teaching is a method used to achieve inclusion for SWDs. Co-teaching is a model of instruction that can benefit both students with disabilities as well as students without disabilities.

Students in a co-taught classroom benefit from having two teachers in the room with them at all times in that they can receive more assistance as it is needed (Conderman, 2011; Fenty & McDuffie-Landrum, 2011). Murawski (2008) explains that co-teaching "is considered a viable option for ensuring students have a 'highly qualified' content teacher in the room, while also ensuring that all students' individualized education needs are met by an instructor who is highly qualified in differentiation strategies" (p. 29). Further, the presence of two teachers can diminish behavioral issues that may arise as well improving the student to teacher ratio (Dieker, 2001; Magiera & Zigmund, 2005). All of these benefits are inherent characteristics of co-taught

classrooms. In addition to the aforementioned built-in benefits, co-teachers can also select from multiple teaching models that could be incorporated in the co-taught classroom, but the two of focus for this study were the One Teach/One Assist model and the Team Teaching model. Understanding of the co-taught classroom continues to be somewhat of a mystery and questions surrounding its overall effectiveness are echoed in the literature and research of this method of inclusion.

Perhaps the two most recognizable co-teaching models are One Teach/One Assist and Team Teaching. Cooke and Friend (1995) explain that the One Teach/One Assist model is characterized by one educator retaining the instructional lead in the classroom while the other circulates through the room providing assistance and support to students as needed. Contrastingly, Team Teaching is defined as both teachers presenting the lesson together (Hepner & Newman, 2010). The original intention of these two co-teaching models was that each would have their place in the instructional process and the daily goals and objectives for classroom learning would determine the model that co-teachers selected for instruction. However, what began to trend with regard to these two models is that One Teach/One Assist, which takes significantly less planning time, was being overused by co-teaching partners. Further, the One Teach/One Assist model was not being implemented with fidelity in that often the special educator fulfilled what would be best described as an instructional aide role when this model was implemented as opposed to circulating the classroom and providing assistance to students (Obiakor, Harris, Mutua, Rotatori, & Algozzine, 2012; Volonino & Zigmond, 2007). Therefore, over time the Team Teaching model became the “end goal” for co-teaching partners and has been regaled as the most effective model (Conderman, 2011; Hepner & Newman, 2010). The unfortunate result is that co-teachers may often feel as if they are not successful co-teachers when they use One Teach/One Assist, even though that model may be the most appropriate for the instructional goals for that day. Ultimately, co-teachers should use the model that most appropriately fits the classroom objective, giving special attention to an equal distribution of active and passive roles as teachers (Conderman, 2011).

While a negative stigma with regard to One Teach/One Assist exists for teachers (Burks-Keeley, Brown, 2014; Keeley, Brown, Knapp, under review) students remain untainted regarding perceptions of co-teaching model preferences and actually reported a partiality for the One Teach/One Assist model in contrast to common teacher opinions (Keeley, Brown, Knapp, under review). This study assesses student on-task behavior as a measure of the effectiveness of the One Teach/One Assist model as compared to the Team Teaching model.

The purpose and objective of this study was to effectively measure on-task behavior of students in a co-taught classroom and to determine if student on-task behavior varied when a) the One Teach/One Assist co-teaching model was applied or b) when the Team Teaching model was applied. Additional student data was collected as well, including standardized test scores, area of disability, gender, grade level, and ethnicity.

Method

Participants and Setting

Prior to the onset of the data collection all participants were provided with both consent and assent forms. The consent form asked the signature of a parent or guardian allowing the child to participate. Additionally, each student was asked to sign an assent form if he/she agreed to participate. There was no penalty applied to students that did not want to participate. Further, only those students that returned both consent and assent forms were included in this study in compliance with the Institutional Review Board of both the participating university and school district. Participants in this study included four ninth grade students, two students receiving services for specific disabilities and two students that were classified as general education. In an effort to maintain confidentiality for the participants, four pseudo names were selected and randomly assigned. The selected pseudo names were Leonardo, Cecil, Racquel, and Bianca. All of these students were being served in a co-taught Algebra I classroom in a minority serving public high school in the southwest United States. Table 1 provides demographic information for all participants (viz., gender, ethnicity, age, grade level, etc.). The table also provides the participants current level of achievement on the state standardized test, Partnership for Assessment of Readiness for College and Careers (PARCC). Additionally, for the two students with identified disabilities, their disability by which the student qualified for special education under the Individuals with Disabilities Education Act (IDEA) is identified.

Table 1
Demographic information for Participants

Student	Disability	Age	Gender	Cultural Background	PARCC Math Score and Level
Leonardo	None	15	Male	Latino	695 (level 1) Does not meet expectations
Cecil	None	16	Male	Latino	706 (level 2) Partially met expectations
Racquel	SLD Reading and Mathematics	16	Female	Latino	710 (level 2) Partially met expectations
Bianca	SLD Reading and EMD	16	Female	Caucasian	695 (level 1) Does not meet expectations

The co-teaching partners for the students were both held state licenses in either Special Education or Math. In an effort to minimize the risk of internal validity errors, all intervention sessions were recorded and reviewed for validity purposes. An independent observer reviewed all videos to ensure the reliability of the dependent measures as well as fidelity of implementation of the two co-teaching models.

Research Design

This study was crafted as a result of previous research findings in the co-taught classroom evidencing that students felt they preferred the One Teach/One Assist co-teaching model over the Team Teaching model (Burks-Keeley, Brown, 2014, Keeley, 2015, & Keeley, Brown, Knapp, under review). In order to test the discovery, a study was designed and conducted in three major phases. The first phase was the determination of on-task and off-task behavior definitions. The lead author attended three separate class meetings for the full class session and collected notes on the behaviors that constituted on-task or off-task for the specific classroom. The list was later compiled and reviewed by the research assistant to determine that the behavior definitions could be “seen” or were “observable” for use as a visual method of data collection for the baseline data. The next phase was the collection of baseline data to evaluate the presence of on-task and off-task behaviors for students in the classroom when no intervention was being implemented. Five separate teaching sessions were video-recorded for 12 minutes. Video-recording was initiated 15 minutes into the start of the class and the middle 10 minutes of video was reviewed for on-task/off-task behavior occurrences. Lastly, the third phase of the study was the implementation of the alternating co-teaching models of One Teach/One Assist and Team Teaching. During the 7 intervention sessions, the co-teaching models were alternated as to which came first and their implementation was recorded for 12-minute sessions.

Baseline Data

Baseline data for this particular study were critical. The determination of the frequency of occurrence of on-task behavior for students in the co-taught classroom under typical circumstances was important when determining a differentiation in behavior when the two co-teaching models were applied. Therefore, the lead author scheduled 5 visits to the classroom prior to data collection to video record 12-minute segments of the class. All baseline video recordings began 15 minutes after the start of the class bell ringing. Teacher participants were instructed to go about their normal teaching routines. The class was designated as a co-taught classroom, therefore, both teachers were present for the entire data collection session. However, the teachers used a One Teach/One Observe model in which the general education teacher served as the lead teacher and the special educator observed.

Response Measure

The dependent variable of student on-task behavior was collected by video recorded sessions and evaluated through observation of the 4 student participants by the lead author as well as the research assistant for reliability. Each intervention session lasted 12 minutes, and fixed interval time sample recording was used to record the occurrence of the target behavior (on-task) at the end of each interval. The fixed interval time sample recording was chosen as it is a superior method for collecting on-task or engaged behavior (Cooper, Heron, & Heward, 2007). Data was recorded for only the 10 minutes in the middle of the recording and on-task behavior was checked every 15 seconds. Therefore, the 10-minute recordings were divided into 15 second intervals and data was recorded for the 4 participants at the end of every 15 second interval (Gast, 2010). Over the 10 minutes session, 40 data points were collected for each participant. Data are reported as the percentage of intervals occurring.

The independent variable in this study was the application of two co-teaching models (i.e., One Teach/One Assist and Team Teaching) for 10 minute alternating sessions. An alternating-

treatments single-subject research design (ATD) was used to determine if the on-task behavior for the 4 student participants varied as a result of the co-teaching model being implemented. The co-teaching model that occurred first was alternated between the two models. Each model was implemented for a minimum of 10 minutes and the alternating treatment occurred during the same class period. Therefore, the co-teachers would teach using One Teach/One Assist for 10 minutes, there would be a short break and then the co-teachers would then teach using Team Teaching. The co-teaching models were not repeated back-to-back. The first session was One Teach/One Assist and after that the models were continuously alternated.

Procedural Integrity and Observer Reliability

Co-teaching model training for the co-teachers and data collection (video recording), was the responsibility of the first author. However, to minimize the risk of internal validity errors an independent observer conducted multiple checks to ensure reliability of the dependent measures as well as intervention fidelity.

The research assistant served as the independent observer in the project. The research assistant was an undergraduate student in Communication Disorders at the time the study was conducted. The research assistant was introduced to the nature of the study, her role in monitoring the reliability of the alternating treatment design data, reliability of the recording of on-task behavior, as well as the fidelity measures for the co-teaching model interventions. Completed prior to the commencement of data collection, the research assistant was thoroughly trained in the observable characteristics that would demonstrate on-task behavior for the purpose of this study as well as the characteristics that would be present for both the One Teach/One Assist and Team Teaching co-teaching models. Further, prior to the collection of baseline data, the independent observer and lead researcher tested the checklists created to determine on-task behavior in order to achieve mutual agreement as well as to test the instrument. Once 100% agreement between observers was achieved, baseline video data was collected.

Scoring reliability on the dependent measure was assessed by the RA scoring a random sampling of the data. The RA inspected 100% of the baseline sessions and 70% of the intervention sessions. Inter-observer reliability for baseline measures was 100% and the intervention phases yielded an agreement level of 95%.

To establish fidelity of the intervention all sessions were video recorded. Both the lead author and RA used a checklist to mark the occurrence of the essential components of the respective co-teaching model for 50% of the total of seven sessions per co-teaching model. For the purpose of this study, One Teach/One Assist is characterized by the following: a) content instruction is the primary responsibility of only one educator present, b) student support, monitoring, answering questions for clarification is the primary responsibility of only one of the educators present, c) if during class, in a formative manner, assessment questions are asked by only one of the educators in the class, and d) evidence of pre-planning is not present in the instructional choices, processes, or teaching configurations of the educators. An inter-rater evaluated the One Teach/One Assist co-teaching model for presence of characteristics for 20% of the sessions with a 100% agreement between observers.

Similarly, for Team Teaching there were five separate characteristics for agreement, for the purpose of this study, Team Teaching is characterized by the following: a) both general and special educator are sharing content instruction responsibility, b) both general and special educator are sharing assessment responsibility, c) evidence of pre-planning is noticeable in instructional choices, processes, or teaching configurations of the educators, d) interactions with student are equally shared by the general educator and special educator, and e) multiple instructional techniques are being incorporated by the general and special educator. Further, an inter-rater evaluated the Team Teaching co-teaching model for presence of characteristics for 20% of the sessions with a 100% agreement between observers. Agreement of 90% or higher is considered a reliable measure (Alberto & Troutman, 2006; Bailey & Burch, 2002).

Data Analysis

Single-subject design research can often reveal information to researchers through a simple visual inspection of the data. In order to determine the degree of difference between two independent variables, the percentage of on-task behavior was calculated. It was hypothesized that there would not be a significant difference between percentage of on-task behavior for the two co-teaching models (i.e., One Teach/One Assist and Team Teaching), but rather that behavior would stabilize as a result of the implementation of the two models.

Results

Baseline

Student baseline data were analyzed to identify their percentage of on-task behavior using the fixed interval time sampling data recording method. Each 10-minute session was divided into 40, 15-second intervals and data was marked at the end of each 15-second interval. Table 1 is a representation of the range of behavior for each participant as well as the mean percentage for on-task behavior during the data collection.

Intervention

Results of each student's on-task behavior during the treatment intervention are presented in *Table 2* and *Figures 1* through *4* in the order in which they were physically placed in the classroom. Absences from participants resulted in missing data points. Specifically, Racquel's absences potentially contributed to the overall difference in her results as compared to the other participants. Unfortunately, due to the nature of the data collection, these absences could not be made up.

Mean Scores for Conditions

This research did not seek to reach a specific level of on-task behavior for each treatment, but rather make note of any differences that may or may not occur as a result of the interventions. Such changes can be the detection of a decreased level of variability when the interventions are applied. Changes in variability are an accepted method for interpreting single subject design research (Wolery & Harris, 1982). With that, a visual inspection of data suggests a decrease in variability of on-task behavior when the treatment of One Teach/One Assist or Team Teaching is applied as compared to baseline data. Further, if the mean scores for each treatment are calculated, then in addition to the visual inspection, statistical analysis also indicates a reduction in variability (standard deviation) of on-task behavior for participants (See *Table 2* and *Figures 1*

through 4). Therefore, what is noted seems to be a stabilizing effect that the treatments have on the participants with regard to on-task behavior.

For example, both Leonardo’s graph (Figure 1) and numerical data suggest an increase in on-task behavior as compared to baseline data (i.e., an increase of 24% One Teach/One Assist; 29.7% Team Teaching; 26.6% Combination) and a decrease in variability (i.e., a decrease of 8.22 One Teach/One Assist; 12.5 Team Teaching; 12.1 Combination). Cecil’s data also suggest an increase in on-task behavior as compared to baseline data (i.e., an increase of 34.2% One Teach/One Assist; 42.7% Team Teaching; 38.4% Combination) and a decrease in variability (i.e., a decrease of 10.5 One Teach/One Assist; 14.3 Team Teaching; 11.1 Combination). Likewise, Bianca’s data suggest an increase in on-task behavior as compared to baseline data (i.e., an increase of 27.9% One Teach/One Assist; 30.3% Team Teaching; 19.4% Combination) and a decrease in variability (i.e., a decrease of 1 One Teach/One Assist; 15 Team Teaching; 7.7 Combination). Contrastingly, Racquel’s data are the opposite from the other participants revealing a decrease of on-task behavior (i.e., a decrease of -1.8% One Teach/One Assist; -9.7% Team Teaching; -19.4% Combination) when the interventions are applied and an increase in variability (i.e., an increase of -8.1 One Teach/One Assist; -10.5 Team Teaching; -8.8 Combination). See Table 2.

Overall, data suggest an overall increase of on-task behavior and decrease in variability for three participants, but a decrease of on-task behavior and an increase in variability for one participant.

Limitations and Implications for Future Research

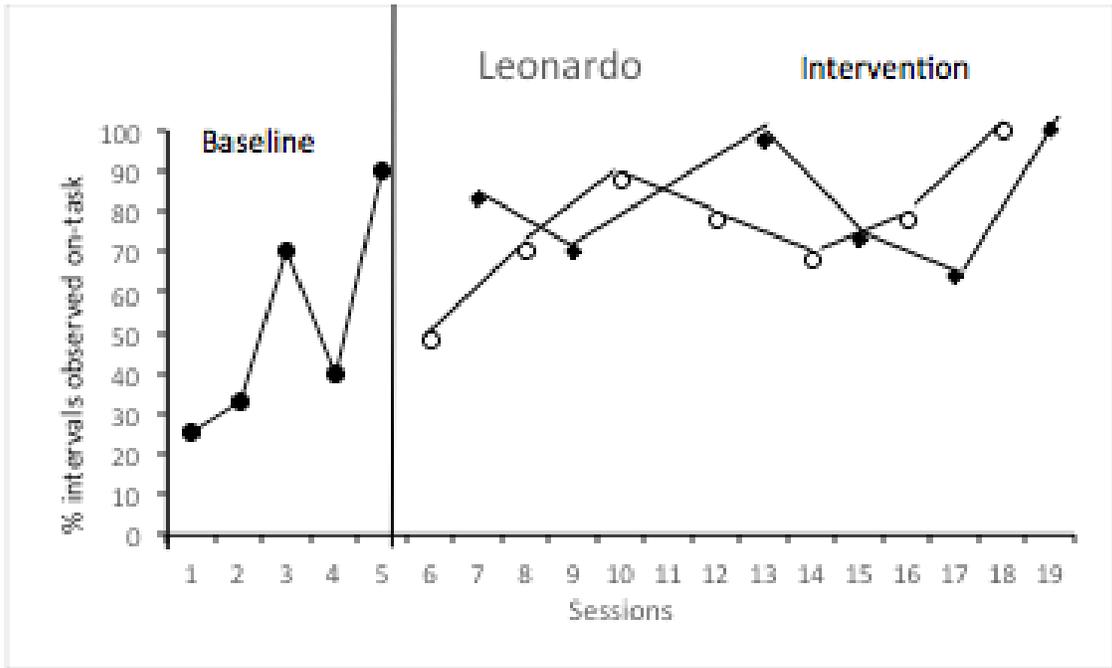
There are certain limitations to this study that should be considered. Single-subject design, particularly the alternating treatment design is inherently accompanied by some specific limitations. Specifically, interference can occur as a result of the rapid alternating treatments across sessions and the design cannot provide abundant information about the effectiveness about one particular intervention (Gast, 2010). Further, time sampling provides only an estimate “behavior frequency duration” and results tend to be underestimates the frequency of the behavior (Gast, 2010, p. 150).

Table 2

Mean percentage of on-task behavior for each treatment (i.e., Baseline (BL), One Teach/One Assist (OTOA), and Team Teaching (TT), mean differences, and standard deviation

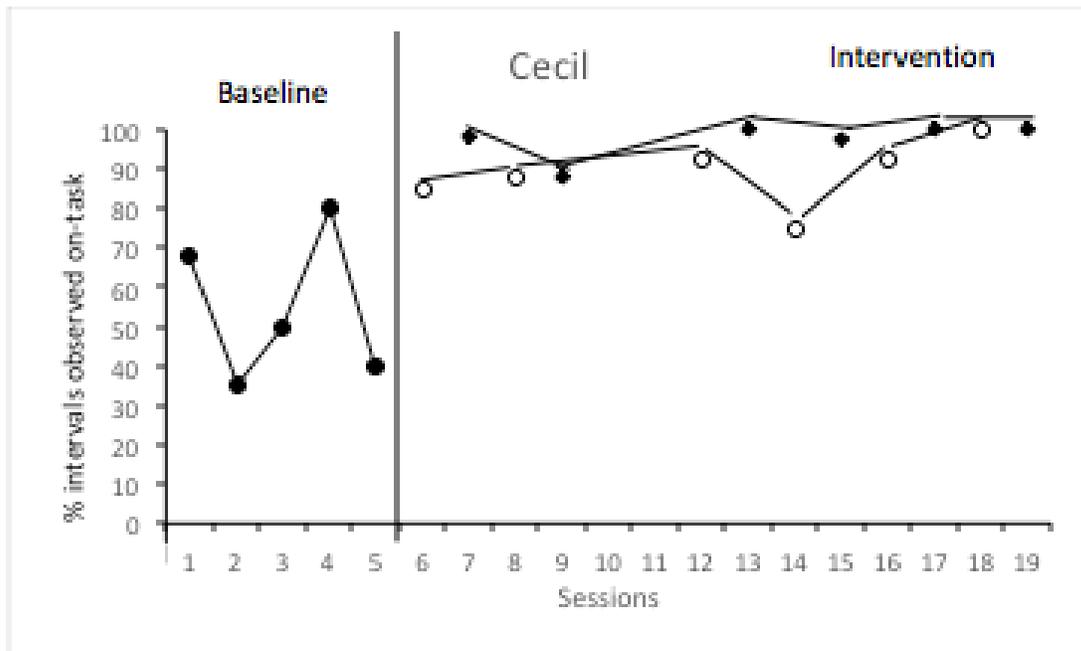
Student	BL Mean	BL SD	OTOA Mean	OTOA SD	TT Mean	TT SD	Combination Mean	Combination SD
Leonardo	51.6	27.4	75.6	16.3	81.3	14.9	78.2	15.3
Cecil	54.6	19	88.8	8.5	97.3	4.7	93	7.9
Racquel	79.8	11.4	78	19.5	70.1	21.9	74	20.2
Bianca	61.2	26	79.5	25	81.9	11	80.6	18.3

Note. Results are presented in percentages.



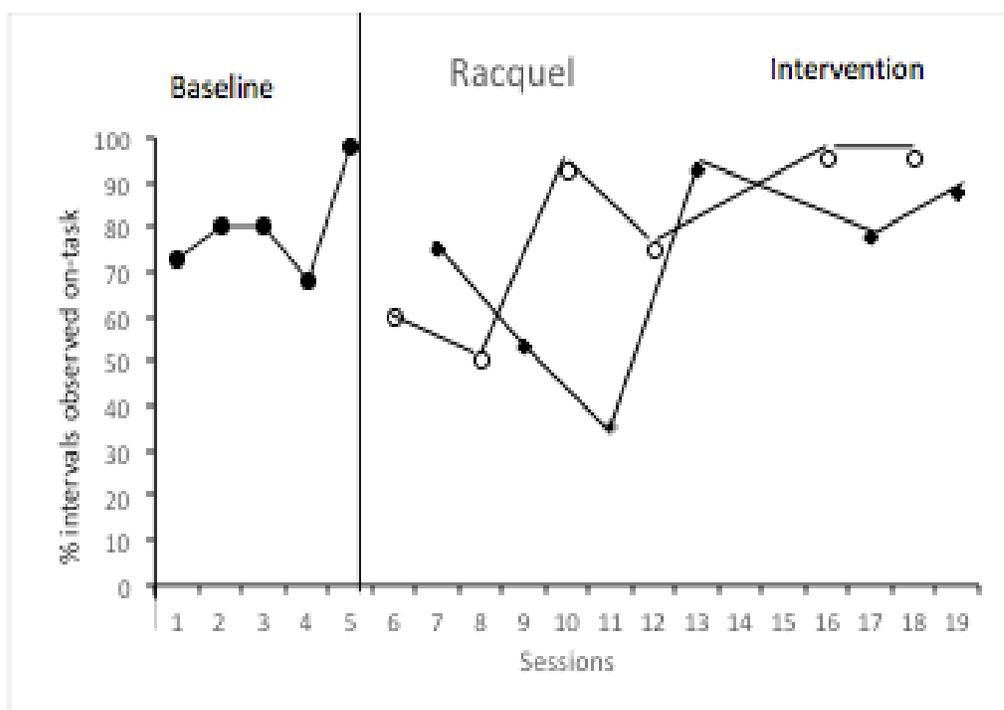
- Baseline
- One Teach/One Assist
- ◆ Team Teaching

Figure 1. Percentage of on-task behavior for Leonardo to include baseline data and One Teach/One Assist and Team Teaching treatment.



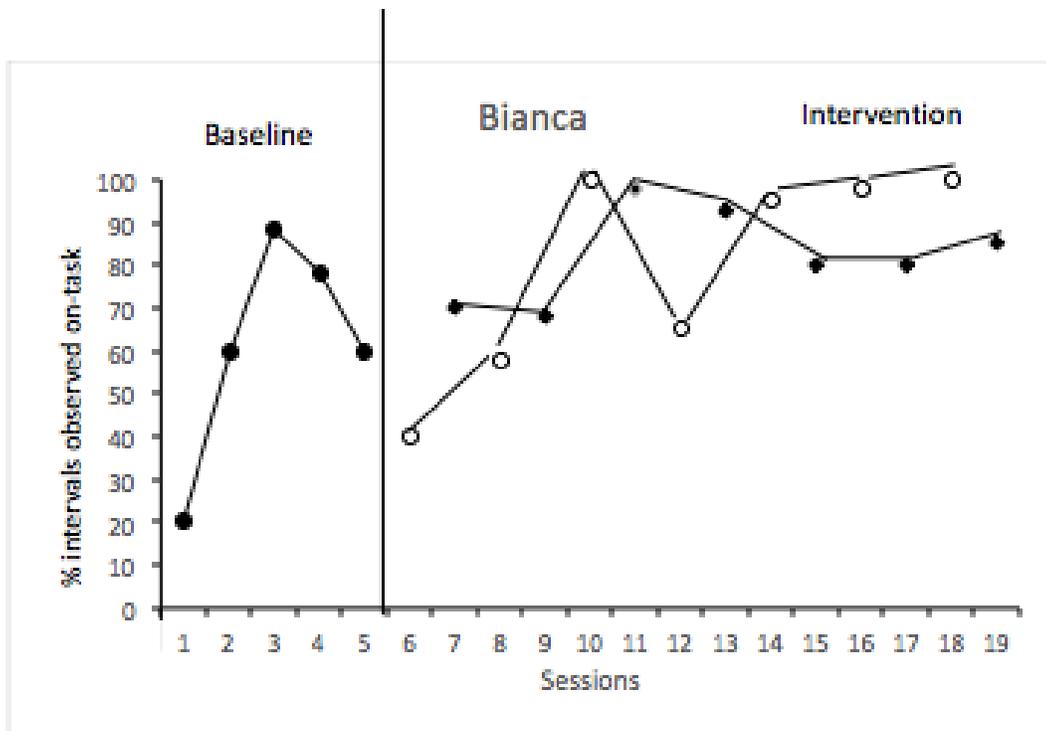
- Baseline
- One Teach/One Assist
- ◆ Team Teaching

Figure 2. Percentage of on-task behavior for Cecil to include baseline data and One Teach/One Assist and Team Teaching treatment.



- Baseline
- One Teach/One Assist
- ◆ Team Teaching

Figure 3. Percentage of on-task behavior for Racquel to include baseline data and One Teach/One Assist and Team Teaching treatment.



- Baseline
- One Teach/One Assist
- ◆ Team Teaching

Figure 4. Percentage of on-task behavior for Bianca to include baseline data and One Teach/One Assist and Team Teaching treatment.

Aside from the inherent limitations afforded the design, other limitations are present. For example, the dates and times for data collection were greatly affected by the elements that were outside of the control of the researchers (i.e., school assemblies, testing cycles, teacher absences, etc.). Therefore, the dates for data collection are not in any pattern and have no real consistency. In addition, the baseline data in this study was highly variable and it is not recommended to conduct an intervention when a high level of variability exists because “strong” conclusions cannot be made (Wolery & Harris, 1982). However, this study was exploratory in nature and did not intend to make definitive conclusions about co-teaching and these two co-teaching models (i.e., One Teach/One Assist and Team Teaching). It is duly noted by the author that the limitations of this study prevent broad conclusions, but also recognizes that this research can contribute to the larger body of research concerning co-teaching in an attempt to further understand this practice from the perspective of the student.

Future research in this specific area would benefit from the over-lapping of specific teaching strategies in conjunction with the application of co-teaching models to determine student on-task behavior when specific strategies are also applied along with the co-teaching models. Further, it is recommended that a treatment intervention not begin until behavior becomes stable; however, this was not possible with the aforementioned time constraints and availability of the classrooms for intervention purposes (Wolery & Harris, 1982). Additionally, some form of academic measure should be collected to complement the strategies and co-teaching models implemented. Finally, collection of baseline data would be extended or modified to ensure fidelity of single-subject research design.

Conclusions and Implications for Best Practice

Initially, this study was designed to determine if a difference existed in on-task behavior when two co-teaching models (i.e., One Teach/One Assist and Team Teaching) were alternated. However, it seems that this study potentially revealed something quite different, yet useful. The data tends to suggest that regardless of the model being implemented, on-task behavior will increase when a co-teaching model is implemented, whether that model is One Teach/One Assist or Team Teaching. By and large, participants experienced increased on-task behavior and an overall decrease in behavior variation when specific co-teaching models were implemented. This would suggest that in a co-taught classroom, whether the One Teach/One Assist or Team Teaching model is implemented it will yield increase on-task behavior of students as compared to business as usual teaching.

The implications of these results are far-reaching because while this small piece of information regarding on-task behavior may seem insignificant in nature, these treatments, at times, suggest a 30% increase in on-task behavior over a ten-minute period of class. This percentage equates to about three minutes. But, over time, these small increases in on-task behavior could add up and become much larger chunks of time for the student and teacher. The implications of these findings, if consistent, could be much more impactful. For instance, in a 60-minute class, these results indicate the potential for an increase of 18 minutes of on-task behavior for the duration of the class. Projecting out, should these results consistently be demonstrated, this equates to 90 additional minutes per week and 3,240 additional minutes per year of on-task behavior. Amazingly, when taken in its entirety this approximates to 54 additional full class periods per

year that a student is on-task. Thus it appears that the implementation of the co-teaching models of One Teach/One Assist and/or Team Teaching may be able to increase time spent on-task for students in a manner that could potentially lead to meaningful gains.

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Let me know if you prefer this.

A Whole Language Reading Intervention: A Case Study

Matthew Glavach, Ph.D.
Warren Pribyl, M.A.

Abstract

The study presents a reading intervention for children having a variety of reading deficits. For this study it was found that most of the children had not responded positively to phonics instruction. Based on brain imaging studies, it has been shown that there are positive changes in the left brains of readers with dyslexia who receive phonemic and phonics training early, thus there has been a strong emphasis on phonemic and phonics training in schools. It is believed that if children receive this instruction early, reading difficulties can be avoided, and children develop into both accurate and fluent readers. The authors see this as valuable, however, they question the continued use of phonics for children who do not respond. While research shows that reading pathways in the right hemisphere register for readers with dyslexia, the authors suggest this could be a strength for a whole language reading intervention. Also, research shows that children with dyslexia are less sensitive to the rhythm of natural speech and that can lead to poor phoneme production and reading failure.

A Whole Language Reading Intervention: A Case Study

Introduction

The authors of *A Whole Language Reading Intervention* present a reading intervention for severely reading-impaired children with a variety of reading deficits. Most of the children had not responded positively to phonics instruction (a strategy for learning letter-sound relationships). When children do not respond to phonics, more of the same only adds to their dislike of reading. The authors consider reading too important to school success to accept this as the only approach for these children. The authors describe their program in the context of today's reading research, which shows that an initial right hemisphere focus with whole language benefitted struggling readers as evidenced by significantly improved reading scores and increase in the number of schools implementing the program.

Their research with hundreds of children shows that when interesting books are presented in an orderly way, using specific reading strategies, including phrase-cued reading and repeated reading, children with reading impairments can become readers who love to read.

The following comment is one of twenty similar comments received from the principals of the elementary schools where the *Whole Language Reading Intervention Program* was implemented.

“I can honestly say that as a principal of seventeen years and as a former reading specialist, I have never before seen such positive results with so many children who have had severe reading problems. I participate in the program by having the children read their books to me when a book is completed. It is an absolute joy to listen to them read with fluency and understanding. One of the most important aspects of the program is the tremendous growth in self-esteem that these children exhibit. They suddenly feel competent, motivated

and excited about reading. Children stop me on the playground to tell me how many books they've read and ask when they can come and read another one to me." *Elementary School Principal*

Review of Literature

Reading Interest

Reading includes recognizing patterns in print, using strategies for sounding out words (phonics), and constructing meaning. Reading involves the brain's limbic system which manages stress. A supportive and safe reading environment reduces stress and promotes interest in reading and motivation to read. (Willis 2008).

Brain Imaging Studies

According to Sally Shaywitz (2003, p.87), "The core problem in dyslexia is phonologic: turning print into sound". Based on brain imaging studies showing positive reading changes in the left brains of readers with dyslexia who receive phonemic and phonics training early, there is now a strong emphasis on phonemics and phonics training in schools. Sally Shaywitz and Bennett Shaywitz, (2003), believe that if children receive this instruction early, reading difficulties can be avoided, and children develop into both accurate and fluent readers.

Sally Shaywitz (2003), classifies struggling readers into two groups: the classic reader with dyslexia was born with a glitch in the left posterior reading systems responsible for rapid, automatic word recognition. This can also affect spelling. The classic reader with dyslexia has strong language skills, but relies on systems on the right side of the brain and the front of the left brain, for accurate but slow and difficult reading. The language deficient reader with dyslexia is the result of a poor language environment and / or poor reading instruction. In this group, the system for reading is there but was never activated properly, and without effective intervention this group remains poor readers (Shaywitz 2003). While both groups of individuals with dyslexia were represented in our case study, the terms struggling reader and dyslexia are used interchangeably in this paper.

Lateralized Cognitive Processes

Both hemispheres of the brain work best together, yet, the hemispheres show different specializations. The left hemisphere involves language production, grammar, syntax, and literal meaning. Neuroimaging research has shown that typical readers use mostly four areas in the left hemisphere, while individuals with dyslexia show under activation in those areas (Helland et al., 2011).

The right hemisphere takes in the whole picture. It learns holistically and processes emotional, rhythmic, intonation, and melodic aspects of language along with humor and metaphors (Toga & Thompson, 2003). Prosodic language includes rhythm, expression, and intonation. These are mostly lateralized to the right hemisphere (Ross & Monnot 2008).

Right Hemisphere Reading Circuits

Research shows that when individuals with dyslexia process print, it follows a pathway to the right hemisphere, where print can be processed, but very slowly (Shaywitz, 2003).

According to Dehayne (2009, p. 259) “After instruction for dyslexia, brain activity often increases in several areas of the right hemisphere at locations symmetrical to those of the normal reading circuit. It seems likely that in the presence of a left hemisphere impairment, equivalent regions of the right hemisphere take over.” This is important because the right hemisphere processes language as a whole.

Whole Language

Based on current brain hemisphere research studies, it seems that children who do not do well with phonemics and phonics might relate to a whole language approach that builds on reading meaning and right hemisphere strengths. Also, important to the approach, Usha Goswami (2003), found that children with dyslexia were less sensitive to the rhythm of natural speech – partly determined by how the sounds in words change through stress and beat patterns. This can lead to poor phoneme representation and reading failure. In whole language, children use print, grammar, and meaning to understand text. While the main focus of whole language is on meaning, our approach for this study uses whole language for learning to read and reading to learn.

At-Risk Readers

Even with the best instructional programs taught by experienced teachers, there are still children who are resistant to learning to read. While the author was working as a curriculum specialist for a county office of education, many schools expressed their concerns about children going into second grade who were still nonreaders. The author met with the special education resource specialist at a local school. They discussed trying a different approach with these children. Because a phonics approach had not worked, they decided to try a whole language approach. Popular children’s books were used and specific teaching strategies were researched. The strategies included: tracking, phrase-cued reading, repeated reading, slower paced reading, and timed reading. The strategies chosen were a combination of the authors experience with teaching reading to struggling readers and research regarding repeated reading in which children are taught to read by reading a text until it can be read fluently. Using a whole language approach and the teaching strategies, children would be taught to read and to understand what they were reading.

Oral Reading

Listening to a child read aloud provides a window to the child’s reading ability. It explains what a child knows and does not know about words (Wolf 2007). “Reading aloud underscores for children the relationship between their oral and their written language” (Wolf, 2007, p. 118). According to Rasinski (2003, p. 21), “It is the expressive reading by the teacher that makes oral reading so special.” Another advantage of the oral reading approach is that one of the brain’s reading pathways responds to saying and articulating each word orally (S. Shaywitz 2003). Reading orally includes multiple sensory modalities. In the program, children learn to read while reading a book orally. They see, pronounce, and hear the words, which helps them remember the words. When children hear oral reading with expression, they have a model for fluent reading.

Reading Strategy 1: Tracking

While the teacher reads, children follow under the words with their dominant hand. This is called tracking. While tracking assures that children focus on the words, it does more: Breznitz

(2006), suggests an asynchrony, a timing gap between the visual and auditory inputs that interfere with reading. Tracking helps children develop a synchronization between phonological and visual components of reading, and develops their eye and hand coordination.

Reading Strategy 2: Oral Reading Fluency

Oral reading fluency is reading text quickly, accurately, and with expression. By listening to the teacher read, children naturally pick up oral reading cues and use them in their reading.

Reading Strategy 1: Repeated Readings

Samuels (1979), described a reading method called repeated readings. In this method, children read a passage several times. After each practice the children's reading rate (wpm) and error rate improves. In repeated readings, children learn to read by reading the text many times. The method transfers to new and more difficult texts and leads to automaticity. According to Lebarge and Samuals (1974), for children to improve comprehension they must work toward automatic and fluent word recognition.

Reading Strategy 4: Reading in Phrases, Phrase-Cued Reading

Phrase-cued reading is a special kind of repeated reading. Struggling readers mostly read word-by-word. Once they become locked into word by word reading, it is difficult for them to read in phrases. "When teachers read a book with expression and natural phrase pauses, readers are helped to read in meaningful phrases and comprehension improves. With practice, this transfers to their other reading material." (Rasinski, 1994, p. 165). Phrase-cued reading provides visual cues, usually a slash (/), to help students follow natural phrases and pauses in a reading selection (Rasinski, 2003).

Reading Strategy 5: Slower Reading

Reading slower helps with asynchrony, the time between when a child sees and hears a word. Breznitz (2006). "Also, researchers found that eighty percent of language-impaired children had auditory cortex neurons that were firing too slowly; therefore, they lost large amounts of language information" (Doidge, 2007, p. 69). "Tallal's research (Doidge, 2007, p. 69) showed that children with language disabilities have auditory processing problems with common consonant-vowel combinations that are spoken quickly, and are called the fast parts of speech. The children have trouble hearing them and as a result, reproducing them accurately." Slowing the presentation can help students keep pace with the reading and help to strengthen weak auditory neurons.

Reading Strategy 6: Reading with Expression

In repeated reading, reading with expression provides a model of good reading. In oral reading, phrasing includes prosodic cues such as delivery, diction, intonation, inflection, and pauses. From the program's beginning, children hear reading with expression. Soon students may be reading with expression, just as they have heard the book read to them. According to Miller and Schwanenflugel (2008), children who read with adult-like prosody in the first and second grades could comprehend text better at the end of the third grade.

Reading fluency, reading accuracy and reading rate, are important to prosody. Poor decoding limits prosody for most young readers. Their timing and phrasing are disrupted. (Schwanenflugel, Hamilton, Wisenbaker, Kuhn, & Stahl, 2004).

Timed Reading (Above First Grade)

Timed reading helps reading become automatic. Putting too much energy into recognizing words interferes with comprehension (LaBerge, & Samuels, 1974). Breznitz, (2008) found that poor readers were characterized by problems with processing speed. Wolf, (2007) describes the most severe reading problems as children with deficits in processing speed and phonology.

Method

A Whole Language Reading Intervention

Participants

The children in the study were in grade one and above. They were a combination of special education and regular education struggling readers. Children were chosen by the resource specialists and classroom teachers based on reading assessment results. The children included were non-readers and children with the lowest reading scores at the school. They were taught one-to-one by trained aides consisting of students, parents, and teachers. There were twenty private and public elementary schools involved in the program.

Development of: A Whole Language Reading Intervention Program

Book Organization

To begin the program, the study chose popular children's books and organized them into reading levels for a smooth transition from one book's reading level to the next. The books started at pre-primer and went through grade four reading levels. The focus looked for certain features in the books. For example, at beginning levels, the features were highly predictable stories with illustrations, rhymes, and repeated phrases.

It was found, that predictable, easy readers worked well. With predictable readers, children have easy-to-read short stories. The pictures in the readers tell the stories. Repeated phrases help children follow and understand the story lines. Repeating the words helps put them into long term memory. The books have many high-frequency reading words. Often, the books include rhyme.

Series books also worked well. Some of the series books we used were:

- *Amelia Bedelia* by Peggy Tarish, (Grade Level: .5 - 2.0) Harper Collins;
- *Mouse Tales* by Arnold Lobel (Grade Level: Primer +) Scholastic;
- *Nate the Great* by Marjorie Weiman Sharmat (Grade Level: 2.0 - 3.0), Dell Publishing;
- *Frog and Toad* by Arnold Lobel (Grade Level: 2.0 - 3.2).

It is recommended that teachers have a set of their own books, or school sets of books after pre-primer, so that they can put phrased-cued markers in the books.

Phrase-Cuing Text

While reading the text, teachers add marks between the natural pauses that occur in and between sentences. Marking is based on the expression and phrasing that teachers hear as they read. One slash mark (/) is made between phrases. Make a slight pause at each phrase marker. Two slash marks (//) are made between sentences. Two slashes (//) are also used at end-of-sentence markers. Teachers pause slightly longer at two slashes (Rasinski, 1994). Two examples of text with phrased-cued markers follow.

Bears

Bears / are big animals. // They are strong. // They have thick fur. //
Some bears / sleep all winter. // They get ready. // They eat a lot of
food. //
Glavach and Associates (2012)

A Lighthouse

It is / a cold night. // The fog / makes it hard / to see. //
A ship / has lost its way. // The people / on the ship / see a light. //
The light / gets bright. // It is from / a lighthouse. //
Now / the ship / can find / its way. //
Glavach and Associates. (2012)

Following are the steps included in the program. The steps were chosen after testing the steps and sequence with a group of twelve non-readers in second grade.

STEP 1: Determine the Reading Level

If teachers know the child's reading level, they start the child with the first book at that level. The child may read at higher reading levels but exhibit problem reading characteristics such as: reading word-by-word, and exhibit difficulties in expression and rhythm. They start children at the level where they exhibit the problem reading characteristics. It is better to start children at an easier level to insure success. Teachers also can administer an easy-to-use reading inventory such as the *Slosson Oral Reading Test (SORT)*.

STEP 2: Introduce the Book

For beginning reading books, teachers go through the book's pictures and discuss what the book might be about. Teachers link the book to information the child knows. For example, if there is a picture of a park, they ask "Have you been to a park?" or "What kinds of things do you see in a park?" For higher level reading books, they discuss pictures and chapter titles.

STEP 3: Tracking

To begin, teachers sit across from the child, tracking on top of the words while the child tracks under the words. After the child is able to track, they sit next to him or her. When they start, the child moves under each word. As children develop, they track smoothly under the phrases. As children gain fluency and their eyes can follow the print, tracking can be used as needed.

STEP 4: Read the Book or Book Part to the Child

For short books, pre primer, and primer, teachers read the whole book. For longer books, they divide the book into parts. For the first reading, read at a slow pace, with expression. (For the second reading, read the same text at a regular pace with expression.) The child continues to track under the words as the teacher reads.

STEP 5: Teacher Reads Book or Book Part with the Child. Child Reads

The child reads the words and phrases with the teacher and tracks under the words. After practice, the child reads alone. The teacher reads words that are difficult for the child and the child continues the reading.

Teachers do not stop to sound out the words. Children do repeated readings with limited, if any, interruptions. If the child is constantly interrupted, he or she begins to anticipate the interruption and the interruptions lead to word-by-word reading.

For difficult parts of books or passages, the teacher reads a sentence, and the child reads the sentence right after the teacher. Then the teacher reads several sentences or more as the child is able. After practice, the child should be able to read the book at a seventy percent correct level.

A Seventy Percent Reading Score: A Path to Success

Most of the children in the program had not read a book successfully. They had developed a failure syndrome, just giving up. The first goal was to help them read a book successfully and experience the joy of reading. To do this, the level of correct words read was 70 percent or better.

Initially, there were questions about the 70 percent correct level. According to Gillet & Temple (2000), a child should read at an accuracy rate of ninety to ninety-five percent or comprehension will be compromised. At a ninety percent accuracy rate, most of the children lose interest and give up. After teachers began to see the excitement and improved self-esteem of the children, most reading their first book, it became obvious that this was an important component of the program. Their success makes the children want to read their books again and again - to anyone who will listen. They see many of the same words again in new books. Teachers also had children review books. As children gain success, their level of correct words read goes up, to 90 percent or better. Teachers made adjustments to book levels as necessary.

STEP 6: Use Timed Reading (Above First Grade)

Timed reading helps the child's reading become automatic and helps with comprehension. For beginning children, the teacher types 50 words from a book or a book part previously read. For more advanced children, the teacher types 100 words from a previously read book or book part. When children are able to read a book part fluently, use that book part to check their reading rates. If the child reads a word incorrectly, the teacher reads the word and the child is not given credit for the word. Children practice until they reach an 80% correct reading or higher. Make a Reading Progress Chart. While reading speed helps coordinate reading components in the brain, the outcome of reading fluency is not to be the fastest reader, but to read fluently with expression and understanding.

STEP 7: Reading Fluently with Expression

The teacher reads the text with expression. Then the child reads the text with expression. This was great fun for them, they loved to read the book with expression just as the book had been read to them.

Additional Activities:

Phonics from Book Context

While most of the children had tried phonics and did not respond well, it was thought there would be benefit to include phonics and spelling in the program. Once a child had completed a book, we developed phonics activities based on the words in the books they were reading. The children responded to the activities. To minimize confusion, the children completed the reading of a book or book part before introducing phonics activities. Writing activities were also included after a book or book part had been read.

Assessment Results

Most children demonstrated solid reading gains. School assessments also showed significant gains in comprehension. While not measured, but noteworthy, is that the children were reading in phrases with prosody. Approximately, twenty percent of the children were E.S.L (English as a Second Language).

Assessment Results

#1: Twenty students received thirty minutes of individual reading instruction daily for one year. See test scores. *Elementary School Principal*

#2: Eighty struggling readers were provided individual reading instruction of thirty minutes every other day for six months. Yearly school pre- and post-test results on the California Test of Basic Skills indicate an average reading growth of eight months to one and one-half year's growth". *Elementary School Principal*

#3: The results for the first few children were so encouraging that the teachers in grades 2 through 5 gave up their classroom aides to implement the program more widely. The program now serves 55 students in grades 1 through 5, about 20 percent of the school population. Staff and parents alike continue to be extremely positive about the results of the program. *Elementary School Principal*

Summary

Current reading research suggests that when children with dyslexia react to print, it follows a pathway to the brain's right hemisphere, and with phonemic and phonics practice, the child's brain repairs itself, and the child reads as a normal reader, using left hemisphere reading components (S. Shaywitz, 2003).

All of the children in this study were already identified as exhibiting difficulties in reading. Most of the children who completed the whole language reading approach that included learning to read and reading to learn became successful readers. Apparently, when some readers with

dyslexia react to print, and the print follows a pathway to the brain's right hemisphere, the children may respond to a whole language approach to reading. The fact that the children's reading, phonics, and spelling ability improved might also suggest that they were beginning to use left hemisphere reading components.

There is still much to know about brain function and reading acquisition. The authors see their research as bringing another approach, another chance for success, to struggling readers who had not responded to phonics.

Table 1
Test Scores, Grade 2

STUDENTS	PRETEST	POST TEST	GAIN
J.V.	.4	2.5	2.1
J.S.	.6	2.2	1.6
J.W.	.3	2.3	2.0
L.H	.1	2.2	2.1
E.M	.9	3.2	2.3
C.S.	.5	3.5	3.0
A.H.	.0	1.2	1.2
M.B.	.6	1.0	.4
R.R	.4	1.6	1.2
K.T.	.4	.6	.2
O.L.	.3	1.6	1.3
J.G.	.4	1.7	1.3
J.A.	.3	1.0	.7
A.B.	1.4	3.4	2.0
W.H.	.1	3.7	3.6
T.D.	.6	3.7	3.1

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Matthew Glavach, Ph.D., Teacher, Researcher, and Writer: Matthew Glavach graduated from Western Michigan University with a major in biology. He received a master's degree in special education from California State College in Los Angeles, California, and a Ph.D. in Psychology. Matthew has taught regular education and special education. He also has taught for Dominican University. He currently works with The Old Schoolhouse Magazine providing on-line reading lessons for children with reading problems including dyslexia. His research and writing include numerous educational programs including *Reading with Donny and Marie Osmond*, an original music based reading program for younger readers, and research articles, including "Breaking the Failure Pattern" in the Journal of Learning Disabilities. More recent research articles include "The Brain, Prosody, and Reading Fluency" and "A Reading Strategy for Content Area Teachers. In 2005, his reading program *Core Reading* was among programs chosen by the National Institute of Child Health and Human Development, NICHD, for a possible visit by First Lady Laura Bush. He is currently on the editorial board of The Journal of the American Academy of Special Education Professionals (JAASEP) an online peer-reviewed journal committed to advancing the professional development of special education professionals.

Warren Pribyl, M.A. Teacher, Researcher, and Writer: Warren Pribyl graduated from Chico State College in 1965 with a Bachelor of Arts Degree. During the ensuing forty-three years (1967-2010) he taught 5th grade, 6th grade, and special education. His work in special education covered a period of thirty-six years (1974-2010) during which time he completed a Master of Arts in special education. Warren worked with Dr. Matthew Glavach at the county office of education on a special reading program, *A Whole Language Reading Intervention*, for struggling readers. The program was based on children's literature. Warren was involved in the development, teaching, and training of the program. Based on the success of the program, he applied for a grant from a national company doing business in the community, and was successful in being awarded a monetary grant to expand the program for English reading students. Because of the documented success of the grant/program, Warren submitted another grant for the next school year, adapting the English reading strategies for use with the Hispanic students experiencing difficulty learning to read in Spanish before transitioning to English. The monetary grant was awarded, with year-end test results showing solid reading gains.

Common Purpose, Uncommon Results: A Literacy Collaboration for a Preschooler with Down Syndrome

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Abstract

This paper describes a single-case study that focused on an intervention to teach sight words to a preschool student with Down syndrome through a collaborative approach in which responsibility for design and implementation was shared by the child's parents and her early childhood special education teacher. The intervention was consciously tailored in response to available research regarding the neurodevelopmental profile of children with Down syndrome. The aim of the intervention was focused on challenging deficit perspectives in special education and highlighting the importance of parent-teacher partnerships. Results indicated positive literacy outcomes, with the student retaining 14 of 22 (63%) sight words introduced as part of the intervention. Recommendations for future literacy interventions for children with Down syndrome and increased home-school collaboration are discussed.

Keywords: home-school collaboration, parent-teacher partnership, Down syndrome, early literacy, preschool

Common Purpose, Uncommon Results: A Literacy Collaboration for a Preschooler with Down Syndrome

“As an educator, I have always valued my children’s education. But, I knew my daughter’s path would look a little different than my son’s. I knew my involvement in her education would be essential. I expected more than just volunteering in her class once a week. I expected true collaboration and working with her teachers for a common purpose – to help Emily become the best she can be.” –Parent & Co-author

Just prior to the beginning of the 21st century, the National Association for the Education of Young Children (NAEYC) collaborated with the International Reading Association (IRA) to present a position paper on reading and writing in early childhood. The statement emphasized the need for reading instruction in the early years and the importance of individualized reading instruction that responds to each student's developmental needs (NAEYC & IRA, 1998). Despite these guiding statements for early childhood educators and policy-makers, the data from the most recent National Assessment of Educational Progress (NAEP; 2015) showed poor success rates on national reading achievement. The NAEP reported that only 36% of fourth-grade students are reading at or above the “proficient achievement” level. Also alarming, the 2015 NAEP report found only 12% of fourth grade students with disabilities are reading at or above proficiency

(NAEP, 2015). This dim outlook on reading achievement illustrates a clear need for improved individualized interventions in early childhood, specifically for children with disabilities.

This case study focuses specifically on a reading intervention for a child with Down syndrome. Trisomy 21-nondusjuncture is the most common form of Down syndrome in which an individual is born with three copies of the 21st chromosome, resulting in a total of 47 chromosomes in each of the individual's cells (National Down Syndrome Society, n.d.). The presence of this extra chromosome often leads to difficulties in areas of learning, which can lead to delays in skill acquisition (Down Syndrome Education International, 2017). However, reading is a potential area of academic strength for children with Down syndrome (Appleton, Buckley & MacDonald, 2002). Relatedly, research has shown that students with Down syndrome can acquire sight words at a rate that is higher than expected (Byrne, MacDonald & Buckley, 2002) and at speed naming rates comparable to cognitive-same aged peers (Ypsilanti, Grouios, Zikouli, & Hatzinikolaou, 2006).

In early childhood education, literacy instruction is primarily focused on pre-reading skills such as awareness of print, exposure to print, and learning letters and their associated sounds. In addition to a focus on pre-reading skills, the intervention was designed with the purpose of highlighting the importance of parent participation in planning services and supports in special education. Numerous studies have shown a correlation between the involvement of parents in interventions and improved student progress (Flynn, 2007; Henderson & Mapp, 2002; Topor, Keane, Shelton & Calkins, 2010). It is also important to note that research on parent involvement has influenced disability policy and in 2004, the Individuals with Disabilities Education Improvement Act (IDEA) stated:

“The education of children with disabilities can be made more effective by strengthening the role and responsibility of parents and ensuring that families of such children have meaningful opportunities to participate in the education of their children at school and at home...” (IDEA, 2004).

Given connections between parental involvement and a child's reading development, suggesting a partnership between the teachers and parents of children with Down syndrome may contribute to their reading success is no exception (Senechal & Young, 2008; Ricci, 2011). Studies indicate that parents of children with Down syndrome believe their children are interested in reading and that reading is an important academic goal (Al Otaiba, Lewis, Whalon, Dyrland, & McKenzie, 2009; Ricci, 2011; Ricci & Osipova, 2012). Indeed, these families often advocate specifically for their child's literacy instruction (Fidler, Lawson, & Hodapp, 2003) and they set high expectations in the area of reading development (Ricci & Osipova, 2012). Ricci & Osipova (2012) have urged educators to “build upon this knowledge and build home/school partnerships with families to support the reading progress of children with Down syndrome in their classrooms” (p. 128).

Such ideal partnerships, however, face difficulties within a system where the achievement of students with different abilities is viewed through the lens of deficiency. For one, special education services and supports are only provided to students who are found eligible, determined by displaying a deficit or delay. Also, the legalese of special education law is framed around the

remediation of such delays and lacks encouragement to support the areas of strength that children with disabilities have. Contrary to a deficit perspective, there is a growing body of literature that rejects disability as a limitation (Annamma, Connor, & Ferri, 2015; Colker, 2013; Collins, 2013). There is also support that disability has both biological and social roots which require careful consideration of the individual. As Anastasiou, Kauffman, and Michail (2016) state, “There is great diversity in types and degrees of disability, and this diversity makes generalization inappropriate” (p.5). Drawing from this literature, the intervention described in this paper adds support to a perspective shift away from deficit, rights-based planning and instead, to strengths-based, student-centered planning to provide services and supports beyond what is required by special education law. Further, research on the neurodevelopmental profile of students with Down syndrome guided many design decisions; however, careful consideration was given to individual preferences and interests of the student. As such, what follows is a description of the jointly planned effort to implement a reading intervention program, provided over a six-month period in both home and school, meant to contribute to the success for a preschool child with Down syndrome.

Method

Participant

Emily (pseudonym) was diagnosed with Trisomy 21-nondisjunction prenatally. At the time the intervention began, Emily was 5-years-old and was enrolled in an early childhood special education preschool that offered a reverse inclusion classroom environment, enrolling students without disabilities as “model” students. It was her second consecutive year in this preschool program with the same teacher. She was receiving preschool as a special education service under the eligibility category of “developmental delay” at the time of intervention. Emily had received speech and language therapy prior to the intervention both within the local school context and in the community. Her baseline early literacy skills were observed prior to the intervention start date. She was able to recognize her name from a list of twelve names and identify seven capital letters and four lower-case letters in isolation in both the home and school environments. Her expressive language ability, as measured by PLS-5 Preschool Language Scale (5th ed.) demonstrated an age-equivalency level of three years, one month.

Design

The available research related to the neurodevelopmental profile of children with Down syndrome provided guidance on how to best customize a literacy-based intervention. Children with Down syndrome appear to do better on spatio-sequential tasks (Frenkel & Bourdin, 2009; Laws, 2002; Vicari, Bellucci & Carlesimo, 2005). These tasks, Frenkel and Bourdin (2009) describe, highlight the relative strength of non-verbal short-term memory as well as a storage capacity in individuals with Down syndrome that is comparable to peers of the same developmental age. Further, visual memory and visual discrimination are also comparable to same age peers (Appleton, Buckley, & MacDonald, 2002). Based on these neurodevelopmental characteristics, Emily’s parent and teacher chose the identification of sight words as an appropriate target intervention task.

Once the use of sight words was determined to be a potential strength for children with Down syndrome, a review of additional research guided tailored accommodations to the intervention. Specifically, adjustments were made to a) the sight words selected for use; b) the number of

exposures of each word per session and over time; c) appropriate length of time to wait for verbal response; and d) methods for responding to incorrect responses. The impact and implications of the decisions to make these adjustments is discussed following the results.

Sessions

Protocols for sessions were co-written by the teacher and parent to assure session consistency of procedures and use of common language between home and school (see Figure 1). Each session occurred within a ten-minute time span and included a review, practice, and activity component. A model session using the protocol was video recorded and reviewed throughout the intervention to ensure continued quality of the sessions over time. Sessions were expected to occur three times a week both at home and in school for a total of six sessions every seven days and the intervention was implemented for six months. Home sessions were parent-directed, although they occasionally included Emily's older brother who followed directives from a parent. School sessions were teacher-directed and occurred in the early childhood special education classroom setting Emily was attending daily.

Before beginning the session	Pre-assessment	<i>For all 5 WORD FLASHCARDS, prompt: “What word is this?”</i>
		Within 3 seconds, If answered, place a + sign in the “no prompt required” box.
		If unanswered, at 3 seconds, ask again, “What word is this?”
		Within 6 seconds, if answered, place a + sign in the “prompted after 3 seconds” box
		If unanswered, at 6 seconds, ask again, “What word is this?”
		Within 10 seconds, if answered, place a + sign in the “prompted after 6 seconds” box
		If unanswered, say the word aloud and mark a - sign in the final box
During the session	Practice	Using DATA SHEET 2 and two words marked with a – (unidentified) from previous step
		For both WORD FLASHCARDS prompt: “(Student), we are going to work on your sight words together.”
		“This word is (WORD). Can you say it after me?” “(WORD)” Can prompt: “Your turn to say it.” <i>Place a tally in column 3 for exposure</i>
		“Great. Now let’s say it together three times.” (while pointing at flashcard together)
		Let’s look at the letters in this word (Show WORD). <i>Place a tally in column 3 for exposure</i>
		Review letters in WORD (Include saying the letter, repeating the letter out loud and/or saying the letters together)
	Activity	<p>“Let’s have some fun building your two words.”</p> <p>Once parts are out, present the words again.</p> <p>“Here is WORD 1 and here is WORD 2.” <i>Place tally in respective column 3 for each word for exposure</i></p> <p>Complete building tasks noting in column 2 for student interaction and completion.</p> <p><i>Tasks are completed for both words and within 6 minutes.</i></p> <p>Note: Cleaning up can be completed when the session is over rather than immediately after activity.</p>
	Practice	“You worked really hard today! Let’s practice our words again.” <i>Do not tally exposure from review session.</i>
		For both WORD FLASHCARDS prompt: “This word is (WORD). Can you say it after me?” “(WORD)” Can prompt: “Your turn to say it”
		“Great. Now let’s say it together three times.” (while pointing at flashcard together)
		“Sight word time is so fun. Thanks for playing. Let’s clean up.”

Figure 1. Script of sight word sessions.

Data collected from sessions were used to measure current progress and to guide word selection as well as a method to observe patterns of word identification that could contribute to understanding Emily's progress and inform future interventions. Data collection sheets (see Figure 2) were maintained during each session by parent or teacher so information about the subject's achievements and progress with the sight words would be communicated between home and school daily. This data included the retention of words Emily correctly identified in previous sessions as well as tracked the introduction of new words, recorded the length of time until a correct response, and documented exposures. "Correct identification" was defined as the subject saying the word in less than ten seconds from when it was first presented. "Retention" was defined as the correct identification of a word over six consecutive sessions. "Discontinuation" of a word was defined as a word that was not correctly identified within the exposure limit. An "exposure" was defined as the sight word being visually presented either before or during the session. The exposure limit was set at fifty exposures. Sight word flashcards were divided into the following categories: "Words I Am Learning", "Words I Will Learn", and "Words I Already Know"—a format used by others to teach sight words (Vanalst, 2013). Five words were included in the "Words I Am Learning" category. Each time a word was moved into the "Words I Already Know", a new word from the "Words I Will Learn" replaced it. Data collected from sessions was used to measure current progress and to guide word selection as well as a method to observe patterns of word retention and/or discontinuation that could contribute to understanding Emily's progress and inform future interventions.

Before Session				
Date: _____				
Location: (Home or School) _____				
Instructor: _____				
WORDS I AM LEARNING	No prompt required	Prompted after 3 seconds	Prompted after 6 seconds	Correct answer (+) Other answer (—)
During Session				
Hands-on activity used in session: _____				
Note: Word must have been removed from sight and presented again to count as column 4 tally.				
WORDS USED	Record engagement: Working on letters & Hands-on Activity	Notes about practice or activity	# of times teacher/parent presented word in session	

Figure 2. Data collection sheets for sight word sessions.

Multisensory activities were chosen to allow for hands-on practice in spelling the sight words. All of the activities contained a common exploratory component in that they required touch interaction with the materials. This exploratory element was added to the intervention based on the positive results yielded from a 2012 study examining the acquisition of sight words utilizing a multisensory approach (Phillips & Feng, 2012). The activities were created with the intent that they could be changed and adapted throughout the study to maintain student interest and motivation and each activity was something Emily had demonstrated a preference or interest for. Activities included, but were not limited to, letter magnets, wiki sticks, dry-erase markers and a white board, connectable blocks labeled with letters, and paper shapes that formed letters.

Two identical program bags (one for home and one for school) were used for sight word sessions. Printing Emily's name and the words "Sight Word Bag" in her favorite color individualized each bag according to her preferences. The bags were used to organize materials, create a sense of consistency between home and school sessions, and increase Emily's ownership and motivation during the intervention. The program bags contained three items: 1) thirty sight words in flashcard format, 2) five hands-on activities, and 3) the scripted protocol and data collection sheets.

Results

Over the course of 188 days (approximately six months), Emily participated in a total of 91 intervention sessions. She retained 14 out of 22 (64%) introduced sight words at a rate of .52 words per week. Figure 3 displays a visual of the time between the first correct identification of a word and retention/discontinuation. For example, the word "for" was used twelve times before correct identification. Then the word was intermittently correctly identified over its next seven sessions. Finally, the word was correctly identified six consecutive times, warranting retention. As another example, the word "and" was correctly identified in the fifth session it was used but was not correctly identified six consecutive times before reaching the exposure limit; therefore, it was discontinued.

Table 1 displays data specific to the words Emily retained during the intervention period. Of note, the number of exposures may exceed the number of sessions given that the word could be exposed multiple times per session. For example, “for” was used in twenty-five sessions prior to retention (see Figure 3) but it was exposed a total of thirty times during those sessions (Table 1). On average, Emily correctly identified sight words for the first time after 11 exposures and retained words after an average of 26 exposures. Additionally, out of 121 total correct identifications of words that were retained, 26% of the exposures (n=31) were correctly identified only when she was given more than three seconds. This suggests preschoolers with Down syndrome may need to be permitted lengthened response time during speed-naming tasks, practice, and assessment. Table 1 also displays the number of times a retained word was used in the activity by setting, averaging three uses for both home and school settings.

Table 1
Retained sight words by exposures and setting

	Retained Words			Settings	
	Exposures before correct identification	Exposures prior to retention		# of uses in home sessions	# of uses in school sessions
a	4	15	a	3	0
down	4	20	down	2	3
it	17	44	it	5	5
my	14	22	my	2	3
look	5	28	look	3	4
for	17	30	for	5	3
his	28	48	his	8	4
I	20	33	I	4	6
up	5	9	up	2	0
of	11	15	of	1	3
to	12	32	to	3	5
she	10	37	she	5	3
little	4	12	little	3	0
go	4	12	go	2	1
Average:	11	26	Average:	3	3

Table 2 displays data specific to words discontinued during the intervention period. On average, Emily still correctly identified these sight words for the first time after 11 exposures; however, she did not then retain the words prior to reaching the set exposure limit. Table 2 also displays

the number of times a discontinued word was used in a session, averaging six uses in the home setting and four at school.

Table 2
Discontinued sight words by exposures and setting

Discontinued Words			
	Exposures	Setting	
	Exposures before correct identification	# of uses in home sessions	# of uses in school sessions
away	14	8	2
and	4	6	4
in	8	9	4
can	0	6	6
you	16	6	6
with	45	8	4
not	0	1	4
be	0	3	2
Average:	11	6	4

Six months after the program’s end, a follow-up assessment revealed Emily could still identify each of the 14 words she had retained during the intervention. Additionally at the end of her kindergarten year—one year after the program’s end—she correctly identified each of the 14 words retained during the intervention and had added an additional 17 words by using the same model with words required from the kindergarten curriculum expectations for a total of 31 known sight words.

Discussion and Implications

This intervention surpassed expectations and offers promise for follow-up studies using a similar commitment to home/school collaboration and encouragement to better customize learning based on individual students. It emphasizes students as capable and family-teacher partnerships and participation as valuable with a necessary, important focus on improving academic achievement for students with different abilities.

Records of sight word acquisition have shown that students with Down syndrome can learn sight words at the same rate as their typically developing peers; a few even outpace their peers (Appleton, Buckley & MacDonald, 2002). One of the key reasons for the success of sight word instruction is its ability to leverage particular strengths within the neurodevelopmental profile of children with Down syndrome (Dehghan, Yadegan, Shirazi, & Kazemnejad, 2004). While this study did not compare Emily’s rate of sight word acquisition to her peers, we can assess the rate of word retention compared to expectations for same-aged peers. In kindergarten, if children are

expected to learn a total of 20 sight words, as is common practice in the county schools in which Emily attends, this represents an expected trajectory of .56 words per week (based on an average of 36 weeks in a typical public school year) or, one word every other week. Emily's rate of word retention in this intervention was .52, or, approximately one word every other week. At a continued rate of .52, Emily would be expected to obtain 18.72 words by the end of her kindergarten year, a number almost equal to the 20 word expectation. If those words were in addition to the 14 words retained from preschool, this would represent a total 60% higher than the kindergarten expectation. These projections were confirmed: at the end of her kindergarten year, Emily exceeded the kindergarten expectation of 20 words with a total of 31 retained words. The finding suggests that structured, intensive intervention can help prepare students with disabilities to be kindergarten ready in the area of pre-reading skills.

Another key finding is related to the wait time allotted for Emily to correctly identify a word. In kindergarten assessments, it is common practice to provide approximately three seconds to identify the sight word shown to a student. However, in Emily's case, 26% of the words she was exposed to were correctly identified only when she was given more than three seconds. This suggests preschoolers with Down syndrome may need to be permitted lengthened response time during speed-naming tasks, practice, and assessment.

Finally, this intervention was meant to operate not just within the technical structure of a project, but also within Emily's social relationships and network (Wenger, 2010). While the authors recognize Peter McLaren's assertion that, "the ability to read and write in no way ensures that literate persons will achieve an accurate or 'deep' political understanding of the world and their place within it" (McLaren, 1992), the authors found that the Emily's progress in sight word recognition did in fact yield changes in her identity. Gee (2004) writes that identities within educational institutions are often a root cause of diminished expectations. Throughout the intervention period, Emily identified her sight word sessions as a positive experience and always appeared to look forward to sessions. She began self-identifying as a "reader" and would confidently demonstrate knowledge of the words in her "Words I Already Know" deck of cards to all willing listeners. Declaring herself a "reader" will be important to Emily's understanding of her place within the world and believing in her own abilities, challenging current diminished institutional expectations, and defining future expectations others may have.

Limitations

This intervention suggests isolated sessions focusing on sight word instruction had a positive outcome for Emily. There are, however, limitations that affect the transferability of the intervention itself to other students if demographic variables impacted progress. Emily's parents are both highly educated and the school she attended at the time was privileged with resources and supports congruent to an upper middle-class environment. Also, data was only collected by the teacher and parents, which may have created biases in data collection despite several consistency measures put in place. It is important to make the caveat this intervention was not intended as a widely used protocol. It was, instead, intended to add to the literature related to the importance of parent-teacher partnerships in the design and implementation of academic interventions for children with disabilities. In this regard, the results suggest this is an informative exemplar for other students, parents, and educators.

Conclusion

Teachers are consistently challenged to engage in innovative practices and expand possibilities for parent involvement in student learning. Future intervention designs and implementation of meaningful intervention require a fundamental shift in two ways. First, interventions for students with disabilities should be developed with a focus on their academic strengths to produce progress with an end goal of over-achievement rather than focusing on a student's deficits to produce progress with the goal of baseline remediation. In Emily's case, this meant identifying her strengths using the learning profile of children with Down syndrome to target areas of possible individual academic success. Second, parents and educational institutions should approach learning as a co-constructed shared responsibility. This focus on literacy intervention in more than one context (home and school), where teachers and parents were simultaneous partners in design and implementation was associated with positive outcomes.

Emily recently finished her kindergarten year in an unforgettable event: she stood in front of 19 of her peers and their families and read a book she authored and illustrated, titled "My Dad." She read with equal amounts of confidence and fluency in comparison to her classroom peers amongst an audience teary with pride and support. At the outset of this sight word collaboration, the authors set the joint goal that Emily would be a reader. Together, the authors created a specific and individualized plan based on Emily's strengths. Together, the authors worked diligently and consistently. Together, the authors helped Emily become a reader. With a common purpose, the authors yielded uncommon results and hopefully changed the path of Emily's future by helping her – and those that are involved in her educational planning – see that anything is possible.

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Educational Policy: Instruction and Assessment

Christina M. Sorrentino, M.S. Ed

Abstract

A challenging educational issue, which has in recent times been overlooked in the educational community, is what should be the relationship between instruction in the classroom and assessment at the end of the school year. Specifically, the educational issue concerns special education students in general education classrooms. Researchers within the field of education have come to understand the most beneficial method to ensure student progress at the high school level is for there to be a parallelism between instruction in the classroom and assessment at the end of the year. This paper presents an argument criticizing the existence of non-alignment between instruction in the classroom for the high school science curriculum and end of the year assessment. This research critique of educational policy provides new incite to how non-alignment is present between instruction and assessment, but it is possible for changes to be made to the educational policy.

Educational Policy: Instruction and Assessment

The purpose of the persuasive research paper is to call attention to an educational issue concerning the lack of existence of alignment between instruction in the classroom and assessment at the end of the school year in public high school classrooms, specifically concerning instruction and assessment for science. Additionally, an objective of the research is to provide incite for how alignment can be improved between instruction and assessment in New York State. Although the intention of alignment exists, or the idea that alignment does in fact exist, the issue of alignment not being present with regards to instruction and assessment for science still needs to be addressed during the present time.

Alignment in the context of the persuasive research paper relating to the educational system of instruction and assessment is defined as all components making up the system to come together and relate to one another. The components of instruction and assessment need to be coordinated as to establish a system which strives to reach a single, common goal. The goal is for students to become educated and to attain high levels of performance on end of the year assessments (La Marca, Redfield, Winter, Bailey, & Hansche, 2000). “Ultimately, alignment refers to how well all elements in a system work together to guide instruction and student learning” (Webb, 1997, p. 4).

The No Child Left Behind Act calls for all students to be able to progress on to the next grade level by achieving satisfactory grades on state assessments, but students cannot move forward in their school career if they fail to meet up to the necessary standards for state assessments. The current educational policy for instruction and assessment is not meeting the goals of the No Child Left Behind (NCLB) Act of 2002, especially for special education students in general education high school science classrooms. Additionally, federal legislation has existed since 1994 that mandates states to assess students based on alignment of standards, but states, such as New York are failing to meet up to the goals of the U.S. Department of Education (Rothman, 2003).

Alignment in classrooms is pertinent to both teachers and students. There is persuasive evidence that students benefit when alignment exists between instruction in the classrooms throughout the year and assessment at the end of the year. There are a magnitude of students, specifically the students with special needs that are learning in inclusive classrooms, who are being negatively affected by the existence of non-alignment between instruction and assessment. However, general education students as well will be impacted negatively by receiving instruction that lacks parallelism with end of the year assessment. The goal of teachers is to help their students to have the opportunity to perform well on assessments based on practice throughout the school year, which should go hand in hand with assessment. When instruction and assessment do not share a relationship then we find that students fail to meet up to expectations for certain passing grades on end of the year state assessments.

The significance of the research is to address the educational issue of there being a lack of alignment between instruction and assessment relating to the subject of science, specifically earth science, living environment, and chemistry. Earth science is a subject that is taught to students in New York State, and the methods by which students are assessed does not match up to how they are instructed throughout the school year, with regards to laboratory practice. Additionally, for the subjects of living environment and chemistry the method of evaluation with regards to the students' knowledge of laboratory concepts is not aligned with how they are taught about such concepts throughout the school year in their laboratory classrooms. It is pertinent for it to be made known that if students are expected to perform well on regents examinations given to them after completion of a course then states, specifically New York, should be obligated to ensure that instruction and assessments align with one another. Policy makers must be made aware that the current methods for instruction and assessment for the subjects of earth science, living environment, and chemistry do not align with each other. The U.S. Department of Education has intended for students to not only have the opportunity to be promoted to the next grade level, but to be able to have the ability to move on to the next grade level in high school.

The research paper provides valuable information demonstrating how the current educational policy for instruction and assessment in New York State fails to meet the goals of the No Child Left Behind Act, and other objectives mandated by the U.S. Department of Education. Examples illustrating the lack of presence of alignment in New York State's public high schools concerning the subjects of earth science, living environment, and chemistry will be shared in the paper. Additionally, methods of instruction and assessment that are aligned in other states will be discussed, and how such methods are beneficial to teachers and students. Additionally, such methods will demonstrate how the proper alignment of instruction implemented by state standards and then end of the year assessment fulfills the overall objectives of the U.S. Department of Education concerning how all students are required to have the opportunity to be able to leave their current grade level and then move on to the next step in their education career. Suggestions will be given with the goal of providing means to ensure the presence of alignment in New York State's public high schools, and how students will only benefit from an improvement in the current educational policy.

It is imperative that policy makers understand that alignment between instruction and assessment needs to exist for students to even have a chance at passing their New York State Regents

Examinations. If the state standards call for students to learn throughout the year certain material in a specific way, and then such a method is not utilized on their examinations the students will have a much lower chance of performing well on the test. It must be known that an educational policy which includes a lack of alignment for instruction and assessment only hinders the performance of students, and will provide false information with regards to students meeting standards. If students are not being taught in a way similar to how they are assessed then results may illustrate an incorrect picture for what students know concerning the content matter (Rothman, 2003).

The hypothesis is that when instruction and assessment are aligned with one another, specifically in New York State, then overall students will perform better on their Regents examinations. For example, if students taking earth science at the end of the course are taught throughout the year by their teachers to work together in groups for laboratory practice then they will perform better on the Regents examination if they are allowed to work in groups for the laboratory practical component of the Regents examination. Additionally, if an English Language Learner (ELL) student is instructed in the laboratory setting in the English language and his laboratory assignments are given to him in English, but his end of the year regents examination is provided to him/her in another language then anti-parallelism exists between instruction and assessment. The student would have a more significant chance of scoring higher on the Regents examination if he/she was provided with an opportunity to learn certain subject material in his/her native language and then tested at the end of the year in his/her native language as well. Students should be instructed in the same way that they are assessed on their end of the year examination.

Educational Policy: Instruction and Assessment

Instruction in public high school classrooms in the state of New York fails to align with mandated end of the year assessments. There is no argument against curriculum being designed to allow students to be able to take an end of the year assessment relating to the knowledge that they have acquired from participating in a high school science course. The instruction provided to students with regards to content being learned does match up to state mandated end of the year assessments, but the problem that arises is how the act of instructing does not align with end of the year assessments. An example of instruction not being parallel to final assessments at the end of the year is students being taught to work in groups in a laboratory setting to complete experiments. The science Regents examination for New York State, specifically for the subject of earth science, does not permit the students to work together in groups to take their laboratory practical. Throughout the year, students work together in small groups to complete laboratory experiments. They learn about what is involved in completing such experiments, but then when they are tested on their knowledge with regards to earth science laboratory concepts they are expected to take an exam without any assistance from their peers.

Another defined example of the anti-parallelism that exists between instruction and end of the year assessment is how students are taught and then tested on their knowledge of living environment concepts. Students are taught during the school year how to work together to conduct experiments and certain laboratory practices concerning the subject of living environment. In comparison with the earth science regents, although there is no practical for the subject of living environment, the students are still tested on their final assessment as individuals

or alone. Students are expected to become familiar with certain concepts that will be tested at the end of the year, but if students are taught specific concepts in small groups there is reason to believe that those same students understand such concepts and remember the concepts better if they are assessed in the same way that they have been instructed throughout the year.

The method of instruction and assessment for the subject of chemistry is the same as the method of instruction and assessment for the subject of living environment. Students are taught by their teachers in small groups which allows them to work together to conduct experiments, and to then answer questions based on their knowledge of chemistry laboratory concepts. Students again are familiar with working in groups to learn about chemistry laboratory concepts, but then at the end of school year in June the chemistry Regents examination calls upon students to take the regents examination by themselves, working independently on the exam.

The end of the year assessments, specifically the regents examinations for science, expect students to have the ability to work alone to answer questions relating to the laboratory component of their courses. Earth science students are expected to take a laboratory practical alone, which involves them being assessed on previously learned laboratory concepts that were taught to them while they worked together in small groups in their laboratory classroom. Although towards the end of the school term students are provided with the opportunity to test their knowledge of laboratory concepts alone, it is not reasonable to consider it to be adequate enough practice to master such concepts.

Students are not permitted to take the regents examination for living environment and chemistry in groups, which once again illustrates how the final assessment for students does not align with instruction. Students are expected to work independently on the end of the year assessments and recall knowledge that was taught to them while working in small groups in the living environment or chemistry laboratory classroom. Concepts taught are tested on the final assessment at the end of the year, but the concepts are not being tested in the same manner of which they were taught to students.

Another example of evidence of non-alignment between instruction and assessment pertaining to how students are taught in the laboratory setting and then assessed at the end of the year concerns ELL students. An ELL student is taught scientific concepts pertaining to the laboratory component of a science course in the English language, but then he/she is provided with the opportunity to take the earth science regents practical, or another science regents examination in his/her native language. A student is learning concepts in a foreign language, but then is expected to have the ability to recall such knowledge, but in his/her own language. Instruction and assessment in two different languages illustrates clear evidence of how teaching and then how a student is being tested on content matter is not aligned in the public school system.

The observation can be made based on review of instruction and assessment in public high schools that instruction and assessment are not parallel with one another. The public school system fails to properly align the method by which concepts are taught to students with the method by which students are assessed on such concepts. Researchers believe that non-alignment is present within the public school system, and at the present time students may have the opportunity to learn, but they cannot truly demonstrate what they have achieved due to such

an issue. Students, as a result, may perform very well in the classroom and appear to be progressing with the amount of knowledge being attained, but if students are not being assessed in a manner that is familiar to them then assessment will not illustrate their true knowledge (Martone & Sireci, 2009). For example, students may appear to be performing laboratory procedures well, and seem to have a significant understanding of scientific concepts as they work together in groups, but then when they are tested at the end of the year individually, results may show a different conclusion. Evidence suggests that students did not learn the material efficiently, but there is reason to believe that if the students are assessed in the same manner that they are taught then results will be more positive.

According to Roach, Niebling, and Kurz (2008), instructional programs, state-content standards, and assessments are implemented with the goal of measuring student achievement, but are failing to make such an accomplishment in the public school system. Evidence illustrates how instead of measuring student achievement efficiently and accurately; instructional programs, state-content standards, and assessments are in actuality contradicting one another. The goal of measuring student achievement efficiently and accurately is not being met, and in contrast to the goal the results are heightening the stress levels of both teachers and students. There exists a lack of coordination between curriculum, instruction, and assessment, in high schools around New York State, which illustrates the major concern being addressed with regards to how instruction and assessment are not being aligned in the schools.

The non-alignment between instruction and assessment is not a new issue, although it may be a new issue being brought to the attention of the New York State public school system. There is specific evidence from other states that suggests that non-alignment between instruction and assessment has been a significant issue for quite some time, and it has yet to be officially addressed nation-wide, although some school districts have addressed the issue.

Studies have been conducted concerning alignment for a number of years leading up to the present time. The issue of alignment between instruction and assessment exists within the New York State public school system, specifically being addressed is the issue of alignment at the high school level. The alignment of science and mathematics state standards, instruction, and assessment has been measured in a study conducted in four different states during the nineties during a four day institute conducted review. It was even during that time that reviewers discovered that alignment is not equal in all states, and that alignment is not always present between instruction and assessment. If state standards and instruction do not align with one another then the conclusion can also be made addressing how as a result instruction and assessment are not in alignment with one another as well (Webb, 1999).

The non-parallelism between instruction and assessment is a major issue and concern in New York State, and as an observer in the public school system, specifically at a New York City public high school level, evidence of non-alignment is present. There is evidence illustrating how students in an earth science laboratory classroom are taught the laboratory component of the earth science course working in small groups. The students are expected to take on different roles in their groups and to work together to conduct experiments and to attain knowledge pertaining to the earth science curriculum. The end of the year assessment demonstrates instruction and assessment not being parallel with one another since students take an earth

science practical testing their knowledge of earth science concepts in a laboratory setting working alone. Students are not permitted to work together in groups in contrast to how they first learned the subject matter in the laboratory classroom during their laboratory periods throughout the year.

Another distinct piece of evidence showing non-alignment between instruction and assessment is concerning how students are taught on a day to day basis in a science classroom. Special education students are instructed in a different matter than general education students, but at the end of the school year take the same regents examination as everyone else in the school and state-wide. For example, special education students are instructed by special education teachers in a smaller environment outside of the classroom, where the special education teacher has the ability to tailor lessons to the needs of his/her students. The teacher then is provided with the opportunity to teach the students in a quieter environment where they are isolated from outside influence, such as the noise that comes with being a part of a large classroom with a significant number of students.

During the school year the special education students are able to learn in a peaceful environment without any outside distractions. The non-alignment between instruction and assessment becomes apparent when during regents exams the same students who throughout the year were instructed in a quiet environment are now placed into an environment that differs substantially from their previous learning environment. While taking their regents examinations, since the special education students receive extended time for state and city-wide exams, they are placed into either the library or the cafeteria. The students are not the only students utilizing these facilities, especially in schools that share a building with other schools. During the regents examinations special education students are surrounded by students from other schools who utilize the same learning space. The sharing of learning space creates an extremely different environment than the environment that the students had become accustomed to during the school year when they were instructed by their special education teachers. Special education students are expected to perform well on regents exams, although the classroom environment has been drastically altered from how they were instructed throughout the school year prior to the administering of the regents examinations. Special education students are taught by their teachers in one type of environment, but then at the end of the school year are assessed in a dramatically different environment.

There is another imperative observation proving the existence of the non-alignment of instruction and assessment in a New York City public high school. A student in a tenth grade chemistry class spoke Russian as his first language, but was taught in English, which would have been expected in a New York City high school. The student was ELL and at the end of the year for his chemistry Regents examination he was assessed in his native language, which was Russian. If the student is instructed in chemistry in the English language without a Russian translation then non-alignment exists since then at the end of the year for his final assessment he must take his regents examination in Russian. He was taught in one language, but then was assessed in another language.

There are a significant number of views and opinions relating to the topic of non-alignment between instruction and assessment in the public school system. Researchers are in agreement

that non-alignment between instruction and assessment exists and that it negatively impacts the public school system nation-wide. According to La Marca, Redfield, Winter, and Despriet (2000) alignment between instruction and assessment is imperative because it helps to guide the public school system as a whole towards improving student learning, and ensuring that students are being assessed accurately and in an efficient manner. If non-alignment exists between instruction and assessment then the measure of the performance of students on state-wide exams is not an accurate interpretation as to whether students have gained certain skills. Since non-alignment exists it is unfair to make the conclusion that students are deficient in certain areas relating to subject-specific content. Therefore, it is not an accurate measurement of whether students have met expectations that have been set up by state-wide school districts, which demonstrates student knowledge and skills.

Another researcher, Webb (1997) believes that the non-alignment of instruction and assessment, which begins at a state-wide level eventually leads to major complications and difficulties at the nation-wide level. For example, if non-alignment exists between instruction and assessment in a large number of states, then there will be failure on behalf of these states to obtain the goal set up by No Child Left Behind (NCLB). Students meeting standards is a key performance indicator for states, districts, and schools, and if non-alignment is present between instruction and assessment then the results of state-wide assessments is not an effective measure of student performance levels state-wide.

According to Roach et al. (2008) non-alignment between instruction and assessment becomes a major issue for the success of special education students in public schools on a state-wide level. The existence of non-alignment between instruction and assessment significantly affects special education students since the end of the year assessment does not accurately portray the skills and knowledge gained by the students throughout the school year. Special education students are taught using specific methods throughout the year and perform well in their classes, but then when it comes to the end of the year assessment the students fail the exams. It appears that the students have not reached the benchmarks provided by the state as well as by NCLB, but when in reality the student's progress was not fairly measured on the assessment. Students have accommodations and modifications made to their instruction, but then for the assessment that they must take at the end of the year no such accommodations or modifications are put into place. (Roach & Elliot, 2006) It would appear that students have failed to obtain the necessary skills and content knowledge to move onto the next grade level, but in reality their failure on the assessment is due to there being the existence of anti-parallelism between instruction and assessment.

According to Roach et. al. (2008) the non-alignment between instruction and assessment results in overall lower grades on assessments for students. The lower grades on assessments shows that students have not met state-defined criteria for assessment, but that is not an accurate conclusion to be formulated since non-alignment between instruction and assessments is one of the major reasons for such low assessment grades. Low assessment scores in addition to being an inaccurate portrayal of performance for obtaining state-wide goals is also an inaccurate measure of whether school-wide districts are meeting federal standards for education. If students are being taught by a different means than they are assessed at the end of the year, how can a valid conclusion be formed as to whether students have actually be able to learn required subject-

content and apply certain skills? Student achievement cannot be accurately measured as long as non-alignment between instruction and assessment exists within school districts. (Anderson, 2002)

Since it is apparent that non-alignment between instruction and assessment has become a nationwide issue it is pertinent that alignment research exists throughout the United States. Martone (2007) has concluded that alignment studies can be valuable professional development activities for teachers and curriculum developers. By evaluating test items and their congruence to state-defined benchmarks, participants in alignment studies are forced to become intimately familiar with state standards and the assessments. This increased familiarity could have positive effects on instruction. By participating in an alignment study, teachers can apply what they are learning through the alignment process in their classroom.

There are no current research studies assessing alignment between instruction and assessment in New York State, although studies have been conducted in other states. New York, although facing an old issue, is failing to address the issue that is presently facing New York Public schools. Observations have been assessing alignment by teachers, student teachers, administration, and even students but there is not any research at the present time that points out the specific types of non-alignment that exists, and how it is a detrimental issue facing New York State public schools. The non-alignment between instruction and assessment needs to be addressed by research studies, and the level of non-alignment cannot be accurately determined if some type of studies are conducted within the state in its public schools, specifically at the high school level.

There is no questioning that non-alignment does exist between instruction and assessment in the public school system. Non-alignment between instruction and assessment is not only detrimental to the students that it affects, but in addition it significantly impacts the success of the New York State public school system as a whole entity. As long as anti-parallelism is present between instruction and assessment students will continue to suffer from the consequences, especially special education students, and English Language Learners in the New York State school system. Students cannot be expected to pass state examinations and become successful at meeting goals set by NCLB when the fault lies within the system itself; the lack of alignment between instruction and assessment. There must be a correction in the faults within the system, which should work and strive to create a successful and efficient partnership between instruction and assessment. An improvement in students' assessment scores can only accurately be measured and utilized as a gauge to examine whether students are attaining goals and gaining subject-content knowledge and skills when there is an appropriate and adequate parallelism between instruction and assessment. The New York State public school system can only achieve such a pertinent goal by researching and conducting studies, which examine such a major issue, and developing a means by which to correct the flaws in the system. Non-alignment between instruction and assessment continues to be a detrimental force that for years to come will wreak havoc and hinder the success of students within the New York State public school system.

There is valid evidence that alignment between instruction and assessment creates positive results for school-districts, and leads to education departments within states reaching the goals of NCLB. Although, there have been no studies thus far measuring the level of alignment in New

York State public schools, there have been multiple studies conducted in other states. The degree of alignment between instruction and assessment varies among different states, but the studies illustrate how alignment is necessary for positive results in school systems state-wide, and eventually leads to positive results on a nation-wide scale. The success of alignment between instruction and assessment is necessary for students to reach specific benchmarks set up by school districts and then on a nation-wide level, and for results of assessments to accurately portray student levels of accomplishment, and obtaining certain skills and subject-content area knowledge. There is no arguing that alignment between instruction and assessment leads to students' statistics for passing assessments being valid, and then being used to direct future instruction in classrooms.

Positive results from alignment between instruction and assessment have been seen in various states across the nation. For example student grades on assessments have been higher when textbooks used for instruction in the classrooms shared similar content to the end of the year assessment. Special education students, especially, have benefited from textbooks utilized in the classroom being similar in content as well as the type of phrasing used in questions. When teachers have utilized workbooks or textbooks in the classroom created by companies that align their books to the actual regents examination students appear to perform better on end of the year assessments. Students are able to recognize commonalities between what they have learned the entire year, and how they have learned the content the entire year in relationship to the assessment that they take at the end of the school year. The tools that teachers use in their classrooms, such as textbooks for the students, play a powerful role in bringing positive results due to alignment of instruction and assessment (LaMarca et al., 2000).

Alignment has also been proven to have positive results when technology, materials, and tools in the classroom match up with the technology, materials, and tools students are allowed to use on the end of the year state assessments. For example, students have performed at a much higher level on state examinations when the technology, materials, and tools that they were used to using throughout the school year were the same as the technology, tools, and materials permitted for use on state assessments. When students have been working with calculators throughout the year in their classrooms they have performed better on state examinations when they were allowed to use a calculator to take their state examination. Students develop certain skills and a strong level of confidence as a result of being able to use the calculators to solve scientific problems, or even mathematical problems for that matter. When they are given their familiar technological device to use on the state examination that same level of confidence and the use of their skills that have been utilized throughout the school year enable them to perform better when taking their end of the year assessment. Another example besides a calculator being used throughout the year would be a computer. If a student takes computerized assessments all year long for their quizzes and/or examinations then if for the state assessment he or she is provided with the same opportunity then a positive result is the outcome due to alignment between instruction and assessment. Specifically, we are examining the relationship between technology, tools, and materials used by students all year long, and then what is provided to students on their state examinations for them to use while they are taking the examination (Webb, 1997).

Alignment between assessment and instruction provides positive results when what is expected of students throughout the year is the same as what is expected of students for their state

assessments. When students have set benchmarks to attain throughout the year that match the benchmarks that students are expected to meet for their end of the year assessment then alignment between instruction and assessment exists within the system with favorable results (1997).

When teachers, specifically special education teachers, align benchmarks for students with the benchmarks that are supposed to be attained by the end of the year for state standards alignment is successful. For example, for the subject of science, specifically earth science, if students are expected to know three different types of rocks, and how those three different types of rocks are formed then for the state assessment that same content is all the students should have to know to meet their benchmark with success. Positive results come into play when a satisfactory level of understanding for the student is the same level of understanding that students are expected to have for their state assessments. The problem only comes into play when throughout the year students are expected to attain a goal that at the end of the year for their assessment is not deemed satisfactory enough for the gaining of appropriate content knowledge. If a student knows the three different types of rocks and how they are formed, and on the state assessment the students are only expected to know that content about rocks and no more than that then we would see positive results. Any other knowledge that students have above that extent should be deemed beyond satisfactory, but students should not be held accountable for information tested of them on an examination when throughout the year they performed at a Level B, but are now expected to perform at a Level C. If a benchmark for a student is attained and throughout the year it has been deemed an acceptable goal then for the exam only attaining that benchmark and beyond would result in positive results.

In the state of Kansas positive results due to alignment have been evident when instruction and assessment work hand and hand together. For example, students throughout the year learn in collaborative team teaching classrooms where special education students and general education students learn together in the same classroom. When state assessments called for special education students to work together with general education students on their state examination scores were not hindered due to both groups of students working together. For a portion of the state assessment special education students and general education students have been required to work together to take the examination, which is similar to the way they work throughout the school year. When students had the opportunity to take the end of the year assessment in a familiar setting with regards to the same type of environment the scores of special education students did not decrease and the scores of general education students although not going up did not become affected negatively by those students working alongside special education students (Webb, 2006).

There are certain suggestions that need to be provided to help improve the lack of alignment between instruction and assessment in the state of New York. With regards to laboratory practices, such as earth science laboratory classes for students, changes must be made to help align instruction and assessment. If end of the year examinations, such as the earth science practical call for students to work alone then it is pertinent that throughout the year students are taught to work on lab assignments independently rather than work in a group. If students are expected to know how to perform certain skills by themselves then they must have the

opportunity throughout the year to gain such skills in the classroom by learning to use those skills while they work alone.

Another solution to laboratory assignments being taught differently to students all year than how they are expected to take the laboratory practical is to teach students at the beginning of the year in collaborative learning groups, but then towards the end of the school year slowly weaning them off relying on each other for laboratory exercises. When it comes time for teachers to review for the lab practical for earth science instruction should involve students working independently to work on certain skills that they are expected to know for the laboratory practical exam. The Department of Education needs to put aside collaborative learning for the end of the year and allow teachers to examine students' skills in a way that is similar to how their skills are examined for the laboratory practical examination. Independent learning as the Regents approaches in June in the only method by which instruction and assessment can relate to one another.

In contrast to instructional practice needing to be changed we can also view the issue from an alternate perspective. If students are thought to learn best by working in groups then New York should use the Kansas state assessment model where examinations provide opportunities for students to work together in groups. No one is stating that students should have to take examinations as a group for an entire examination, but there should be a section allotted to them to work together with their peers as they have done throughout the year in their classrooms with their classmates. Group work throughout the year and group work on a state examination will lead to New York State leaning towards acknowledging how non-parallelism exists between instruction and assessment, and that efforts are being made to improve such a detrimental problem.

If students work alone all year long in their classrooms then they should be expected to work alone on their state assessments, but such is not the case in the state of New York with the Workshop Model being the main form of instruction that is expected of teachers to use in the classrooms. The Workshop Model pushes for students to work together in collaborative groups to help each other to learn, but at the end of the year the Workshop Model is not the format for students to take an examination. If a student become dependent on the aid of another student and that student is no longer there to offer them assistance when it comes to taking the end of the year assessment then there is no doubt scores will be lower for those students. The lack of alignment between instruction and assessment can only be fixed if the Workshop Model is incorporated into formal assessment at the end of the year or if the Workshop Model is no longer the desired method for instruction by teachers. The removal of the Workshop Model would be detrimental to students because peer review and collaboration amongst peers has been proven to be beneficial to students, and the only solution is to incorporate the ideal method for instruction into the end of the year assessment.

Public high schools at the present time are experiencing a lack of alignment between instruction and formative assessments given to students at the closing of the school year, specifically referring to Regents examinations. Since the Department of Education is aiming to soon do away with the regents examinations it is pertinent that the new state assessments takes into consideration the issue of non-alignment between curriculum and assessment. The issue of anti-

parallelism between instruction and assessment needs to be addressed at the present time and New York State should perform research studies investigating the lack of alignment that exists and how it is wreaking havoc on the New York State public school system. It is pertinent that New York State becomes a model for the public school systems in other states and strives to develop the most beneficial means by which to ensure all students whether they are special education students or general education students have the same opportunity to succeed in their academic career, which will lead to success later on in their lives.

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Increasing Use of Research-Based Practices: Action Research Report on a College-School Partnership to Support Instruction Aligned to Middle School Common Core Math Standards for Students with Significant Disabilities

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Abstract

Teachers of students with significant cognitive disabilities have expressed the need for additional training and resources to realign instruction to general education standards. At the same time, pre-service teachers preparing to enter the field of special education need to be placed in classrooms where teachers have updated knowledge and skills to deliver grade-aligned instruction to students in this population. In this project, the needs of both groups were addressed through a partnership between an Institute of Higher Education (IHE) and local board of cooperative education services. Specifically, in-service teachers received training in research-based practices to implement grade-aligned math instruction to middle school students with significant cognitive disabilities. Pre-service teachers who received the same training in their college coursework created adapted materials to implement the instruction. Results of the project's effect on in-service teachers, their students, and pre-service teachers are reported. Implications for future directions in professional development are discussed.

Introduction

Prior to the Individuals with Disabilities Education Act (IDEA) reauthorization in 2004 that stated, "all students must have access to and progress in the general education curriculum," pre-service training and in-service professional development for teachers of students with significant cognitive disabilities emphasized use of a "functional curriculum," which targeted a set of isolated skills necessary in daily living. This functional curriculum was often separate and different from the general education curriculum (Trela & Jimenez, 2013). In 2001, the No Child Left Behind Act (NCLB) mandated that all students, including students with significant cognitive disabilities, be assessed annually to measure progress toward grade appropriate academic standards, stipulating that students in this population may participate in alternate assessment to grade-aligned alternate achievement standards. Given both mandates, teachers of students in this population and pre-service teachers preparing for certification in special education faced a dramatic change in pedagogical skills needed to support daily classroom practice. Although both mandates have now been in effect for over a decade, recent surveys reported that in-service teachers of students in this population still question a focus on aligning

instruction to general education curriculum, express hesitation to teach to academic standards without additional training, and continue to state a need for additional resources to implement grade-aligned instruction (Ergul, Baydik, & Demir, 2013; Lee, Browder, Flowers, & Wakeman, 2016; Timberlake, 2014). For school districts that support in-service teachers of students in this population and IHEs that prepare candidates for special education certification, a model of professional development is needed that both updates in-service teachers' knowledge and skills and provides pre-service teacher candidates with relevant pedagogical skills based on the growing body of research in teaching to general education curriculum standards. One way to approach the need for training at both the pre-service level and "renewal" at the in-service level is through partnerships between IHEs and schools with whom they collaborate to create opportunities for professional development and intentional linkages between coursework and experiences in the field-based classroom (Allsopp, DeMarie, Alvarez-McHatton, & Doone, 2006; Prater & Sileo, 2002, p. 325).

Teacher education programs face an ongoing need to establish reciprocal relationships with school districts to provide opportunities for pre-service teachers to connect research and theory from their college coursework to best practices that support students in "real classrooms." The importance of bringing pre-service and in-service teachers together is highlighted by findings from recent research indicating that (1) in-service teachers of students with significant cognitive disabilities found IDEA's expectations to be unrealistic to their students' lives, especially if the teachers began their careers prior to the emphasis placed on access to general curriculum (Goldstein & Behuniak, 2012), and (2) current clinical practice models place teacher candidates in settings where in-service teachers may still question a focus on aligning instruction to general education curriculum or express hesitation to teach to academic standards without additional training (Timberlake, 2014; Ergul, Baydik, & Demir, 2013). It would be logical to assume that, if pre-service teachers are placed with teachers who express hesitation or question a focus on teaching to general education curriculum, then they may take on existing practices that differ from what they learned in their methods courses when placed in local schools (Wilson, Floden, Ferrini-Mundy, 2001). To respond to the need for both renewal and development of knowledge, skills, and dispositions to teach to general curriculum standards to students with significant cognitive disabilities, in-service professional development and pre-service courses can be aligned to provide the same training in translating research to practice. For pre-service teachers, opportunities to "operationalize" that knowledge into lesson materials and hands-on work in the classroom provides logistical support to in-service teachers who can then readily share their expertise in delivering those lessons while supporting individual needs of students. In this action research project, in-service teachers and pre-service teachers received the same pedagogical training to teach to general education standards for middle school students with significant cognitive disabilities. Specifically, training focused on aligning instruction to common core middle school math standards.

Review of Literature

The literature consulted in this project's design included studies that made recommendations for best practices in professional development, IHE-school partnerships, teaching to common core math standards for students with significant cognitive disabilities, including learning characteristics of students with significant cognitive disabilities. A review of the literature

consulted with its implications for the design and implementation of the present action research project will be presented next.

Professional Development for In-Service Teachers of Students with Significant Cognitive Disabilities

Findings from research on professional development for in-service teachers in general have shown that training is most effective when it follows four principles: (1) be ongoing, intensive, and aligned to practice, (2) focus on learning and address specific content, (3) align with school improvements and priorities, and (4) promote teacher collaboration (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009). Additionally, Leko and Brownell (2009) suggested that professional development models for special educators consider addressing the isolation that some teachers experience as they work in settings separated from same age and grade level colleagues. Further, in-service teachers of students with significant cognitive disabilities have reported that they have not received the necessary guidance and support to align instruction to general curriculum alternate achievement standards (Roach et al, 2007; Timberlake, 2014). Although some states have posted alternate achievement standards to provide a framework to which teachers can align lessons, little research has been conducted to evaluate if or how teachers use that guidance to inform daily instruction and ensuring that students have an opportunity to learn the skills against which they are measured. In fact, in a recent investigation of teachers' perceptions regarding accessibility of their state's alternate achievement standards, (i.e., are their students able to learn the skill and concepts addressed in the state's alternate achievement standards?) teachers reported that the skills assessed were "out of reach" (Goldstein & Behuniak, 2012). This finding is aligned with earlier research on teacher perceptions of the "appropriateness" of holding students accountable to learning standards aligned to age and grade level general curriculum standards (Kleinert, Kennedy, & Kearns, 1999; Wehmeyer et al, 2003). In this same (Goldstein & Behuniak) study, the researchers pose the question, "Do these students have sufficient opportunity to learn academic content?" and further suggest that future research address the needs of teachers of students with significant cognitive disabilities to enhance skills to teach to academic content standards. Clearly, teachers of students with significant cognitive disabilities need a collaborative model of ongoing, targeted professional development grounded in current research in order to guide the instructional focus on teaching to general education curriculum standards.

In a response to the need for providing this guidance, two studies were conducted to evaluate the effect of an instructional package that included task analytic instruction, adapted story-based problems, and graphic organizers to teach students how to solve math problems aligned to general curriculum middle school math standards (Browder, Trela, Courtade, Jimenez, Knight, & Flowers, 2010; Browder, Jimenez, & Trela, 2012). In these studies, teachers received training before implementing each unit in their classrooms, and were evaluated by the researchers for adherence to following steps of the task analytic lessons, including use of adapted materials to implement the lessons. Training was delivered by researchers from the partnering university at full day workshops where teachers attended with a general education math teacher from their school. The trainers also provided background knowledge and encouraged dialogue with the general education math partners to clarify how to teach to the specific competency standard (i.e., algebra, data analysis, geometry, measurement). Further, teachers in these studies completed social validity surveys and indicated that the training was fair, the training was feasible to implement in their classrooms, and their students benefited from the lessons they implemented.

Most important, students showed an increase in number of steps completed independently and accurately to solve math problem aligned to grade level standards. These findings suggest that professional development on aligning instruction to general education math standards for in-service teachers of students with significant cognitive disabilities needs to support both teachers' understanding of the standards being addressed and current knowledge of evidence-based practices in designing and implementing instruction that has been shown to support student learning. Specifically, professional development in the use of task analytic lessons and how to develop a task analysis that addresses the essence of the standard, writing adapted story-based problems, and constructing a graphic organizer that supports student understanding and problem solving may provide much needed guidance to in-service teachers of students with significant cognitive disabilities as they refocus instruction and assessment aligned to grade-level general education standards.

IHE-School Partnerships

One approach to provide guidance for in-service teachers is through IHE-school partnerships. In this model, instructors from the IHE work with schools to provide professional development to in-service teachers on updated knowledge and skills based on current research-based practices to implement in their classrooms. In return, pre-service teachers receive the same training in their college coursework and then are placed in classrooms with in-service teachers to support implementation of the research-based practices. For the IHE, the partnership supports opportunities for fieldwork experiences in classrooms with teachers who are renewing their skills at the same time that pre-service teachers are developing the same body of knowledge and skills. This reciprocal relationship between the IHE and school supports educator preparation programs' effort to provide high quality fieldwork and student teaching experiences (i.e., clinical experiences). For IHEs that respond to the Council of Accreditation of Educator Preparation (CAEP) standards, providing high quality clinical experiences is essential to supporting successful development of effective teachers. According to CAEP Standard 2 (Clinical Partnerships and Practice), partnerships between IHEs and P-12 schools "are central to preparation so that candidates develop the knowledge, skills, and professional dispositions necessary to demonstrate positive impact on all P-12 students' learning and development" (CAEP, 2015). Another goal in the formation of clinical partnerships is to "ensure that theory and practice are linked and to maintain coherence across clinical and academic components of preparation" (CAEP, 2015). In other words, it is essential that IHEs work closely with P-12 school partners to intentionally craft opportunities for teacher candidates (i.e., pre-service teachers) to make "linkages" between theory and research from college coursework to practice in real world classrooms (Allsopp, DeMarie, Alvarez-McHatton, & Doone, 2006, p. 20). In their 2006 study to create opportunities for "linkages" between courses and fieldwork experiences, Allsopp et al provided teacher candidates with instruction to support their fieldwork students' behavior in a classroom within the cooperating school. At the same time, cooperating teachers at the school also attended the class to receive the same information and then collaboratively work with teacher candidates to apply the practice in the classroom. Researchers then examined teacher candidates' responses to questions about their fieldwork experience, with one question at mid-semester specifically targeting the connection between coursework and fieldwork (e.g., "Describe the extent to which you are seeing/experiencing meaningful connections between your practicum and the topics covered in your coursework?"). Candidates' responses showed that, from mid-semester to the end of the semester, this model supported their ability to make linkages between coursework and fieldwork. Although this model was situated in

a Professional Development School (PDS) model where pre-service and in-service teachers could physically attend classes and receive the same information together, an important feature is the shared knowledge both groups gained and then applied in their classrooms. The purview of this study did not include responses from cooperating teachers or effects of the practices on students in the classroom. However, the practice of creating opportunities for in-service and pre-service teachers to receive the same training and background knowledge to support application of research-based practices in the classroom is an important finding from this study that may be applied to other models of IHE-school partnerships. Specifically, this feature of an IHE-school partnership has promise to support candidates' ability to more directly link college coursework to fieldwork experiences.

Teaching to General Education Math Standards for Middle School Students with Significant Cognitive Disabilities

Supporting access to and progress toward middle school math standards, including alternate achievement standards, poses a unique challenge for teachers of students with significant cognitive disabilities. One challenge is the variability in math skills that students in this population may bring to middle school. For example, a recent survey in which teachers were asked to characterize their students' math skills reported variations from "no awareness or use of numbers (13%)," to "complete computational problems with or without a calculator (57%)" (Towles-Reeves, Kearns, Kleinert, & Kleinert, 2009 p. 246). An additional challenge for teachers of students at the middle school level is aligning instruction with math standards that place an emphasis on students being able to "engage in metacognitive processes" and "operate at a higher level of abstraction than is typical of the mathematics they have encountered previously" (Kalchman & Koedinger, 2005, p. 353).

Task analytic instruction. One way to promote learning across math content areas is to use task analytic instruction, an evidence-based practice that has supported students' with significant cognitive disabilities' learning in the areas of daily living as well as academic skills (Browder, Wood, Thompson, & Ribuffo, 2014). In their 2012 study, Browder, Jimenez and Trela used task analytic instruction to teach math skills aligned to extensions of one state's secondary general education math standards. In this study, task analytic lessons were delivered using adapted story-based math problems and a graphic organizer. Findings from this single subject study suggested a functional relationship between use of the instructional package (task analytic lesson plans, adapted story-based problems and graphic organizer) and students' increased independent, correct responses to steps of problem-solving task analyses in each of four units aligned to secondary general education curriculum standards. Lessons were designed to promote independent problem solving skills by following a task analysis that introduced students to a problem in a story context, then guided them to find facts in the story to place on a graphic organizer, and finally use a graphic organizer to apply quantitative or spatial reasoning to solve the problem.

Teaching to Middle School Math Standards: Steps to Metacognitive Thought. In the Browder et al study, the problem solving task analyses for two units (Algebra and Geometry) included a specific step that promoted development of metacognitive thinking essential to making progress toward the middle school math standards to which they were aligned. For example, the alternate achievement standard for Grade 8 Algebra stated, "solve simple algebraic equations with one variable using addition and subtraction" (National Governor's Association

Center for Best Practices, 2010). Teaching to this standard, instruction needed to provide opportunities for students to recognize that facts can be represented by both numbers for known quantities and letter symbols for unknown quantities, and to determine the relationship between those facts in order to select an operation to arrive at a solution (quantitative reasoning). In the Browder et al. Algebra task analysis, one step consistently guided students to an awareness that a letter can stand for something unknown, a basic step toward abstract thought (Witzell, Mercer, & Miller, 2003). Once students completed this step, they used a graphic organizer to compose an equation that represented the relationship between the known and unknown quantities in the story-based problem and solve for the unknown quantity.

Similarly, an alternate achievement standard in Grade 7 Geometry stated, “recognize geometric shapes with given conditions” (National Governor’s Association Center for Best Practices, 2010). In the Browder study, one step of the geometry task analysis guided students to construct a geometric shape that did not have any intersecting lines on a map (i.e., the best route to travel from one point to another without backtracking) and then name the shape a plane, using its identified points and line segments in its name. As in the Algebra task analysis, a specific step promoted the application of spatial structuring (i.e., composing a figure with the given condition of no intersecting lines), an example of early abstract thought developed in geometry (Sarama, Clements, Swaminathan, McMillen, & Gonzalez Gomez, 2003).

Results from the Browder and colleagues research clearly showed that use of the instructional package (i.e., task analytic instruction, graphic organizer, and adapted story-based problems) had a positive effect on students’ with significant cognitive disabilities’ learning to middle school math standards. In addition, results suggested a functional relationship between teachers’ receiving training and implementation of the instructional package and number of independent, correct student responses to steps of the task analyses. Although students showed progress in the studies’ four units, only two of those units targeted development of a metacognitive skill (i.e., Algebra and Geometry). Therefore, an important consideration in designing future instruction aligned to middle school math standards is to provide students with opportunities to respond to steps of a task analysis that specifically promote the application of metacognitive skills essential to making progress toward those standards.

Summary of Research

The mandate to realign instruction to grade-appropriate general education standards for students with significant cognitive disabilities has posed a challenge to schools that provide instructional services to this population of students. As shown in the research, in-service teachers have expressed the need for additional support to respond to this mandate, and may continue to question the relevance of teaching to higher standards when their students may demonstrate early numeracy skills. A growing body of research on teaching academics and specifically, teaching to middle school math standards to students with significant cognitive disabilities may provide guidance to schools that support teachers of students in this population.

As in-service teachers work to renew their knowledge and skills to implement instruction to these higher standards, there is also a need to provide the same training to pre-service teachers so that they enter the field ready to respond to the challenge of teaching to general curriculum

standards. Institutes of Higher Education that prepare pre-service teachers to enter the field also need to provide high quality fieldwork experiences in which their candidates can readily link the knowledge and skills learned in college courses to classroom practice. However, unless in-service teachers have received updated training, pre-service teachers may not benefit from fieldwork experiences where there is a disconnect between current research and classroom practice. For these reasons, there is a need to design IHE-school partnerships that meet educational training needs at both levels (i.e., college accreditation standards for clinical practice, pre-service teachers' need to make linkages between college coursework and fieldwork, in-service teachers' need to renew knowledge and skills aligned with mandates, and school's responsibility to provide targeted professional development to their teachers). Research on connecting college courses with fieldwork, principles of effective professional development, and teaching to math standards for middle school students with significant cognitive disabilities may guide the design of a model that supports meaningful clinical practice for pre-service teachers and renewed skills to sustain research-based practices in the classroom for in-service teachers.

Conclusion

The literature reviewed on professional development supported this project's use of an IHE-school partnership to develop and sustain in-service teachers' use of research-based practices to teach grade-aligned math to middle school students with significant cognitive disabilities. In addition, literature on connecting college coursework to practice for pre-service teachers supported research on levels of linkage that pre-service teachers experience when placed in classes with in-service teachers who received the same training in their professional development.

Action Plan

Context

This project was conducted over a 10 month academic year through a partnership between a private college that prepares teacher candidates for state certification in general and special education at the elementary level and the neighboring county's Board of Cooperative Educational Services (BOCES). In this county, school districts may contract with BOCES to provide services to students with significant cognitive disabilities either in their district schools or at a public separate school. Internal Review Board (IRB) approval was obtained from the IHE's IRB committee to conduct research in collaboration with its BOCES partner. Teachers chosen to participate in the study (i.e., those who provided services to students with significant cognitive disabilities at the middle school level) and their students provided signed consent to participate to the IHE instructors before any research activities were conducted. Of the three in-service teachers who participated in professional development, two supported students in self-contained classes at the public separate location and one supported students in a self-contained class within the cooperating school district's middle school.

As shown in Table 1, students ranged in age from 12-13 years and had IQs ranging from 41-57, and qualified for services under IDEA under the disability categories of Autism or Multiple Disabilities. All demographic information was obtained from students' most recent psychological evaluations. All math assessments were conducted by the IHE instructors in the special education classrooms. Teachers implemented the lessons with students grouped by grade level, including students who were not targeted in the study. All names used are pseudonyms.

Table 1
Student Demographic Information

Student Name	Age	Gender	IQ	Test Administered	IDEA Classification	Communication Skill
Bryan	13	Male	>44	WISC	Multiple Disabilities	Verbal
Kyle	12	Male	44	WISC	Autism	Non-verbal, uses assistive technology
Selena	13	Female	57	WISC	Autism	Non-Verbal, uses assistive technology
Lorenz	12	Male	>44	WISC	Autism	Verbal
Miguel	13	Male	56	WISC	Autism	Verbal
Hoang	13	Male	Verbal Intelligence (standard score) 41	RIAS	Autism	Verbal

In-Service Teachers’ Needs Assessment. Prior to implementing the study, the IHE instructor, BOCES administrators, and teachers met to identify priority math standards to target in the instructional units for the following year. From teachers’ input at that meeting, it was decided that extensions of the state’s Algebra, Geometry and Ratios and Proportions (Unit Rate) standards would best support their instructional and assessment plans. In this state, teachers consulted a state website to access the priority standards for the academic year and then planned instruction and progress monitoring toward those standards. Meeting notes also indicated that teachers expressed a strong need for materials that were adapted to meet their students’ needs. To support access to Algebra and Geometry for their students, it was agreed that the lesson task analyses, graphic organizers, and story formats described in the Browder, Jimenez et al study would be used. That is, all stories would be written using considerate text supported with graphics for key vocabulary, problem statements consistently placed at the end of the story, and problems embedded in activities typical to middle school students. Figure 1 shows a math story that was developed by pre-service teachers to depict an activity in which the participating students experienced in their gym class (i.e., using a stationary bike).

To support access to Ratios and Proportions (Unit Rate) , a new unit was needed that would continue to promote development of metacognitive skills in the lesson task analysis. For that reason, the task analytic lesson guided students to first identify the two different measurements that expressed a Unit Rate (i.e., \$2.99 per 1 pound), naming the first value (\$2.99) the “Partner Amount,” and the value per 1 pound as the “Unit Amount.” This first step was designed to support students’ ability to identify the measurement value that changed in the story problem (i.e., purchased 2 pounds). Figure 1 shows the graphic organizer that students used to construct

an equation that showed how a change in one of the measurement values proportionately affected the corresponding measurement value.




 Riding at the Gym




 Joy rides a bike at the gym. She rides **4**  **1** .




 Last week, she rode for a total of **3** hours.




 How many miles did Joy ride ?

8

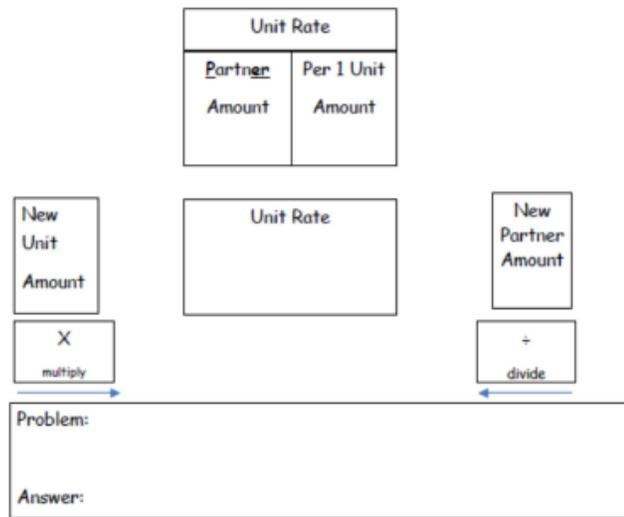


Figure 1. Adapted math story and graphic organizer for Ratios and Proportions Unit (Unit Rate).

In this way, students were consistently guided to “understand proportionality, a turning point in mental development” (Hoffer, 1988, p. 293 as cited in Cramer, Post, & Currier, 1993). As with the Algebra and Geometry units’ task analyses, specific steps were included in the task analysis to promote development of higher order thinking.

Course Feedback at the Pre-service Level. At the same time that in-service teachers provided feedback about which standards to target in this project, teacher candidates enrolled in the IHE’s curriculum strategies for students with disabilities and math methods courses provided feedback to IHE course instructors about course assignments they perceived as strongly aligned to their fieldwork experience. In a survey adapted from Allsopp et al (2006), candidates rated characteristics of course assignment/fieldwork linkage on a scale of 1-5 from “5- a very strong link, 4-a strong link, 3-a noticeable link, 2-a minimal link, and 1- no link .” In the semester prior to the collaborative project, a total of 31 pre-service teachers completed course feedback forms. Of the 31 candidates, 15 were placed in classes that used a text adapted in their course work to support the class’s literacy lessons. Feedback showed 60% of candidates chose “very strong link” to describe the connection between the course assignments (i.e., adapting a grade-appropriate book) to their fieldwork setting. Interestingly, comments from candidates who were in classrooms that did not use the text still noted a strong link, with one candidate recommending use of the adapted text in her fieldwork reflection paper . Using this feedback, course assignments for the semester were created to align with feedback from in-service teachers (i.e., candidates would apply knowledge from course reading to create adapted story-based math problems aligned with the instructional units chosen by in-service teachers).

Research questions:

- 1) Will in-service teachers increase adherence to a research-based practice after they receive professional development in the practice’s background and implementation?
- 2) Will in-service teachers find the intervention practical and supportive of their daily instructional needs?
- 3) Will students in the participating in-service teachers’ classrooms demonstrate increased independent problem solving skills after their teachers receive training?
- 4) Will pre-service teachers placed in the participating in-service teachers’ classrooms report higher “linkages” between college coursework and fieldwork experiences?

Intervention

In this study, three in-service teachers received training in the use of story-based problems, a graphic organizer, and a task analysis for each unit. All training and materials were designed to teach students to solve problems by identifying facts from a math story and placing facts on the graphic organizer. In-service teachers in this study attended three workshops at the IHE conducted by one special education and one math methods instructor. At each workshop, teachers received training and materials to begin teaching the unit in their classrooms. Data were collected on two students from each class for a total of six students throughout the school year. Sixty three pre-service teachers enrolled in the special education instructor’s classes received coursework that included background knowledge and training in the use of story-based problems, a graphic organizer, and a task analysis to solve problems aligned to extensions (i.e., alternate achievement standards) of the state’s middle school math standards. In their coursework, pre-service teachers received training in use of SymWriter™ software to create

adapted text supported with graphics and used this software to create math stories for the in-service teachers to use as they implemented each unit.

Data Collection

Data were collected for four outcomes: two from in-service teachers, one from their students, and one from pre-service teachers. Teachers' adherence to a lesson plan task analysis was examined by IHE instructors and school administrators using an observation checklist, and teacher's acceptance of the intervention was measured on a rating scale adapted from Snyder (2002) to use with teachers. In-Service teachers completed the Teacher Intervention Acceptability Rating Scale at the end of the school year to provide a measure of social validity for this intervention. Data were collected on student outcomes by IHE instructors who conducted probes before and after teachers received training in each unit. In each probe, students' responses to steps of each unit's problem-solving task analysis were recorded by IHE instructors. Finally, pre-service teachers completed an end of course survey on their perception of linkage between their college coursework and fieldwork.

Results

In-Service Teachers' Adherence to Task Analysis

Data collected on teacher use of research-based practices and student responses to steps of the problem solving task analysis were analyzed before and after teachers received training in each unit. Twice before and one time after each training session, teachers were observed to determine percentage of steps followed in the task analytic lesson plan. Percentage of steps teachers followed during the observation was computed as number of steps checked as "observed in lesson" divided by total number of steps.

In-Service Teacher's Social Validity Rating

At the end of the school year, teachers completed the Teacher Intervention Acceptability Scale to provide feedback regarding the value of both the training and intervention to their daily classroom practice. Table 2 shows results of the survey that asked teachers to rate each item on a Likert scale of 1(do not agree) to 6 (strongly agree).

Student Responses

Student responses to steps of each unit's problem solving task analysis were recorded before and after each training session their teacher attended. Three probes on all three unit task analyses (i.e., Algebra, Geometry, and Unit Rate) were conducted before the first unit training (Unit Rate). To collect data, the IHE instructors conducted probes with each student individually at a table in the self-contained classroom. For each probe, the IHE instructors provided the students with a copy of the story-based problem, graphic organizer, calculator, and any manipulatives needed to solve the problem. The instructor read the story aloud, then read aloud each step of the task analysis, waiting 5 seconds for a student response. If the student answered incorrectly or did not answer within 5 seconds, the researcher entered a "0" on the student response form for that step. No instructional feedback or verbal reinforcement for correct responses was provided. Intermittent non-specific verbal praise was given to acknowledge student's attention to the task (i.e., "you're doing a good job paying attention").

After teachers had completed eight of the first unit’s (Unit Rate) lessons in their classes, three probes were conducted by the IHE instructors that followed the same procedure as pre-training probes (i.e., students worked with an instructor at a table in the classroom to complete steps of each unit’s problem solving task analysis). The next training on the second unit (Algebra) was held after all ten lessons from the first unit were completed. After the second training, teachers implemented eight lessons of the Algebra unit in their classrooms before IHE instructors returned to conduct another round of probes. The same probe procedures were followed with all participating students. When all ten Algebra lessons had been implemented, teachers received training and materials to teach the third unit, Geometry. Probe sessions were scheduled after eight lessons of Geometry had been taught in each classroom. After all ten Geometry lessons were completed, IHE instructors conducted a final round of probes to examine if students had maintained any gains made during the year on all three units. Students’ responses were graphed to examine changes in responses before and after their teachers received training. All training sessions and probes were completed by the end of the school year. Pre-service teachers’ feedback on linkages from coursework to fieldwork was collected at the end of the Fall and Spring semester.

Pre-service Teachers’ Perceptions of Linkage to Coursework

On an end of course survey, pre-service teachers ranked the perceived linkage between their college coursework and fieldwork experiences. Responses from pre-service teachers placed in the participating teachers’ classrooms were compared to responses from those placed in non-participating teachers’ classrooms to examine each group’s perceptions of linkage from coursework to fieldwork.

Findings

In-service Teachers Adherence to Lesson Plan Task Analysis

For teacher one, overall steps of the task analyses completed increased from 10% for the two sessions before training to 93% for the three sessions after training. Teacher two increased from 5% before training to 83% after training and for teacher three from 20% before training to 96% after training. Although teachers followed the steps once they received training and materials, anecdotal feedback indicated that the task analysis was sometimes “cumbersome” to use, especially as they tried to collect student data with a small group of students at the same time as they were teaching the lesson.

In-Service Teachers’ Social Validity Rating

As seen in Table 2, all three teachers agreed that the intervention was feasible, fair, and supportive of their teaching as well as their students’ learning.

Table 2
Teacher Intervention Acceptability Rating Scale

ITEM	DESCRIPTION	RATING
1	The lesson plan training was implemented fairly.	100% (6)
2	The training was not too difficult	100% (6)
3	This training helped clarify how to develop lesson plans that access general curriculum	100% (6)
4	The training I received would be helpful for other teachers	100% (6)

5	The training I received was practical	100% (6)
6	The training I received has strengthened my skills as a teacher	100% (6)
7	My students have benefited from my training	100% (6)
8	The lessons aligned with the state's AA-AAS framework	100% (6)
9	The lessons provided opportunities to support students' IEP goals	100% (6)

In addition to the rating scale, teachers were prompted to provide anecdotal comments regarding the intervention. All teachers commented that receiving ready-made materials to implement in the classroom was the most helpful feature of this intervention. One teacher also noted the value of the lessons to promote higher order thinking with the following comment: “The materials developed for the study are easy to use and provide an understandable framework for students to access more abstract concepts.” Another teacher made a recommendation for future intervention studies by commenting, “Perhaps the training could take place in the classroom and the materials can be modeled with a student.” Finally, another teacher suggested that she plans to continue using the materials in her classroom in her comment, “I really like the unit that was able to be expanded into a life skills unit. I felt the students did best with this activity because we were able to approach it from a multitude of angles. I definitely plan to use it again next year.”

Student Responses to Steps of the Task Analysis

Figures 2-7 show the total number of correct student responses across each of three units from pre to post teacher training sessions for each unit. Figures 2 and 3 show responses for students with Teacher 1 (Bryan, & Kyle). Figures 4 and 5 for students with Teacher 2 (Selena & Lorenz) and Figures 6 and 7 for students with Teacher 3 (Manuel & Hoang). Skill maintenance is reported for the first two units taught (i.e., Unit Rate and Algebra). Due to weather-related disruptions in the school calendar during the implementation of the third unit (Geometry), only post-training scores are reported.

Students with Teacher 1. Bryan showed an increase in independent, correct responses across all three units. In the first unit (Unit Rate), he increased from pre ($M=0$) to post-training ($M= 2.6$, range from 0 to 5). For the second unit (Algebra), Bryan increased in correct, independent responses from pre ($M=0$) to post-training ($M= 5.8$, range from 0 to 10). For the third unit (Geometry), Bryan increased in correct, independent responses from pre ($M=0$) to post-training ($M= 4$, range from 1 to 6). Kyle also showed an increase in independent, correct responses across all three units. In the first unit (Unit Rate), Kyle increased from pre ($M=0$) to post-training ($M= 2.9$, range from 0 to 7). For the second unit (Algebra), Kyle increased in correct, independent responses from pre ($M=0$) to post-training ($M= 5.8$, range from 0 to 10). For the third unit (Geometry), he increased in correct, independent responses from pre ($M=0$) to post-training ($M= 3.7$, range from 0 to 6).

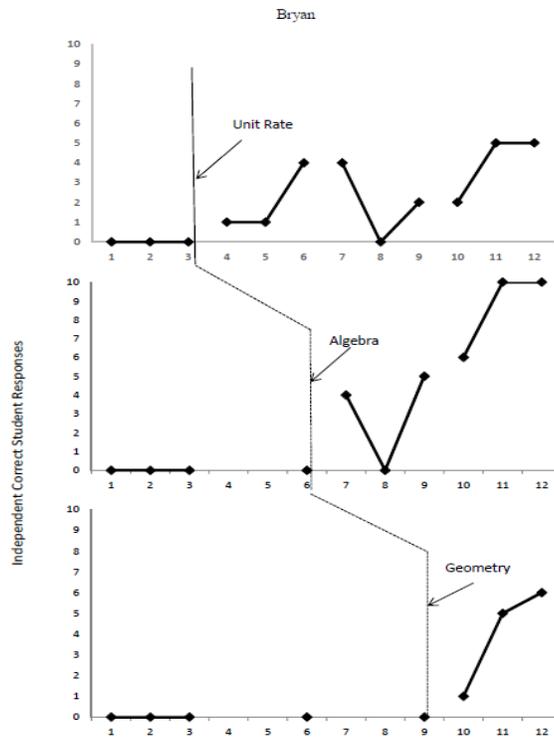


Figure 2. Data for Bryan across math units

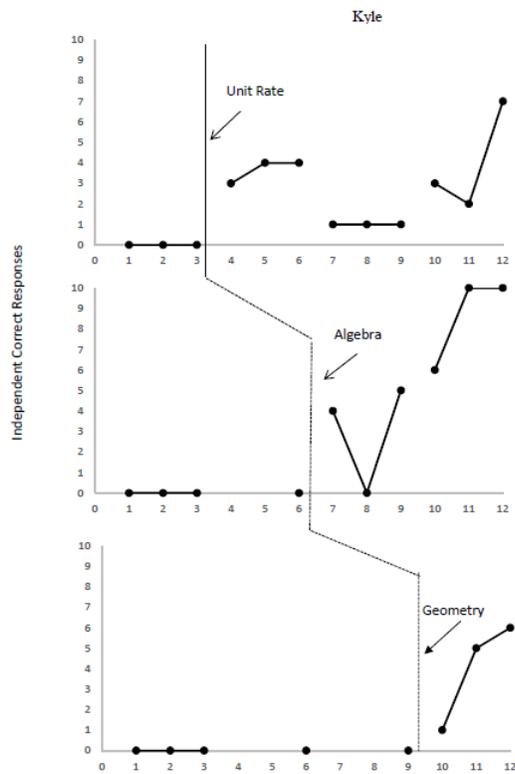


Figure 3. Data for Kyle across math units

Students with Teacher 2. Selena showed an inconsistent increase in correct, independent responses across all three units. In the first unit (Unit Rate), Selena increased from pre ($M=0$) to post-training ($M= 1.1$, range from 0 to 4). For the second unit (Algebra), she increased in correct, independent responses from pre ($M=0$) to post-training ($M= 2.3$, range from 0 to 4). For the third unit (Geometry), Selena increased in correct, independent responses from pre ($M=0$) to post-training ($M= 2.6$, range from 0 to 3). Lorenz showed an increase in independent, correct responses across all three units. In the first unit (Unit Rate), Lorenz increased from pre ($M=0$) to post-training ($M= 1.1$, range from 0 to 4). For the second unit (Algebra), Lorenz increased in correct, independent responses from pre ($M=0$) to post-training ($M= 4.2$, range from 1 to 9). For the third unit (Geometry), he increased in correct, independent responses from pre ($M=0$) to post-training ($M= 3.0$, range from 1 to 6).

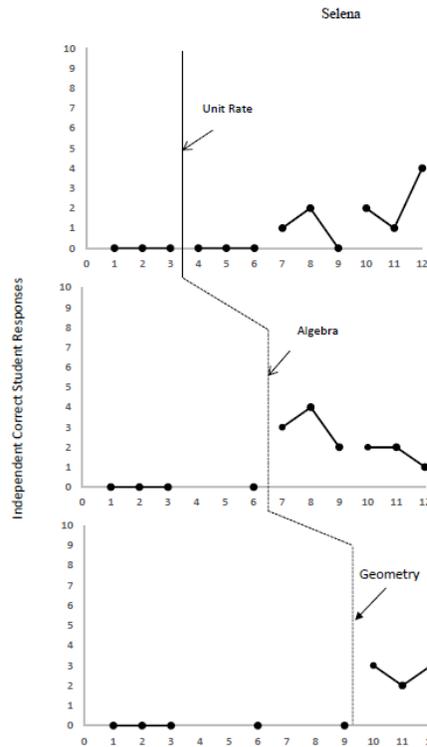


Figure 4. Data for Selena across math units

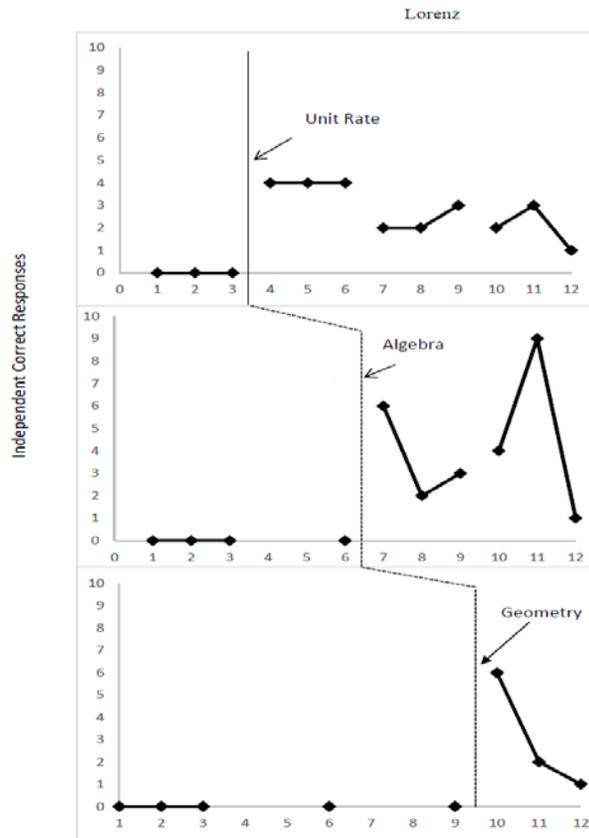


Figure 5. Data for Lorenz across math units

Students with Teacher 3. Manuel and Hoang made the most consistent and marked increases in correct, independent responses from pre to post-training. For the first unit, (Unit Rate), Manuel increased from pre ($M=0$) to post training ($M=9.5$, range from 9 to 10). Manuel maintained these increases 15 weeks after receiving instruction. For the second unit (Algebra), he increased from pre ($M=0.5$, range from 0 to 1) to post-training ($M=10$) and maintained increases 10 weeks after receiving instruction. For the third unit (Geometry), Manuel increased in correct, independent responses from pre ($M=1$, range from 0 to 2) to post-training ($M=8.6$, range from 8 to 9). Hoang increased independent correct responses for Unit 1 (Unit Rate) from pre ($M=1$), to post-training ($M=9.2$, range from 8 to 10). Hoang maintained these increases 15 weeks after receiving instruction. For the second unit (Algebra), he increased independent, correct responses from pre ($M=2.5$, range from 1 to 4) to post-training ($M=10$) maintained increases 10 weeks after receiving instruction. For the third unit (Geometry), Hoang increased in correct, independent responses from pre ($M=0.5$, range from 0 to 1) to post-training ($M=8.3$, range from 8 to 9).

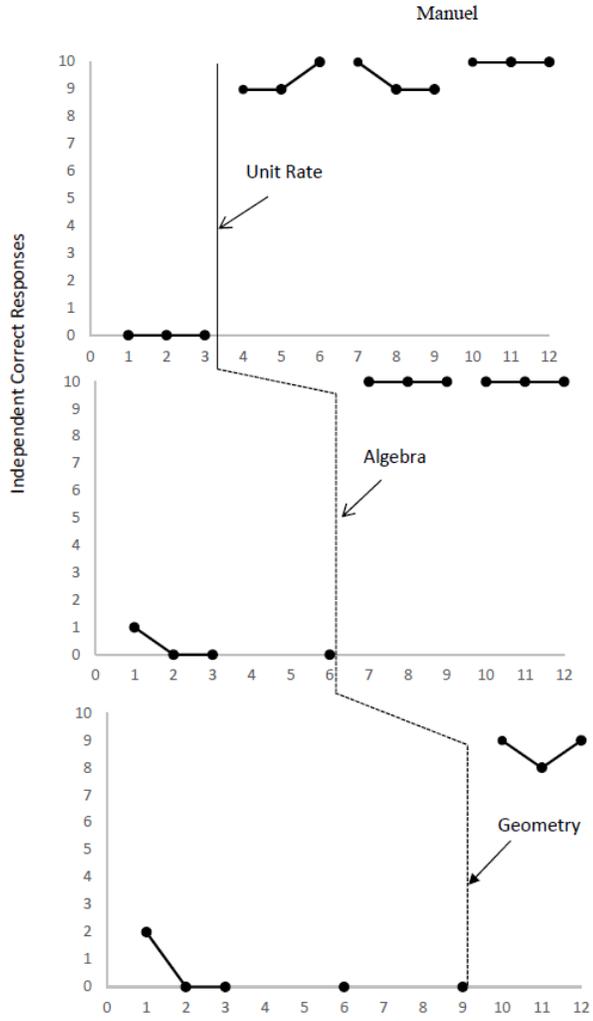


Figure 6. Data for Manuel across math units

Hoang

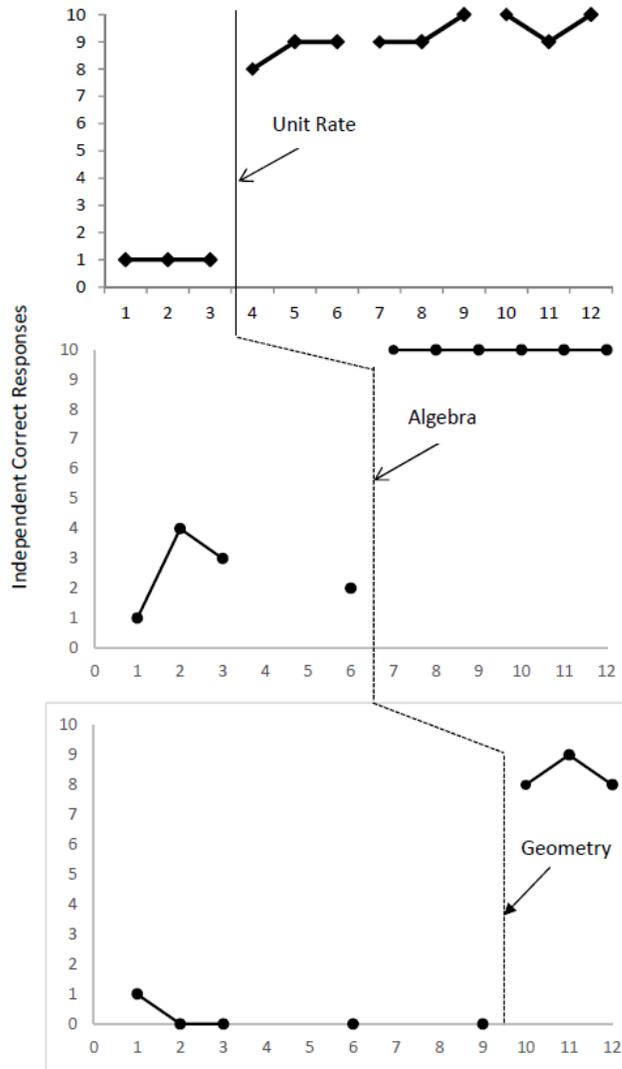


Figure 7. Data for Hoang across math units

These increases in students' correct, independent responses agree with findings from previous studies that examined the use of an instructional package that included training in task analytic lessons, adapted story-based problems, and graphic organizers to teach to grade-aligned math standards for middle school students with significant cognitive disabilities (Browder, Trela et al, 2010; Browder, Jimenez et al, 2012).

Pre-service Teachers Course Feedback: Links to Fieldwork

At the end of each semester, pre-service teachers completed a course feedback form that asked them to rate the connection between course assignments and their fieldwork placements. Table 3 shows responses by candidates ($n=63$) placed in participating teachers' classrooms who received the research-based math training and those not placed in participating classrooms who received one day workshops from the IHE special education instructor on visual supports and using children's literature to provide context for math problems. Although all candidates saw strong links, the choice, "very strong link" was only reported by candidates placed in participating teachers' classrooms.

Table 3

Pre-Service Teacher Reports of Linkage from Coursework to Fieldwork

	Placed with Teachers Who Received Math Training ($n=15$ Fall and Spring)	Placed with Teachers Who Received General PD ($n= 48$ Fall and Spring)
Very Strong Link	81%	0%
Strong Link	8%	69%
Noticeable Link	9%	21%
Minimal Link	2%	9%
No Link	0%	1%

Discussion

In this study, a model of professional development that addressed the needs of in-service teachers of students with significant cognitive disabilities and their students, and pre-service teachers preparing for certification in special education was designed within a college-school partnership. The model was developed and implemented to support in-service teachers' increased knowledge and use of research-based practices to support instruction to their middle school students with significant cognitive disabilities. At the same time, the model provided opportunities for pre-service special education teachers to create adapted materials to support the instructional practices and complete fieldwork in the targeted classrooms. After receiving training in implementing the research-based instructional package (lesson plan task analyses, story-based problems, and graphic organizer), teachers showed an increase in following steps of the task analysis in their classrooms, students showed increases in independent, correct responses to steps of the math task analyses, and pre-service teachers found strong or very strong links between their college coursework and fieldwork placements.

Limitations

Although the increases across measures taken with all groups (i.e., in-service teachers, pre-service teachers and students) is promising, the small sample size limits generalization of this study's findings to the larger population of students with significant disabilities and their teachers. A second limitation is the small number of probes conducted after teachers received training in each unit. Probes were conducted after teachers had implemented 8 out of 10 lessons

in their classrooms. This procedure maintained the typical classroom routine with as few interruptions to students' schedules as possible, as agreed upon by teachers, administrators, and the IHE instructors. Further, no data was collected from parents to discern if students were generalizing vocabulary or concepts from each unit to their everyday activities (i.e., identifying their rate of speed if using a treadmill or stationary bike, noticing unit rate on labels at home or in stores). Finally, although teachers found the training and materials helpful for the three targeted units, it was beyond the scope of this study to examine the extent to which they applied the practices to develop lessons aligned to additional alternate achievement standards targeted by the state's assessment program.

Future Directions

IHE – school partnerships provide a rich resource for both entities as schools respond to higher expectations for in-service teachers and their students, and IHEs respond to higher standards in the selection of clinical experiences for pre-service teachers. In this partnership project, in-service teachers received training and instructional materials appropriate to their students' learning needs. As one teacher added to the Teacher Intervention Acceptability Rating, "...the ready-made materials were most helpful. I appreciated the alignment with standards and functional skills." In addition, school administrators supporting the teachers commented that the "partnership ... offered an opportunity for teachers to receive ongoing, focused training and ready-made materials to implement instruction aligned to extensions of the state's CCSS for math." One implication drawn from this research for future practice is to create more opportunities for pre-service teachers to be placed with in-service teachers who are actively engaged in professional development opportunities with the IHE. As shown in the pre-service teachers' survey responses, being in a classroom where teachers are receiving training and implementing research-based practices provides a "strong to very strong link" to bridge the coursework to fieldwork gap. Another recommendation came directly from in-service teachers' feedback, in which one teacher suggested that IHE instructors work directly in the classrooms with teachers and students to model the practice. This suggestion aligns with research on models of professional development that provide ongoing coaching in the use of research-based strategies (Kretlow, Cooke, & Wood, 2012). In this study, in-service teachers received guidance to teach to three out of a possible total of 18 standards that they need to address in mixed grade level classes. Future studies may need to examine how to generalize skills to create task analytic lesson plans that respond to a wide variety of standards that teachers must address in their classrooms and how pre-service teachers in general education and content area specialists can contribute to that process.

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The Impact of Assistive Technology on Autism Spectrum Disorder: A Systematic Review

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Abstract

The purpose of this research was to review the assistive technology (AT) specific assessment models and instruments that have been developed for children with Autism Spectrum Disorder (ASD) in order to provide an overview of the strategies to be employed in rehabilitation and education. Three electronic databases were searched for peer-reviewed studies investigating children with Autism Spectrum Disorder (ASD) and the use of assistive technology to assist with speech difficulties, little social interaction, and poor motor skills. Relevant studies were independently reviewed and appraised by three reviewers. Methodological quality was quantified using the American Speech-Language-Hearing Association's levels of evidence. In total, 21 studies were included in the review. We argue that there is a need to develop a more thorough guide for AT professionals in the process of AT assessment for children with Autism Spectrum Disorder.

Keywords: *innovative technology, autism spectrum disorder, assistive technology, social skills, speech difficulties, motor skills*

Introduction

Autism Spectrum Disorder (ASD) is related to a range of significant impairments in speech disorders, social interaction, and poor motor skills (American Psychiatric Association, 2013). Individuals with autism are characterized by repetitive and ritualistic behavior and often have symptoms of attention deficit hyperactivity disorders (ADHD) while their cognitive development does not follow a homogeneous path (American Psychiatric Association, 2013). Furthermore, there has been a steady increase in diagnosis of the disorder (Tarbox, Dixon, Sturmey, Matson, & SpringerLink, 2014). However, it is still unknown if the disorder is due to an individual being born with the disorder or increased awareness and improved diagnosis (Tarbox, Dixon, Sturmey, Matson, & SpringerLink, 2014). Regardless of the cause, as the numbers of ASD continue to rise, the need for intervention is more demanding than ever. Children with autism need language, social and behavioral, and motor skills assistance in order to become independent and successful (Ennis-Cole & Smith, 2011). Additionally, the majority of them encounter difficulties to achieve their daily life goals and they rely on continuous support from parents and/or caretakers (Farley et al., 2009).

Assistive Technology

Assistive technology (AT) can play an important aspect of intervention for children with disabilities. Assistive technology has the potential to alter learning opportunities for individuals with ASD. The Individuals with Disabilities Education Act (IDEA, 1997), the Technology Related Assistance for Individuals Act (TRAIDA, 1988), the Americans with Disabilities Act (ADA, 1990), and the Rehabilitation Act (1973) define *AT* as “any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities” (Cardon, Wilcox, & Campbell, 2011, p. 169).

The majority of research available exploring AT and children with autism spectrum disorder (ASD) involves picture systems and their ability to increase children's receptive and expressive language skills. To support the receptive language development, AT often takes the form of picture schedules to assist children with a variety of daily routines and activities (Cardon, Wilcox, & Campbell, 2011). In addition to the low-tech picture systems, research also indicates that high-tech voice output devices have been used to help children with autism between the ages of three and five years request food, help, and gain access to preferred activities (Cardon, Wilcox, & Campbell, 2011). Assistive Technology (AT) can address the specific needs of a child with autism's speech difficulties, little social interaction, and poor motor skills. AT can enable them to experience more independent living. AT can be defined as specialized tools that allow those with a disability to independently and fully participate in schools (Ennis-Cole et al., 2011). Assistive Technology includes, but is not limited, to both non-technical auxiliary aids, mechanical and electrical devices, computer software, simulations, virtual reality, and augmentative and alternative communication devices. These technologies can help a child with a disorder, such as ASD; accomplish a task that is otherwise extremely difficult or impossible without these tools (Ennis-Cole et al., 2011).

Purpose

Identifying effective interventions and supportive strategies for people with ASD is a critical issue for researchers, educators, and practitioners (Stasolla, Damiani & Caffò, 2014). The purpose of this systematic review sets out to examine and evaluate the impact of assistive technologies such as iPad applications, social robots, and neurological exams on speech difficulties, social interaction and the poor motor skills of children in the autism spectrum disorder.

Method

Selection of Research Articles

Between January 2014 and April 2015, the following three electronic databases were searched: PubMed, CINAHL, and PsychINFO. To capture as many relevant citations as possible, a wide range of medical, health and educational databases were searched to identify primary studies of the effects assistive technology on children with autism. To reach this target, we limited the search to recent peer-reviewed articles, as they are more likely to be relevant and adhere to reporting standards. The search terms used were a combination of the following sets: set 1: *autism spectrum disorder AND assistive technology*; set 2: *assistive technology AND autism*; set 3: *autism AND assistive technology AND social skills*; and set 4: *innovative technology AND autism*.

Inclusion and Exclusion Criteria

Screening criteria were established to identify potentially relevant articles that met minimum methodological standards for acceptance. Inclusion criteria were: studies published between 2007 and 2015, cohort studies, case-control studies and randomized control trials that evaluated the use of assistive technology and focused on children with autism. Three reviewers screened the search results and all seemingly relevant publications. This was a process designed to eliminate only papers not meeting the criteria for inclusion.

Selection of Studies

The titles, keywords, and abstracts of the papers identified by the electronic databases were screened for potential relevance by three researchers. This effort resulted in 739 citations from which relevant studies were selected for the review. The full papers of the remaining 21 citations were assessed to select those primary studies pertaining to assistive technologies impacting speech, social interactions, and motor skills. Studies focusing on adults were excluded, as the main focus of the review is on children with ASD. After reading the full texts of the selected articles, the 21 most significant evidence-based articles were selected for further analysis in the review. See flow diagram in Figure 1.

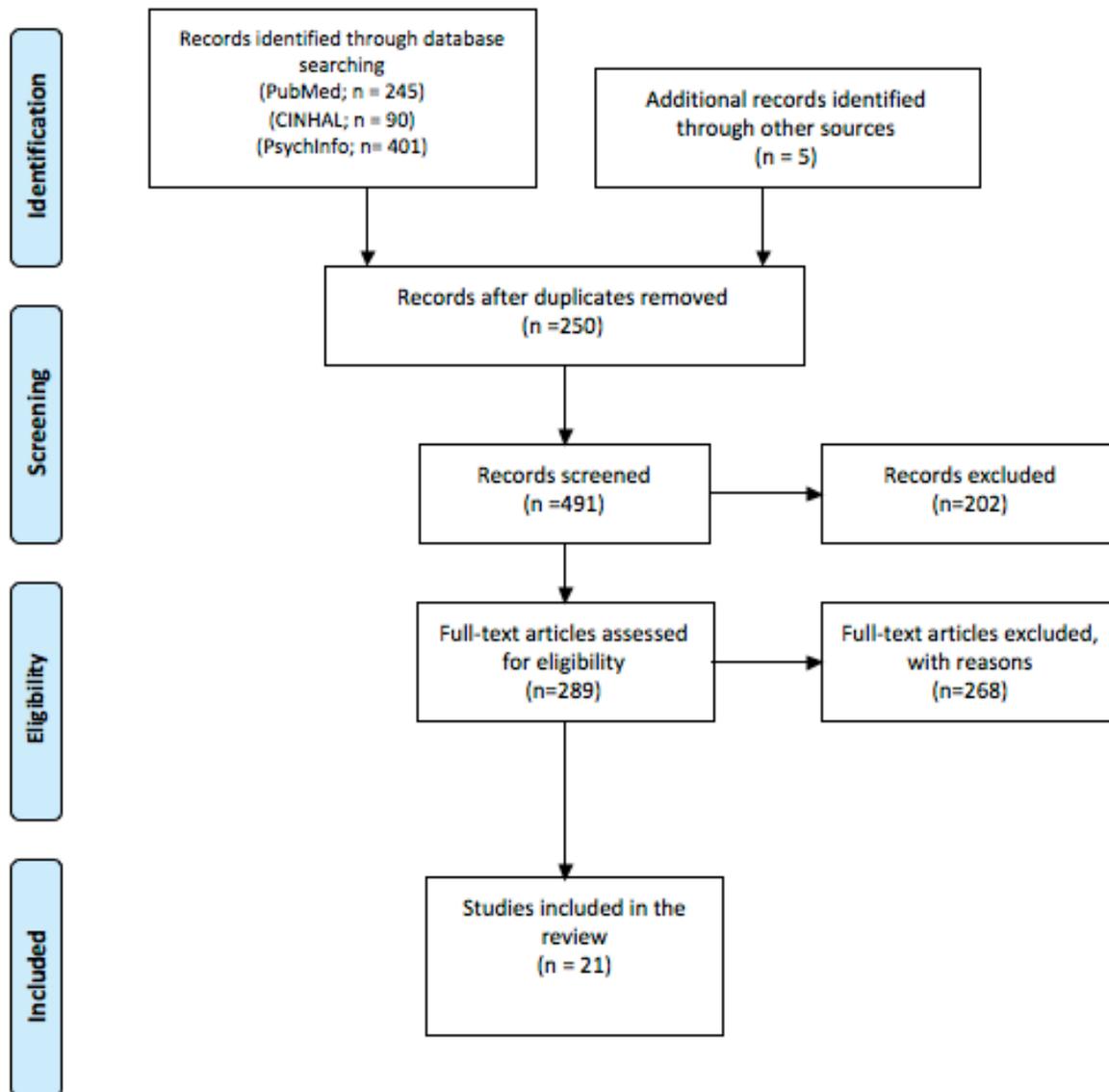


Figure 1. Study flow diagram for review of studies pertaining to assistive technology and ASD.

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

Results

Twenty-one studies were identified that met the inclusion criteria. The review used Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement and guidelines to ensure appropriate and transparent reporting of results (Moher, Liberati, Tetzlaff, & Altman, 2009). Results are summarized in terms of speech difficulties, social interaction and poor motor skills. The main findings are summarized in Table 1, Table 2 and Table 3.

Speech Difficulties

Ennis-Cole and Smith (2011) conducted a case-control study in which a large sample size of 85 participants was recruited between the ages of 10 to 17. The outcomes were positive across all studies as they successfully increased a variety of skills of communication, which also increased other skills such as joint attention, self-help, task completion, motivation, and appropriate behavior (Ennis-Cole & Smith, 2011).

Sampath, Agarwal, and Indurkha (2013) conducted a case-control study using AutVisComm, an assistive communication system. This assistive communication system was developed in collaboration with teachers and parents of children with autism. The study included 24 children with autism all of which were eight years of age. The goal of the study set out to utilize AT, or application AutVisComm, as a means to assist a child in learning to request his or her desired object. Each child had two one-on-one sessions per week with a teacher, in which a food item was placed out of reach of the child and close to the teacher. To receive the food item, the child had to request the AutVisComm and press the appropriate picture on the screen. If they completed this on their own, it was considered to be an independent (IN) response. If the child needed a verbal prompt from the teacher, it was considered to be a verbal prompt (VP). Finally, if the child still did not respond after a VP the teacher would physically assist the child (Sampath et al., 2013). During the initial sessions most children needed to be physically assisted, but as time passed on the need for this became less frequent and most children started responding to VP. An important finding in this study was that while concentrating on usability of AT for the children was important; the usability for caretakers also needs to be considered (Sampath et al., 2013).

Venkatesh, Greenhill, Phung, Adams, and Duong (2012) conducted a case-control study with 16 autistic children between the ages of two to seven. This group of scholars created an iPad-based application called Playpad that provides automated multimedia early intervention for children with autism. This application teaches basic skills designed by trained therapists, software for delivering therapy activities, and collecting progress results. Over a course of four weeks, therapy using the application was implemented and incorporated into the children's daily activities at home. The application specifically increased receptive and expressive language skills using partner activities in which the child and parent interact with the iPad and each other (Venkatesh et al., 2012). To increase expressive language, Playpad presents the image of an object and the child is required to verbally name it. Expressive language requires the child to use language as an expression, where the Playpad application says the name of an object and the child selects the image on Playpad (Venkatesh et al., 2012). To increase receptive language, Playpad presents pictures of objects from the categories and prompts the child to identify the

correct object. Receptive language requires the child to use language receptively, where the Playpad application shows an object and the child names it (Venkatesh et al., 2012). This particular application was extremely successful because it not only incorporated a reinforcement system to motivate the child participating, but tracks and records each trial conducted. Over time, the children in this study decreased the number of errors created and the level of prompting needed, along with an increased number of correct responses (Venkatesh et al., 2012).

Ganz, Boles, Goodwyn, and Flores (2014) conducted a case-control study that included children with autism between the ages of 8 to 14. The study used computer-based visual scripts on vocabulary, and found that all the participants showed an increased use of verbs or nouns with the treatment materials. Also, all of the children required less prompts as the trials progressed over time.

Hill, Belcher, Brigman, Repper, and Stephens (2013) conducted a study with eight participants over the age of 18 with ASD in which the use of the iPad as an AT was tested. All participants at the beginning of the trial had difficulty in communicating and engaging socially while at the workplace, which resulted in a decrease of productivity (Hill et al., 2013). This study found that the use of the iPad's many features helped enhance interpersonal skills needed to communicate and contribute to a positive work experience. An important note in this study was that while the iPad does not replace the need for therapeutic engagement, this type of intervention does indeed improve daily communication for those with ASD (Hill et al., 2013). As described in Table 1, there were a wide variety of high technology AT tools tested and used included voice output communication aids, micro-switch communication systems, touch-sensitive screens, and computer-based language tools.

Kasari et al. (2014) conducted a randomized control study of 61 children with ASD. The study examined the effects of communication interventions which utilized an AT tool created to improve "spontaneous, communicative utterances in school-aged, minimally verbal children with autism" (Kasari et al., 2014, p. 635). The children were randomly assigned a condition of the "developmental/behavioral intervention with or without the augmentation of a speech-generating device (SGD) for 6 months with a 3-month follow-up" (Kasari et al., 2014, p. 2). SGD is a communication AT intervention that "displays symbols that produce voice output communication when selected" (Kasari et al., 2014, p. 3).

In a longitudinal study, the treatment was broken into two phases. In Phase one, all children received 21 one-hour sessions for three months with a clinician, utilizing an SGD. In Phase two, all children received 24 one-hour sessions, for three months with their parents present. It is noted that in phase two, parents received "systematic parent training consistent with the treatment variation to which the child was assigned" (Kasari et al., 2014, p. 5). This experiment, utilizing adaptive interventions, found that in a short amount of time all children improved significantly in spontaneous communication and utterances (Kasari et al., 2014).

Table 1
Results of Assistive Technology Impacting Speech Difficulties

Author	Sample Size	Type of Study	Age of Participants	Measures	Main Findings
Ennis-Cole & Smith (2011)	85	Case-Control	10-17 years	Variety of high-tech AT tools: PDAs, robots, vibrating pagers, switch training, voice output communication aids, microswitch communication systems, touch-sensitive screens, and computer-based language tools	Devices were successfully used to improve a wide variety of skills including communication, self-help, motivation, and appropriate behavior
Sampath et al., (2013)	24	Case-Control	7-8 years	AutVisComm	This application was used at a special school for autistic children in whom each child had two one-on-one sessions per week with a teacher. In order to receive a food item, the child had to use AutVisComm to choose the appropriate picture on the tablet. As sessions progressed, the need for PA and VP became less frequent and the children starting responding independently.
Venkatesh et al., (2012)	16	Case-Control	2-7 years	Playpad	One month of intervention improved receptive

					and expressive language through trails of matching tasks, verbal interaction, and reinforcement. Learning was apparent because of the decreasing number of errors and increasing proportion of correct responses and unprompted responses.
Ganz et al., (2014)	3	Case-Control	8-14 years	Tablet computer-based visual scripts on vocabulary	Results indicated that all the participants showed increase use of verbs or nouns with the treatment materials, all the participants required less invasive prompts as the project progressed.
Hill et al., 2013	8	Case-Control	18 years +	iPad	Support not only independence in daily living, but enhanced the interpersonal skills needed to communicate and contribute to a positive work experience and success.
Kasari, et al., 2014	61	Randomized-Control			

Social Interaction

Cramer, Hirano, Tentori, Yeganyan, and Hayes (2011) conducted a cohort study involving sixteen students between the ages of six and ten years old. The study focused on the interactive tool vSked used in a classroom based setting. Unlike some other studies in this systematic review, vSked focuses on the classroom as a unit rather than just the individual. The use of vSked encourages group practices within the classroom using visual schedules, choice boards, and a token-based reward system (Cramer et al., 2011). The study was conducted in two autistic classrooms over the course of a year. Focusing on a sense of classroom community, the screens in front of the classroom allowed students to see their progress throughout the day as well as seeing their classmate's progress. By awarding tokens as they complete specific tasks and displaying it in the front of the classroom, this encourages students to continue working diligently as well as encouraging their classmates. It is essential for children to feel important and have a sense of community, especially autistic children, and that is the main focus of vSked.

Escobedo, Nguyen, Boyd, Hirano, and Randgel (2012) observed a cohort of twelve children, three who were autistic and nine who were neurotypical (NT), between the ages of eight and eleven year olds in a public school located in Southern California. They studied the effects of a mobile assistive technology named MOSOCO: A Mobile Assistive Tool to Support Children with Autism Practicing Social Skills in Real-Life Situations. MOSOCO is a social compass interactive tool that works on Android smartphones with features that encourage children to make good eye contact, have appropriate spatial boundaries, engage in conversation, identify appropriate communication partners and end an interaction in an appropriate way (Escobedo et al., 2012).

The three students with autism were paired up with NT students as their interaction partners. Video cameras were set up during social exchanges to observe non-verbal communication. Weekly interviews were then conducted to ask participants how the technology was working and how it is impacting their interactions (Escobedo et al., 2012). MOSOCO had a positive influence on the social aspect of children with autism spectrum disorder and changed the group dynamic of student groups. This study can be related back to vSked in that they both work on the individual social skills, but it also focuses on the group dynamic in a school based setting.

Cannella-Malone et al. (2016) conducted a study in which video prompting was utilized to teach new leisure skills. This study included nine students with severe disabilities, including autism spectrum disorder, aged 10 to 22 years (Cannella-Malone et al., 2016). Prior to the study, parents and teachers completed an interview with each student to rank and select specific leisure tasks they are interested in or have done in the past. All videos used in this intervention were created from the perspective of a spectator, and displayed on an iPhone 4. Each video began with a verbal prompt to begin the task, and consisted of a series of short clips for each step of the task. Video prompting was effective in teaching 14 new leisure skills to eight out of the nine students including origami, darts, Lite-Brite, dominos, and painting nails (Cannella-Malone, et al., 2016). This study suggests that the development of new leisure skills leads to an increase in many other skills such as social interactions, positive emotional effects, and increased activity level (Cannella-Malone et al., 2016).

Kim et al. (2013) conducted a randomized controlled experiment to study the effects of a social robot and its interactions of children with autism. Twenty-four children between the ages of four and twelve diagnosed with high-functioning autism spectrum disorder were observed. A social robot was programmed with ten social interaction behaviors and three non-verbal movements designed to replicate a social interaction. An adult stimulus was present during all robot-simulated situations to control the movements of the robot. It was noted that most children did not interact with the adult while the robot was present, only one participant verbalized suspicion that the adult was controlling the robot (Kim et al., 2013). It was found that there was more verbalization while interacting with the robot. This study suggests that in comparison to real therapy support animals, robot animals can be used as a better interactive tool for autistic children. In that, they can be specially customized for each child, controlled by an adult more easily, and are much more affordable compared to training a service animal (Kim et al., 2013).

Lang et al. (2014) performed a cohort study using video self-modeling. Two students with autism spectrum disorder all who are between the ages of four and five years old were the participants. First, there was video footage of children with ASD interacting with other children. During this time, teachers would encourage students to interact more with their peers. After the footage was captured, the raw footage was edited to cut out the teachers interacting with the children as well as poor behavior or solitary play. The students then watched the footage for seventeen school days. Students were then brought out to play with fellow classmates and teachers were instructed not to interfere. The goal was to prompt participants to socially interact more with peers and increase the occurrence of this without the encouragement of teachers. The results indicated an increase in overall social interactions.

Ploog, Scharf, Nelson, and Brooks (2013) conducted a case-control study using computerized visual representations of emotional facial expressions to simulate real life situations. The use of a 3D avatar was used in three stages to study and improve emotion recognition in children with autism spectrum disorder. Stage one, participants were asked to interpret what emotion the avatar was feeling. Stage two participants were given different scenarios and were asked to guess what emotion the avatar was feeling based on that specific scenario. In stage three, the children were a certain emotion that the avatar was feeling and was asked what scenario or event they thought caused this emotion. This virtual environment indicated that children were able to communicate more effectively with other people and that 90% of the participants were able to interpret, recognize and predict emotions from the avatar (Ploog et al., 2013).

Wainer and Ingersoll (2011) conducted a randomized control study with ten participants' ages 16 to 40 using computer treatment. Participants were randomly assigned to a computer treatment group or a no-treatment control group. This computer treatment program was an interactive program that used photographs of faces and eyes. There was a significant increase in emotion identification of the pre-test to post-test. This study relates to the previous studies in that it worked to improve the social skills and emotion recognition in children with autism spectrum disorder.

Table 2
Results of Assistive Technology Impacting Little Social Interaction

Author	Sample Size	Type of Study	Age of Participants	Measures	Main Findings
Cramer et al., (2011)	16	Cohort	6-10 years	vSked	Promoted student independence and encouraged consistency and predictability as well as socialization within the classroom between students as well as staff.
Escobedo et al., (2012)	12	Cohort	8-11 years	MOSOCO	Students learned the basic proper steps to a social interaction including the DO's and DON'Ts and how to help others interact. Learning to apply these skills outside of the classroom was key.
Cannella-Malone et al. (2016)	9		10 to 22 years		
Kim et al., (2013)	24	Randomized Controlled	4-12 years	Social Robots	More verbalization during robot interactions. Found that robot animals serve as a better interactive tool for children rather than real live animals, due to the fact that robots can be customized, controlled and more affordable.
Lang et al., (2014)	2	Cohort	4-5 years	Video self-modeling	Students with ASD were able to learn how to visualize themselves being successful in social situations. Demonstrated an increase in social engagement that was maintained after the study concluded.

Ploog et al., (2013)	34	Case Control	N/A	CAT (3-D Avatar)	Was found that 90% of participants were able to interpret, recognize and predict emotions in the avatar. Which lead to children being able to communicate more effectively with other people in real life situations.
Wainer et al., (2011)	10	Randomized Controlled	16-40	Computer treatment	Participants in the computer treatment group made significant improvements in emotion identification compared to the control group.

Motor Skills

Ament et al. (2015) conducted a case-control study to find evidence for the specificity of motor impairments such as in catching objects and balance in children with autism. The study consisted of two hundred participants with an age range between eight to thirteen years old. All of the children participating needed to meet on the basis of a clinical judgment and if they were diagnosed. The participants for this study were pulled from local schools, pediatrician's offices, outpatient clinics, and the local Autism Society of America chapters. The results of the study indicated that two of the standard scores had main effect on the group [$F(2, 197) = 62.04, p < 0.001$]. Conferroni post hoc test was used during this study to show the differences in the MABC-2 score for the groups. "This test revealed there was a big difference in the total score of MAB-C2 between the TD group ($M = 8.90, SD = 2.52$), ADHD group ($M = 6.38, SD = 2.67$), and ASD groups ($M = 4.14, SD = 2.19$)" (Ament et al., 2015, p. 748).

Barbeau, Meilleur, Zeffiro, and Mottron (2015) conducted a case-control study, which included 39 people ranging from age 14 to 30 years old. The people used in this study were randomly found from database of the Specialized Autism Clinic at the Rivie re-des-Prairies Hospital located in Canada. The study was on comparing motor skills in autism spectrum individuals with and without speech delay. For this study the researchers excluded individuals with a visual impairment, used alcohol (more than two drinks a day) or drugs. The procedure for the study addressed the handedness assessment. This assessment includes ten items monitoring a subject's preferred hand during activities such as throwing a ball. A motor skill assessment was also completed by subjects. Subjects were required to play a game with a wooden board made of two parallel rows of ten holes each of them are eight inches apart. "A trial was considered valid when no pegs were dropped and no significant distraction interfered" (Barbeau et al., 2015, p. 685). Simple reaction time was a visual trigger that was used to obtain the approximant movement speed. The participant's task was to look at the computer screen and each time a black box would appear to the right of the screen they needed to press the button. Results of this study concluded that the use of three standard deviation (3 SD) instead of two standard deviation (2 SD) not affect the overall results. "Planned contrasts revealed that AS-SOD participants were 772, 876, and 913 milliseconds (ms) slower than typical individuals in the DH" (Barbeau et al., 2015, p. 686).

Behere, Shahani, Noggle, and Dean (2012) study was on the motor functioning in Autistic Spectrum Disorders. This is a case-control study; this study focuses on 26 individual's age ranging from six to twenty years old. These individuals were referred for a neuropsychological evaluation. Thirteen of the 39 original participants were excluded from the study because of missing data. This study was divided with the first group having sixteen patients diagnosed with autism with an age range of six to twenty-three, education ranging from first to twelfth grade and the second study consisting of 10 participants with Asperger's disorder age ranging from eleven to thirty-two years old with an education of first to twelfth grade. Participants were administered a DWSMB which is "standardized and norm-referenced measure of cortical and subcortical sensory/motor functioning" (Behere et al., 2012). The participants were then scored based on two different score values of 'W' (different sampling) and 'WD' (norming sample). The results of this study was found by using SPSS "No univariate or multivariate within-cell outliers, at $[\alpha]=0.001$, were found. Assumptions of normality, linearity, homogeneity of variance/covariance matrices, and multicollinearity were met. Also, the covariate of age was found to be reliable for covariance analysis" (Behere et al., 2012, p. 90).

Lloyd, MacDonald, and Lord (2013) study was on Motor Skills of toddlers with Autism Spectrum Disorder. This is a cohort study; this study focuses on a hundred and sixty-two participants ranging from age twelve months to thirty-six months old. This study took place in three different areas including the North Carolina state-funded autism centers; the Chicago autism clinic associated with a private university, and an autism center in Michigan. The participants in this study are part of two investigations for toddlers at risk to become autistic. All of the participants took place in the MSEL testing intended for babies who are from birth to sixty-eight months old. "Scores on the MSEL are organized into five domains including, gross motor, fine motor, visual perception (nonverbal problem solving), receptive language, and expressive language" (Lloyd et al., 2013, p. 4). The calculations that were used during this study was the ratio verbal IQ. This was calculated by taking the mean age; divide by chronological and multiplied by 100. The ratio non-verbal IQ was found by using the age equivalents from fine motor and visual perception tests. The results of the first study revealed no differences in motor skills between the three sites. However, this study showed even though the children had cognitive delays the older children in the study had more delays than the younger children. The second study showed that the fifty-eight children that are autistic in this study showed a delay in gross and fine motor skills, this means the children had significantly fallen behind their chronological age (Lloyd et al., 2013).

MacDonald, Lord, and Ulrich (2013) study was on the relationship of motor skills and adaptive behavior skills in young children with autism spectrum disorders. This is a cohort study focusing on a hundred and fifty-nine participants aging from fourteen to forty-four months. The type of testing used for this study is GML testing; Almost all of the data collected for this study was in an autism clinic. This study focused on testing the relationship between fine and gross motor skills in autistic children. Both gross and fine motor skills were measured utilizing The Mullen Scales of Early Learning (MSEL) (MacDonald, Lord, & Ulrich, 2013). The results for the study were dependent variable on "fine motor skills, nonverbal problem solving, ethnicity and calibrated autism severity" (MacDonald, Lord, & Ulrich, 2013, p. 6). No interactions happened during these results and the fine motor skills were significant of adaptive behavior composite ($p < .001$), daily living skills ($p < .001$), adaptive social skills ($p < .05$) and adaptive communicative skills ($p < .001$).

LeBarton and Iverson (2013) conducted a cohort study on the fine motor skills that predict the expressive language in infant siblings of children with autism, also diagnosed with ASD. Based off of thirty-four participants age ranging from twelve to thirty-six months, a measure of fine motor skills were used to tap motor planning and fine motor control for the children ranging in age from 12-18 months they also used a measure of vocabulary for the children at 36 months. Along with using both of those during this study they used standardized observational measures of fine motor and language skills as a "complementary source of information" (LeBarton & Iverson, 2013). The results of this study showed that the "composite scores were significantly lower for the HR group ($M = 3.62$, $SD = 1.86$) than the LR group ($M = 5.20$, $SD = 1.41$) ($U = 215.0$, $p = .001$)" (LeBarton & Iverson, 2013, p. 6).

Mostofsky, Burgess, and Larson (2008) study examined increased motor cortex white matter volume as a predictor of motor impairment in children with autism. The case-control study included 56 participants ranging in age from eight to twelve years old. The type of testing used during this study is the Physical and Neurologic Examination of Subtle Signs (PANESS). The study's goal was to see if the white matter in the primary motor cortex of these children would predict or not predict impaired motor skills in children with Autism. The results for this study had concluded that the groups did not differ from the amount of age difference between each person in the study (Mostofsky et al., 2008).

Table 3
Results of Assistive Technology Impacting Poor Motor Skills

Author	Sample Size	Type of Study	Age of Participants	Measures
Ament et al., (2015)	200	Case-Control	8-13 Years	Clinical judgment, Autism Diagnostic Observation (module 3), stimulant medications, Performance-based assessment evaluating motor skill ability (MABC-2)
Barbeau et al., (2015)	39	Case-Control	14-30 Years	Handedness assessment, Motor Skill assessment, Clinical diagnosis
Behere et al., (2012)	26	Case-Control	6-20 Years	Neurological exams, DWSMB, MANOVA
Lloyd et al., (2013)	162	Cohort	12-36 Months	MSEL
Macdonald et al., (2013)	159	Cohort	14-44 Months	GLM testing,
LeBarton et al., (2013)	34	Cohort	12-36 Months	Non-parametric Mann-Whitney tests.
Mostofsky et al., (2008)	56	Case-Control	8-12 Years	Physical and Neurologic Examination of Subtle Signs (PANESS)

The three tables in this section discuss the main findings of research conducted on the impact of assistive technology on children in the autism spectrum disorder. Table 1 explains how the studies pertaining to how AT impacts speech and communication difficulties. Table 2 addresses the information found on how AT impacts social interaction, and Table 3 showcases the studies that found how AT impacts poor motor skills.

Discussion

The majority of the studies found during the search for language improvement and motor skills in autistic children included case-control studies. All of the studies range in age from the time of birth until the age of thirty years old. The average amount of participants in the studies was ninety-six people, ranging from twenty-six up to two hundred participants. The main similarity between the studies on motor skills in children with autism is that the participants were randomly selected and found in an Autism Society of America area. All of the studies found impacting speech in people with ASD were similar in that they either created an application for a tablet or used an iPad.

Studies that focus on the development of social skills in autistic children aim to improve social interactions as well as emotional recognition. The majority of the studies used computer based technology in a classroom setting with both the individual as well as the collective body. Video modeling was also found to be an important tool helping participants improve their emotion recognition as well as social skills. The main takeaway from these studies is that after repetition there was a positive improvement. A sense of success and independence is key for all children but especially for children with autism spectrum disorder.

Limitations and future research

The promising outcomes of this particular systematic review indicate that the use of assistive technology devices with autistic children is warranted, and that available evidence indicates that the devices are likely to promote more effect speech, greater social interaction, and better motor skills of children in the autism spectrum. The effectiveness of assistive technology devices is no guarantee that children with ASD will be routinely used. Additionally, findings showed that large numbers of investigators failed to use evidence-based training procedures. Thus, the basic questions that remain open is the importance of future research regarding the effective use of AT and various procedures applicable to individuals with autism and the training or education of professionals and parents.

Conclusion

This systematic review not only discussed the impacts of assistive technology on language, but on social interaction and motor skills. All of the studies selected showed a positive increase in all three objectives with the assistance of AT. This information is not only beneficial to children with ASD, but teachers and parents. Studies focused on the individual as well as students as a collective body. Studies also focused on the importance of an individual with autism to have a sense of independence and a sense of belonging in the community. With new technologies rising, we will be able to better support children with ASD in various aspects of their lives. In conclusion, we have learned that all of the studies we used show an increase in abilities of children with autism.

Autism is a growing occurrence in the world and it is best if people are well informed by researching how technology impacts speech, social interaction, and motor skills. Furthermore research and assessment is needed to measure the benefits of individualized assistive technology tools to aid with other complications associated with ASD. Additionally, future research

regarding best practices in teaching approaches and accessibility to assistive technology to help individual ASD and their families should further be explored.

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Effects of Video Modeling and Video Modeling Plus Prompting and Reinforcement on the Daily Living Skills of a Student with Autism

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Abstract

Video modeling (VM) is an intervention that may be implemented to improve the daily living skills of students with autism. A multiple probe across behaviors design was employed to examine the effects of VM and VM plus prompting and reinforcement (VM+P&R) on the daily living skills of one elementary student with autism. The percentage of correctly completed steps according to a task analysis for each of three target daily living skills was measured across each condition. Results showed the student improved performance under the VM condition. However, further improvement was demonstrated under the VM+P&R condition. Implications for practitioners choosing between VM and VM+P&R and directions for future research are discussed.

Keywords: video modeling, daily living skills, elementary, autism, prompting, reinforcement

Effects of Video Modeling and Video Modeling Plus Prompting and Reinforcement on the Daily Living Skills of a Student with Autism

Many children with autism spectrum disorders demonstrate deficits in daily living skills compared to peers without autism (Liss et al., 2001). Children who struggle with daily living tasks are more likely to allow parents or others to perform the tasks for them (Drahota, Wood, Sze, & Van Dyke, 2010). As such, children with autism are particularly susceptible to becoming over-reliant on adults (Giangreco & Broer, 2007).

Smith and Targett (2009) asserted that improving independence with critical daily living skills could help children with autism become more self-reliant adults. Others have found that ability to perform critical daily living skills is directly tied to overall quality of life in adulthood (Liss et al., 2001; Taylor & Mailick, 2013; Klinger, L., Klinger, M., Mussey, Thomas, & Powell, 2015). With the strong connection between increased ability to perform daily living skills and improved adult outcomes, finding the most effective and most time, cost, and resource efficient interventions to improve such skills is critical. Video modeling (VM) has been identified as an evidence-based practice and has been shown to be effective in improving the daily living skills of students with autism (Bellini & Akullian, 2007; Plavnick, 2013).

VM is an intervention in which a student watches a video of a model performing a skill in its entirety. The student is then expected to complete the same skill in the same way (LeBlanc et al., 2003). Noted benefits of VM include time and cost effectiveness (Charlop-Christy, Le, & Freeman, 2000), an increased likelihood of skill generalization and maintenance (Haring, Kennedy, Adams, & Pitts-Conway, 1987), and greater consistency in how skills are modeled and taught to students (Mason et al., 2013). Additionally, VM is often appealing because many children, especially those with autism, respond favorably to the use of technology (Rosenberg, Schwartz, & Davis, 2010). Finally, VM may provide students with opportunities to work more independently as the strategy relies primarily on the use of a video to deliver instruction rather than a teacher or parent (Hume, Loftin, & Lantz, 2009).

VM can be used to improve the daily living skills of students with autism (Ayres & Langone, 2005) and has reportedly been effective as a stand-alone intervention as well as one paired with other instructional strategies (Plavnick, 2013). Researchers have used VM alone (e.g., Ayres & Langone, 2007; Charlop-Christy, Le, & Freeman, 2000; Rosenberg, Schwartz, & Davis, 2010) and Mechling (2005) reported that positive effects were seen across studies primarily examining the effects of VM alone. Conversely, researchers have demonstrated the effectiveness of VM as a package intervention (e.g., Alcantara, 1994; Haring, Kennedy, Adams, & Pitts-Conway, 1987; Keen, Brannigan, & Cuskelly, 2007; Lee, Anderson, & Moore, 2013).

Overall, positive effects are seen when VM, alone or paired with other interventions, is used to address daily living skill deficits of students with autism; however, the differential effects of VM when used in isolation compared to VM paired with additional strategies remains unclear. Identifying the differential effects may give researchers a better understanding of the critical components of VM (Ayres & Langone, 2005). Practitioners would also benefit from more research on the critical components of VM when deciding how to implement VM interventions with their students. With the numerous and widely varying needs of many students with autism,

finding the most efficient and effective VM interventions would benefit teachers aiming to prepare students for successful adult lives.

Purpose and Research Question

While a substantial amount of VM research exists, few investigators have looked specifically at the effects of VM as an isolated intervention as well as VM as a packaged intervention (McCoy & Hermansen, 2007; Murzynski & Bourret, 2007). Prompting and reinforcement are often paired with VM but such strategies can be effective in changing the behavior of students with autism when used in and of themselves (Hendricks et al., 2009). The purpose of this pilot study was to investigate the effects of VM alone (VM) and VM plus prompting and reinforcement (VM+P&R) on the percentage of correctly completed steps on three daily living tasks. The primary research question was: Will VM improve the daily living skills of a student with autism? A second research question was: Will VM+P&R produce further increases in the student's performance of daily living skills?

Method

Participant and Primary Investigator

Jimmy (pseudonym) was a 10-year-old Caucasian male with autism. Jimmy was selected for participation because he (a) was an elementary-aged student diagnosed with autism by a licensed professional, (b) received special education services under the eligibility category of autism, (c) was described as having deficits in daily living skills by his parent and teacher, (d) was able to sit and watch a video for at least five minutes, (e) could read at the kindergarten level or higher, (f) was not typically absent from school more than 5 days during each grading period, and (g) did not have a physical disability that might impede his ability to complete target daily living skills. Jimmy did not have previous experience with the VM intervention; however, he regularly used iPads at home and at school. According to results of the *Vineland Adaptive Behavior Scales, 2nd Edition* (VABS-II) parent and teacher questionnaires, Jimmy's adaptive levels in the daily living skills domain were in the low range for most subdomains (see Table 1). Jimmy did not engage in problem behavior other than occasional work refusal. Verbal and gestural redirection and systems of reinforcement were often used to encourage appropriate behavior during his typical classroom instruction. The first author was a third-year doctoral student with 5 years of special education teaching experience at the time of the study.

Table 1. VABS-II: Daily Living Skills Domain

	Parent	Teacher
Personal	Low	Low
Domestic	Moderately	Low
Community	Low	Low
Total Standard Score	66	50

Setting

Jimmy attended a suburban public school in western Pennsylvania serving primarily students from middle-class families. Total school enrollment was 331 students. The school district consisted of four elementary schools, one middle school, and one high school. Jimmy received most of his instruction in a special education classroom that primarily served students with autism and sessions took place in this classroom. The back corner of the classroom was conducive to completing daily living tasks. There was a sink, a snack/work table, and a storage area for vacuums and brooms. Jimmy watched the videos on an iPad® Mini while sitting at a table next to the previously described area.

Materials

The daily living skills targeted were cleaning a table, vacuuming under and around the table, and sharpening two pencils. Materials needed for the target skills included a table and five chairs, a supply bin with a spray bottle filled with water and a towel, a manual vacuum, pencils, two bins for pencils, and an automatic pencil sharpener. Other materials included a video camera to record all sessions, an iPad® Mini, and a variety of potentially reinforcing items. Data sheets were used to record performance during study sessions and to gather interobserver agreement and procedural integrity data. Surveys were created to assess the social validity of the interventions and procedures.

Experimental Design

A single-subject multiple-probe experimental design across behaviors (Horner & Baer, 1978) was used to evaluate the research questions. The participant's performance on three daily living skills was measured across three conditions: baseline, VM, and VM+P&R. Baseline probes were administered for at least of 5 sessions for each skill. Skills were introduced to the intervention conditions in a staggered format (Kennedy, 2005). Visual analysis of the level, trend, and variability of each skill was used to determine when a skill moved from baseline to intervention (Horner et al., 2005). Further, a criterion was set to make decisions regarding the introduction of VM+P&R. If Jimmy did not improve by at least one step per session across five sessions, VM+P&R was introduced for a particular skill.

Procedures

Sessions occurred 2 to 4 times per week for 5 to 25 minutes per session over approximately 18 weeks. All sessions were recorded using a video camera so that sessions could be viewed and rescored at a later time by the first author as well as a second observer. On days when multiple skills were probed during a session, the skills were presented in a random order.

Dependent measures. Target skills were selected based on results of the VABS-II and teacher/parent surveys. Additionally, the first author met with Jimmy's parent and teacher on several occasions to discuss the most appropriate target skills. See Table 2 for a task analysis of each target skill. The Murdoch Center Program Library (Wheeler et al., 2001) served as the basis of each task analysis in addition to parent and teacher input. The dependent variable under investigation was the percentage of steps according to each task analysis that were performed correctly and independently. Using a data sheet detailing the task analysis of each skill, the first author coded each step as 1 to indicate the step was performed correctly and independently or 0 to indicate an error was made or the step was not completed.

Table 2
Task Analysis of Target Skills

Step #	Cleaning the Table	Vacuuming	Sharpening Pencils
1	Walk to supply bin.	Walk to table.	Walk to pencil sharpener.
2	Pick up bottle and towel.	Pull out chairs.	Pick up one pencil from “Not Sharp” bin.
3	Go to table.	Walk to vacuums.	Insert pencil into sharpener.
4	Spray table.	Pick up manual vacuum.	Push pencil tip into sharpener.
5	Wipe table (left).	Take vacuum to table.	Hold pencil in sharpener for no more than 5 seconds.
6	Wipe table (center).	Push and pull vacuum around and under table (front).	Pull pencil out of sharpener.
7	Wipe table (right).	Push and pull vacuum around and under table (right).	Put pencil in “Sharp” bin
8	Walk to supply bin.	Push and pull vacuum around and under table (back).	Pick up second pencil from “Not Sharp” bin.
9	Put bottle and towel in bin.	Push and pull vacuum around and under table (left).	Insert pencil into sharpener.
10		Stop vacuuming.	Push pencil into sharpener.
11		Walk back to vacuum storage area.	Hold pencil in sharpener for no more than 5 seconds.
12		Return vacuum to original position.	Pull pencil out of sharpener.
13		Push in chairs.	Put pencil in “Sharp” bin.
Total	9 steps	13 steps	13 steps
Video Length	0:53	1:53	0:49

A more detailed version of the scoring procedures described by Shipley-Benamou, Lutzker, and Taubman (2002) was used to code each step as correct or incorrect. A step was considered correct if Jimmy completed a particular step independently (without any type of prompt) and his behavior matched the description of the step in the task analysis and the model’s behavior in the video. Any response other than what was described in the task analysis and shown on the video was considered incorrect. A skipped step was also considered incorrect as well as steps or components of a step that were unnecessarily repeated. However, if Jimmy correctly completed a step that occurred later in the sequence, he was given credit for completing that step. Generally, the steps within each of the tasks required Jimmy to complete the previous step before he could move on to the next step. A step was also scored as correct if Jimmy self-corrected. Jimmy was

given 30 seconds to complete each step and a session was discontinued if Jimmy did not attempt to perform the next step after this time.

Video development. Videos of an adult model (the first author) completing each skill according to the task analyses were created using a Kodak HD 1080p Pocket Video Camera. An adult model was used as previous research has shown this can be an effective model type (e.g., Charlop-Christy et al., 2000; Shipley-Benamou et al., 2002). After school hours in Jimmy's classroom, the first author used a tripod stand to film all videos. The videos for each task were filmed using a combination of first and third person points-of-view. A first-person perspective, also known as POV perspective (Mason, Davis, Boles, & Goodwyn, 2013), was used to focus in on certain components, materials, or actions of the task. For example, when the model was supposed to pick up the bottle and towel, the video included footage of the supply bin with the bottle and towel and the model's hands picking up the items. When POV was not used, a third-person point of view was used. Jimmy watched the full body of the model completing portions of the task. For example, when the model was supposed to remove chairs from under the table, the video included footage of the model moving around the table and pulling out each chair from under the table.

All videos included text labeling each step of the task. For example, "Go to bin" appeared on the screen when the model was shown walking to the supply bin to get the spray bottle and towel. The videos also included the narration of each step. For example, Jimmy heard, "Pull out chairs" when the model was removing the chairs from under the table. Videos ranged in length from 49 seconds to 1 minute and 52 seconds and Jimmy viewed the videos at "real-time" speed (i.e., the videos were not viewed in slow motion or at a fast pace) on an iPad® Mini.

Baseline. During baseline sessions, Jimmy was directed to the table near the area of the room in which he performed all skills. After Jimmy was seated at the table, an initial verbal and gestural prompt to complete a skill was delivered. For example, the first author would say, "Okay, Jimmy, clean the table" while pointing to the supply bin with the spray bottle and towel. The gesture prompt was provided to encourage Jimmy to stand up from his chair. No further prompts were provided. Jimmy had to begin performing the first step of a skill within 30 seconds of receiving the initial prompt otherwise the session was terminated. If Jimmy began the initial step of the task, he continued performing steps of the skill until he did not move on to the next step after 30 seconds, at which point the session was terminated. No instruction was provided on how to perform any steps during baseline. Neither praise nor reinforcement was delivered when Jimmy performed steps correctly and no feedback was given when Jimmy made an error. After all probes were conducted, a session was complete and Jimmy was told that he was finished.

Video modeling (VM). In the VM condition, the procedures described in the baseline condition were replicated with one addition: Jimmy viewed a video model. After Jimmy was seated at the table, an iPad® Mini was placed in front of Jimmy. Jimmy received one verbal prompt to watch the video while the first author started the video. When the video ended, he was prompted to begin the target skill (e.g., "Okay, Jimmy, clean the table" while gesturing to the supply bin). From here, the baseline procedures were replicated.

Data on Jimmy's performance in the VM condition were visually analyzed after each session and compared to a criterion set to determine if and when VM+P&R should be implemented. If Jimmy did not improve by an average of at least one new step per session across five consecutive sessions, then VM+P&R was implemented for that skill. The criterion was set in an attempt to numerically represent stabilization or decline in performance.

Video modeling plus prompting and reinforcement (VM+P&R). In the VM+P&R condition, reinforcement and error correction procedures were used in addition to the video model. Prior to implementing this condition, the researcher conducted a series of multiple-stimulus without replacement (MSWO; see DeLeon & Iwata, 1996) preference assessments. The entire MSWO procedure was conducted multiple times until one item emerged as the most preferred item. Based on this assessment, Swedish Fish® presented as the most preferred item for Jimmy which was consistent with what Jimmy's teacher and paraprofessionals often used during his typical instruction.

Once the reinforcer was identified, VM+P&R was implemented. In this condition, after Jimmy had checked his visual schedule and was seated at the table, he was prompted to watch the video. After watching the video, the initial verbal and gestural prompt was delivered. As part of VM+P&R, any time an error was made or if Jimmy failed to begin performing a step after 30 seconds, a least-to-most prompting procedure was implemented. A modified version of a least-to-most prompting procedure used by Parsons, Reid, and Lattimore (2009) was used. If Jimmy (a) did not respond to the initial prompt within 30 seconds, (b) did not move on to the next step within 30 seconds, or (c) if Jimmy made an error on a step, the prompting procedure was implemented. First, a "say and point" prompt was delivered. For example, if Jimmy was supposed to pick up the spray bottle and the towel, but only picked up the bottle, the first author would say, "Pick up towel" and point to the towel. The first author would then watch Jimmy for three seconds before delivering the next prompt. If Jimmy was unable to perform the step with a say and point prompt, the first author delivered a "touch to guide" prompt. For example, the first author would guide Jimmy's hand to pick up the towel. Jimmy would then move on to the next step in the task analysis and the prompting procedure was implemented when an error or no response occurred. In the VM+P&R condition, Jimmy completed all steps of a task analysis either independently or with prompting. Once Jimmy had completed the last step of the task analysis in the VM+P&R condition, he was immediately given a Swedish Fish® and verbal praise, which concluded the probe or session.

A modified VM+P&R procedure was implemented for cleaning the table on three of the sessions in response to Jimmy's performance on the fourth step of the task analysis. Jimmy consistently needed a touch to guide prompt to stop spraying the table and move on to wiping the table. In the modified procedure, Jimmy was given a touch to guide prompt before spraying the table and an extra reinforcer was delivered immediately after Jimmy stopped spraying and began wiping the table. On the graph of Jimmy's results, arrows indicate sessions in which the modified VM+P&R procedure was used (see Figure 1).

Interobserver agreement and procedural reliability. The third author was trained in the coding procedure and interobserver agreement (IOA) data were collected on 33% of sessions across all conditions. Training was conducted during multiple sessions and consisted of

reviewing task analyses of similar skills, watching videos of students other than Jimmy completing the skills, coding steps of the task analysis as correct or incorrect, and recording whether a prompt was needed. A criterion of 90% agreement or higher was set for the training modules and 93% agreement was achieved during training. A booster training session was provided to ensure both coders were accurately identifying correct and incorrect steps. Point-by-point agreement was calculated by dividing the number of agreements by the sum of agreements and disagreements and multiplying by 100 (Johnston & Pennypacker, 2009). IOA was 94.0% (81.8% - 100%). The research assistant also used a checklist to collect procedural reliability data on 33% of sessions across all conditions. Procedural reliability was 99% (96%-100%).

Social validity. Jimmy, his mother, and his teacher responded to brief three-point Likert Scale surveys once sessions were complete. One week after the final intervention session, the first author met with Jimmy, his mother, and his teacher to review the results. During this meeting, the first author verbally asked Jimmy to respond to questions regarding his experiences. Jimmy's mother and teacher completed surveys separately and mailed them to the first author.

Results

Visual analysis of Jimmy's graph show an increase in the percentage of correct steps across all three skills when Jimmy moved from baseline to VM, however, he did not reach, or even approach, the mastery criterion of 100% accuracy with VM. Jimmy further increased the percentage of correct steps with the introduction of VM+P&R. See Figure 1 for a graph of Jimmy's results. Overall, data showed a functional relation between the dependent variables and 1) VM on two out of three replications and 2) VM+P&R on three out of three replications.

Cleaning the Table

Jimmy did not complete any steps of the task analysis to clean the table during baseline. All sessions were scored as 0% of steps correct. When VM was implemented, he immediately increased the percentage of steps completed correctly. Jimmy was able to perform between 22% and 44% of steps correctly. Overall, a slight upward trend was seen in this condition, however Jimmy's performance stabilized over the three sessions prior to implementing VM+P&R.

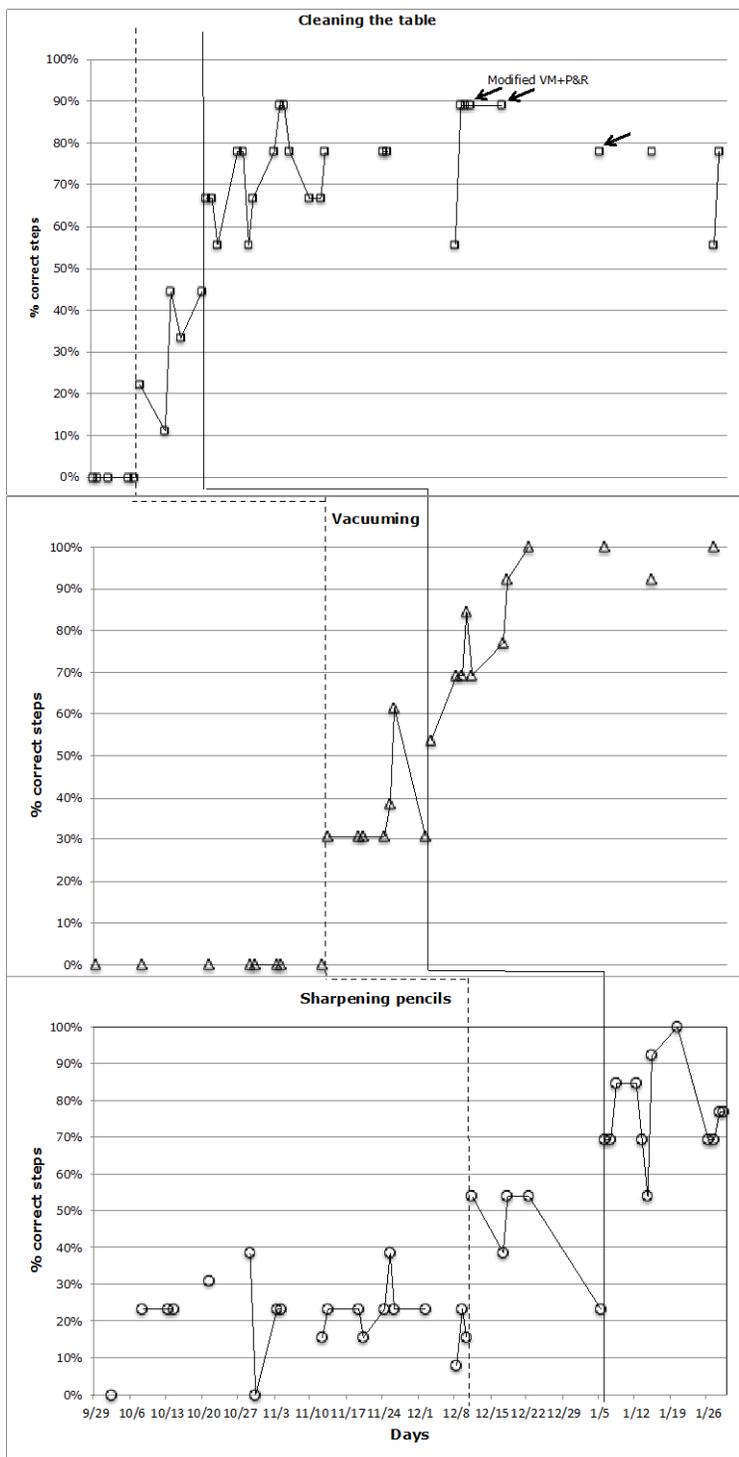


Figure 1. Results: Percentage of steps performed independently

Further, criteria of improved performance of the acquisition of at least one new step per session across five sessions was set for the VM condition. Jimmy did not perform an average of at least one new step per session across five sessions; therefore VM+P&R was implemented. An immediate improvement was seen in performance in the VM+P&R condition. Jimmy was able to perform between 56% and 89% of steps correctly and independently.

Vacuuming

As with cleaning the table, Jimmy was unable to perform any steps of the task analysis for vacuuming during baseline. All sessions were scored as 0% of steps correct. When VM was implemented for vacuuming, Jimmy immediately improved his performance. His performance was relatively stable at 31% of steps correct across most sessions with the exception of one outlier on November 26 when he completed 62% of steps correctly. Again, Jimmy did not perform an average of at least one new step per session across five consecutive sessions and VM+P&R was implemented for vacuuming. With the implementation of VM+P&R, performance immediately improved. Jimmy performed between 54% and 100% of steps correctly and independently.

Sharpening Pencils

During baseline, Jimmy demonstrated some ability to sharpen pencils. He could perform up to 38% of steps for sharpening pencils. When VM was implemented, Jimmy made some improvement and completed up to 54% of steps correctly. Jimmy did not increase his performance by at least one new step across five consecutive sessions in the VM condition. His performance was stable or decreasing during the last five VM sessions and VM+P&R was implemented. In the VM+P&R condition, Jimmy immediately increased his performance and, overall, performed between 54% and 100% of steps correctly and independently.

Social Validity

Jimmy indicated that he liked doing each of his jobs and that he liked watching the videos. Additionally, the first author met with Jimmy's mother and teacher to review the results and display videos from some of the sessions. After reviewing the results and watching videos of Jimmy performing skills during various conditions, Jimmy's mother and teacher completed a survey. According to results of the adult survey, Jimmy's mother and teacher both felt that the target skills selected were appropriate, Jimmy improved his ability to perform the skills, the interventions were beneficial, and the interventions were an acceptable way to teach Jimmy new skills. Also, both were interested in trying the interventions at home or in the classroom.

Discussion

Overall, Jimmy increased the percentage of correctly completed steps across all three skills with the introduction of VM. He also increased the percentage of steps completed correctly when P&R was added to VM. Jimmy was able to perform two of the three target skills with 100% accuracy during at least one session.

Results add to previous research supporting the use of VM interventions to teach students with autism daily living skills (e.g., Mechling, 2005; Ayers & Langone, 2005; Bellini & Akullian, 2007). However, these results suggest a contradiction when compared to some of the existing research examining the use of VM as an isolated intervention (e.g., Charlop-Christy, Le, & Freeman, 2000; Rosenberg, Schwartz, & Davis, 2010) as the student did not meet criteria when performing daily living skills in the VM condition. Across all skills in the VM condition, Jimmy did demonstrate immediate increases in the percentage of correct steps completed; however, after several sessions of VM, performance appeared to stabilize or decrease. Moreover, when VM+P&R was introduced, Jimmy immediately increased the percentage of correctly completed steps across all skills. Performance either continued to improve or was maintained at an increased level. While Jimmy did improve his performance under the VM condition, further improvement was demonstrated under the VM+P&R condition.

Notable observations were made with regard to each of the target skills. First, when Jimmy was asked to clean the table he consistently made an error on the fourth step (i.e., spray the table). Jimmy perseverated on this step and consistently needed a touch to guide prompt to stop spraying and begin the next step. This issue was reflected in the data, preventing Jimmy from reaching criterion of completing 100% of the steps correctly and independently. In an attempt to address Jimmy's persistent spraying, a modified prompting and reinforcement procedure was put in place during the VM+P&R condition to see if a change in performance occurred. In the procedure, a touch to guide prompt to spray the table correctly was delivered before Jimmy made an error (as opposed to waiting for Jimmy to make the error), followed by the delivery of a reinforcer immediately after Jimmy stopped spraying and began wiping the table. This procedure was implemented for 3 sessions. There was no apparent effect on his performance after the modified prompting and reinforcement procedure was removed. If Jimmy's fascination with spraying were known prior to creating the task analysis, an alternative way to clean the table would have been devised. It is also interesting to note that cleaning the table was the task with the fewest steps and the shortest video, yet the task was the most challenging for Jimmy.

Regarding Jimmy's vacuuming performance, there was one outlying data point during the VM condition in which Jimmy was able to perform 62% of steps correctly, which was much higher than his performance during all other VM sessions. However, Jimmy did not meet the criteria to remain in the VM alone condition. Because of the stability seen in across all other data points and because Jimmy did not meet the criteria for continuing his sessions with VM: VM+P&R was implemented, despite the outlying data point.

Finally, while Jimmy's baseline performance for cleaning the table and vacuuming was consistently 0%, it is apparent that Jimmy had some pre-existing skills with sharpening pencils, although he had never formally been asked to complete the task before baseline. It may be due to the fact that Jimmy observed pencils being sharpened more often than he observed tables being cleaned or the floor being vacuumed in his classroom prior to his participation in the study. His somewhat variable baseline performance for sharpening pencils could have been due in part to natural observational learning that occurs in the classroom.

Implications

Based on results of the pilot study, a practitioner may consider implementing VM+P&R over VM alone as Jimmy was able to perform more steps of the task analysis across all skills under the VM+P&R condition. When VM was implemented an improvement was seen in Jimmy's performance; however his ability to complete steps of the task analysis appeared to level off or decrease after at least five sessions.

With that said, an increase in performance level from baseline to VM was seen across all three skills. If a student is performing at a relatively high baseline level, but needs a slight boost in learning or mastering the remaining steps of a task, it is possible that the boost in performance Jimmy demonstrated could be replicated for other students. In this case, it may be more efficient for a practitioner to use VM.

With regard to VM interventions as a whole, a practitioner may consider using video models to incorporate opportunities for students to complete tasks with greater independence (Mechling, 2005). While the effects of viewing a live model versus a video model were not compared, the video model essentially replaced a live model, giving Jimmy an opportunity to work more independently rather than rely on an adult to model a task. Additionally, while an adult was needed to deliver prompts during the VM+P&R condition, the amount of prompting needed generally decreased over time, allowing Jimmy to become more independent, especially for vacuuming and sharpening pencils.

Directions for Future Research

Results add to existing literature supporting the use of VM based interventions to improve daily living skills for students with autism. However, more research is needed to identify the critical components of VM as well as the use of additional strategies that are often paired with VM. Specifically, more research investigating the effects of VM+P&R compared to the effects of P&R alone would be beneficial in identifying the differential effects of the two interventions. Additionally, the effects of VM+P&R on a student's baseline performance rather than his or her performance in an alternative VM intervention should be investigated. For example, an adapted alternating treatments design (Sindelar, Rosenberg, & Wilson, 1985) or a parallel treatments design (Gast & Wolery, 1988) would compare the effects of VM+P&R to a student's baseline level of performance. Such designs could also account for any potential sequence effects that may have impacted the results.

Finally, videos models included components such as text, narration, a combination of first and third-person perspectives, an adult model, and were viewed at real-time speed on an iPad® Mini. Studies have been conducted to begin to investigate the differential effects of some of these components (e.g., Ayres & Langone, 2007; Bennett, Gutierrez, Honsberger, 2013; Biederman et al., 1999; Mechling & Ayres, 2012), however additional research is needed to determine the critical components to be included or excluded from videos used in VM interventions to address daily living skills for students with autism.

Limitations

Although effects of VM and VM+P&R were replicated across most skills and findings support the hypothesis that VM and VM+P&R can be used to improve daily living skill performance,

there were a number of limitations. First, only one participant was involved. Research comparing the effects of VM and VM+P&R across multiple participants is needed. Second, the design did not allow for several important comparisons. The design cannot account for any potential sequence effects (Kazdin & Hartmann, 1978) VM may have had on VM+P&R. Because performance in the VM condition was compared to performance in baseline and performance in VM+P&R was compared to performance in VM, claims regarding the effects of VM+P&R on student baseline performance cannot be made. Additionally, the design cannot account for the possibility that P&R without VM could have been just as effective as VM+P&R. To restate, it is possible that the P&R component of the intervention was more powerful than the VM component.

Next, it is important to consider factors related to Jimmy's performance and ability level. It is possible that Jimmy's ability to complete steps of each task analysis was not reflected in the VM condition. Because prompts were not provided in the VM condition, Jimmy could have been able to perform steps at the end of the sequence, but because the session was terminated before he reached the later steps, there was no opportunity for him to perform the later steps.

A fourth limitation was the omission of a measure to assess the quality of Jimmy's work. In a study conducted by Biederman et al. (1999), independent observers viewed students with autism performing various tasks taught via VM and rated the quality with which students performed the tasks. There were instances when Jimmy would make an error on several steps when sharpening pencils, but in the end, the pencils were sharp. To the other extent, during one session Jimmy completed all steps of the vacuuming task analysis correctly and independently but a few strips of paper remained on the floor. A quality measure would add to the natural application of the VM and VM+P&R interventions and may support the use of the interventions to teach students to complete jobs accurately and efficiently.

Conclusion

Findings add to existing literature supporting the use of VM interventions to improve daily living skills of students with autism. Moreover, results begin to fill a gap within the literature base regarding the investigation of VM alone. Results indicate VM+P&R may be a more effective intervention than VM alone as the participant performed at a higher level with the addition of prompting and reinforcement. More research is needed to determine the critical components of VM interventions including the inclusion of additional strategies (i.e., prompting, reinforcement, visual aids, in vivo modeling) as well as critical components that should be included or excluded from the video model (i.e., text, narration). VM interventions have the potential to not only improve the daily living skills of students with autism, but also offer practitioners and students opportunities to use technology to build independence when completing critical functional skills that may lead to overall improved quality of life.

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