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Maintenance of Language and Learning Skills Using PEAK Relational Training During Extended School Closure

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**MAINTENANCE OF LANGUAGE AND LEARNING SKILLS USING PEAK
RELATIONAL TRAINING DURING EXTENDED SCHOOL CLOSURE**

A Master's Thesis

Presented to

The Graduate College of

Missouri State University

In Partial Fulfillment

Of the Requirements for the Degree

Master of Science, Applied Behavior Analysis

By

Kayla Welch

May 2022

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MAINTENANCE OF LANGUAGE AND LEARNING SKILLS USING PEAK RELATIONAL TRAINING DURING EXTENDED SCHOOL CLOSURE

Psychology

Missouri State University, May 2022

Master of Science

Kayla Welch

ABSTRACT

Autism Spectrum Disorder (ASD) is a developmental and neurological disorder that affects how people communicate, interact with others, behave, and learn. Applied Behavior Analysis is a scientific approach to predicting and influencing behavior that has been applied successfully in supporting children with ASD. Due to communication and intellectual differences experienced by those diagnosed with ASD, it is important to identify therapies and interventions that focus on language development as well as maintenance of intervention gains during unexpected lapses in instruction. The PEAK Relational Training System (Dixon et al., 2017) is a treatment framework that exists within ABA to address language and cognitive skills. In this case study evaluation, which was completed in a public school setting, four students with ASD were assessed using the PEAK Comprehensive Assessment (PCA) prior to the COVID-19 shutdown. During the shutdown, these students received a significant decrease in the amount of direct instruction and instruction was delivered via telehealth. When school resumed the next fall, these students were reassessed, and three out of the four students showed an increase in their PEAK Assessment scores. This case study shows the effectiveness of a modified telehealth model created and conducted by school teachers and staff in a rural public school in Nebraska during the mandatory COVID-19 closures. Once the shutdown was over, scores were collected and analyzed from existing data collected during this time as well as pre-post analysis of PCA scores.

KEYWORDS: autism spectrum disorder, applied behavior analysis, covid 19, derived relational responding, peak

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In the interest of academic freedom and the principle of free speech, approval of this thesis indicates the format is acceptable and meets the academic criteria for the discipline as determined by the faculty that constitute the thesis committee. The content and views expressed in this thesis are those of the student-scholar and are not endorsed by Missouri State University, its Graduate College, or its employees.

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INTRODUCTION

Autism Spectrum Disorder and the Right to Specialized Education

What is a disability and how does one become “disabled”? According to the Centers for Disease and Disabilities Control and Prevention (2022), a disability is “any condition of the body or mind (impairment) that makes it more difficult for the person with the condition to do certain activities (activity limitation) and interact with the world around them (participation restrictions)”. The medical model approach identifies a disability as a problem within a particular person and requires medical interventions or support to help the person learn to adapt to their environment (Goering, 2015). The social model approach focuses on the point that society sets up barriers for people, making it difficult for them to participate in daily activities. The disability is not within the person but is within society (Goering, 2015).

In November of 1975, the United States government passed the Public Law 94-142, which is known as "The Education for All Handicapped Children Act of 1975" (Wright & Wright, 2021). This would allow all children with disabilities the right to an education, and schools would be held accountable if this was not made possible. This law has been changed many times, with the most recent amendment being in 2004. One of the biggest changes that came from this 2004 change was the title change from the original name to the Individuals with Disabilities Education Improvement Act (IDEA) of 2004. The purpose of the changes that were made was to make sure students were getting an individualized education and to prepare students for their next steps after graduation (Wright & Wright, 2021).

Moreover, this education was to be both free and appropriate to ensure that, not only were disabled children able to access support but that those supports successfully achieved the

educational goals individualized to the needs of the student. Individualization is critical within the rights of disabled students (Adams & Grieder, 2005) based on their personal and educational support needs, and this individuation can be difficult to achieve when unforeseen events like school closures due to pandemic make specialized services inaccessible (Smith, 2021).

Therefore, educators, scientists, and behavior analysts at the intersection of these two areas have an obligation to explore and assess strategies for maintaining support services under challenging circumstances.

Not all children with disabilities are eligible to receive special education. IDEA breaks down eligibility into 13 different categories. Not only do students need to have a disability, but they must also need special education to make progress to be successful. One of these 13 categories is Autism Spectrum Disorder (ASD). ASD is a disorder that affects a child's development, neurophysiology, and can influence educational achievement (Siegel, 2003). The biggest differences are seen in the development of a child's social skills, communication skills, and behavior relative to neurotypically developing peers (Lee, 2021). In the previous years, autism was diagnosed and given a subclassification based on three different domains, communication, social interaction, and restricted and repetitive behaviors until the Diagnostic and Statistical Manual of Mental Disorders was created (Randall et al., 2018).

According to the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-V; American Psychiatric Association, 2013), people who are diagnosed with ASD can exhibit deficits in communicating and interacting with others, perform repetitive behaviors, and have restricted interests. (Randall et al., 2018). These types of behaviors are often seen as undesirable behaviors by society which places causation of behavior inside the individual rather than a problem within society. There are no specific ethnic, racial, or economic groups in which

ASD is seen more frequently (National Institute of Mental Health, 2022). There are also currently no known causes of ASD, but it is thought to be linked to environmental factors as well as genetic factors (Hodges et al., 2020). Even though scientists are unsure exactly what leads to ASD, there are some commonly known risk factors which include older parents, low birth weight, and having an older sibling with ASD (National Institute of Mental Health, 2022).

Diagnosing Autism is done by looking at behaviors and development in the younger years of children (American Psychiatric Association, 2013). Doctors and psychologists can usually diagnose ASD by the age of two (National Institute of Mental Health, 2022), although recent advances are making earlier diagnosis possible by regular screenings done by a child's pediatrician at nine months, fifteen months, and an autism specific screening that is done at eighteen months (Hodges et al., 2020). Usually, diagnosing younger children happens in two separate steps. First, the doctor does a general screening. If there is a concern by either the doctor or the parents, the child is usually referred for a second assessment. The second step generally includes an evaluation by an experienced team (National Institute of Mental Health, 2022). This evaluation can include cognitive tests with language and age-appropriate skills tests. Once the assessments are completed, a diagnosis is made, and treatment recommendations are made. Once a diagnosis is made, children may be eligible for services from the school district that the child resides in (Centers for Disease Control and Prevention, 2022).

Referring and diagnosing Autism in older children often happens through the school system by a teacher, other professionals in the school system, or parent when classroom interventions have not been successful. Following the referral, the assessment team will conduct a full evaluation to gather all information needed to inform the eligibility decision making process. Assessments that are commonly used for reaching the autism diagnoses are the Autism

Diagnostic Observation Schedule (ADOS), as well as the Childhood Autism Rating Scale (CARS). The ADOS has been proven to be more successful in identifying children with autism, as well as ruling out children that do not have autism (Randall et al., 2018). Diagnosing ASD in adults is a little more difficult. The overlapping of symptoms of ASD and other disorders, such as ADHD, makes it difficult to distinguish between the two disorders (National Institute of Mental Health, 2022).

Since autism is a complex disorder with no known single cause, there is no cure, however, there are treatments that can be done to reduce symptoms. Due to the variability in symptoms from person to person, it can make it complicated to create an intervention to address the needs of all children with autism (Tiura et al., 2017).

School Based Intervention and Supports for Autism Diagnosis

According to Hyman et al., (2020), there are several interventions that can assist in improving daily skills, cognitive functioning, and supporting those with ASD. Some examples of treatments are developmental approaches, pharmacological and psychological interventions, medical treatments, and behavioral interventions. Each of these approaches can assist in meeting the educational rights and needs of students with ASD in classroom settings.

Developmental approaches focus on the sensory issues and fine motor issues that can be seen in children with autism. Children on the autism spectrum often have developmental delays which may include low muscle tone and issues with gross motor coordination. Physical therapy is used to focus on fine motor deficits and larger movements that use the arms and trunk (Ruggeri et al., 2019). Massages are also used to help with muscle relaxation. Physical therapy

can help a child at a young age to strengthen their core and help with their postures (Ruggeri et al., 2019).

Pharmacological as well as psychological approaches have also been used by practitioners to address different symptoms that arise in people with autism. For example, Risperidone is an antipsychotic that is used with children with autism to help with irritability and mood fluctuations (McCracken et al., 2002). Medications, such as Ritalin and Concerta, are also used to address the lack of focus or high energy levels in a person with autism (Hyman et al., 2020). The psychological approaches focus more on helping with anxiety, depression, and other mental health issues that can be exhibited due to autism (Hyman et al., 2020). Psychologists may also work with students with autism to help them manage relationships and to better understand social cues.

Many different behavioral approaches are used by practitioners to address behavioral and learning challenges (Hyman et al., 2020). Behaviorism was defined by Skinner in his book *About Behaviorism* as “a philosophy of behavior and not the science of human behavior” (Skinner, 1957). Not all approaches to behaviorism are the same. Methodological behaviorists believe that only observable behaviors should be addressed, and mental states do not lead to an understanding of behavior (Cherry, 2022). Another type of behaviorism is Radical behaviorism. Radical behaviorism was initially developed by B.F. Skinner (Skinner, 1974). Radical behaviorism looks at all aspects of behavior, the past and present environments, and the different reinforcements a person has come in contact with. Radical behaviorism also says that private events, such as thinking, are just as important as public events (Baum, 2011). Behavioral philosophy is critical in supporting the needs of children with ASD in school settings by focusing on supporting behavior through systematic changes in the environment (i.e., school environment)

where behavior is occurring. Moreover, the philosophy of radical behaviorism came from the applied subfield field of Applied Behavior Analysis.

Some of the most successful treatments for autism and other disabilities have come out of the field of Applied Behavior Analysis (ABA). ABA is a scientific approach that focuses on identifying, understanding, and improving behavior (i.e., prediction and influence over behavior change (Hayes, 2006). ABA focuses on the environmental variables before and after the target behavior that may influence the behavior and creates interventions that address those variables (Baer et al.,1968). The core subjects that are targeted using ABA are humans and animals (Malott & Shane, 2013). The treatments that have been created using characteristics from the ABA field have also been successfully applied to students with autism and other educational support needs (Dillenburger & Keenan, 2009).

Baer, Wolf, and Risley (1968) defined seven dimensions that define behavioral interventions that include: behavioral, analytic, applied, technological, conceptual systems, and generality. One characteristic involves choosing a behavior that is socially significant for the client. Socially significant behaviors are behaviors that can improve a person's life experience. Some examples of socially significant behaviors are adaptive living skills, communication skills, and academic skills (Manettas, 2021). Another characteristic is behavioral, which includes precise measurements of behavior. This means the target behavior must be measurable and observable. ABA must also be analytical and technological which leads to a different implementor being able to replicate the previous procedures. Another important characteristic of ABA is generality. Generality refers to the idea that the behavior must be able to be seen across time and in different settings.

One area of interest to behavior analysts is successfully supporting and strengthening verbal behavior that is critical to success of people within and outside of educational settings. Skinner first defined verbal behavior in his book, *Verbal Behavior* (Skinner, 1957), as “behavior reinforced through the mediation of other persons”. It requires a speaker and listener, with clear distinctions between the two, although private verbal behavior occurs when both the speaker and listener exist within the same skin. For humans, verbal behavior may be involved in most actions and decisions that a person makes. Moreover, influencing verbal behavior such as knowledge and performance targets is the express purpose of educational services for children with disabilities such as ASD that may negatively impact communication learning. For example, acquiring language, completing a social interaction, and problem solving all require the use of verbal behavior. Skinner identified six verbal operants that require different types of responding from the listener: mand, tact, echoic, intraverbal, textual and transcription (Skinner, 1957).

Although these verbal operant may develop naturally in neurotypically developing children, additional educational supports may be needed to teach these verbal behavior skills. Discrete Trial Training (DTT) is a very systematic approach which involves teaching lessons that are broken down into small steps with a focus on skills in five different areas. DTT occurs when an antecedent prompt is delivered with an opportunity for the student to respond and a consequence is delivered following the response (Sump et al., 2018). This approach is used in home, school and public settings to teach social and behavioral skills, academic, cognitive, and language skills (Bogin, 2008). DTT requires a one-to-one approach in which a staff member sits across the student and delivers the antecedent and immediately delivers a consequence following a response. The consequence varies based on the response the learner gives. A prompt is delivered following an incorrect response. These prompts can be verbal prompts or physical

prompts (Sump et al., 2018). The prompts that the learner requires are set up to be delivered by a person in the same room, making this a difficult task to complete when the staff member is not near the learner.

Relational Frame Theory and Supporting Educational Performance

Due to its complexity, language has been hard to describe since it cannot be defined as only using operant and respondent learning (Törneke et al., 2010). Relational Frame Theory (RFT) establishes a framework for the study of human language to be conducted with great precision. RFT encourages language to be described as a relationship between stimuli and is made up of very specific components (Blackledge, 2003). One component of RFT is known as derived relational responding. One of the early researchers, Sidman and Tailby (1982), looked at derived relations and how they could be used to address stimuli that have been learned without being taught and have never been reinforced, leading to more complex language being learned. Sidman (1971) originally described derived relational responding while explaining how a client was able to convey comprehension by matching a written word to a picture as well as a written word to a spoken word. This then led to the student being able to match a picture to a spoken word without any training or direct reinforcement learning.

There are three specific types of derived relational responding with mutual entailment being the first type. Mutual entailment means that if one stimulus is related to a different stimulus, then the second stimulus is also related to the first stimulus in some way (Blackledge, 2003). For example, if A is related to B, then that also means B is related to A. This can also be known as symmetry. The second type of derived relational responding is called combinatorial entailment. This is also known as transitivity. Transitivity explains the relation between three

different stimuli (Blackledge, 2003). For example, stimulus A is related to stimulus B and stimulus A is also related to stimulus C, this allows us to see that stimulus B and C are also related to each other even though that relation was never specifically taught. This further supports the fact that derived relational responding does not rely exclusively on direct reinforcement learning.

The third property of derived relational responding is known as the transformation of functions (Hayes, 2006). Transformation of functions is like the previously mentioned combinatorial entailment; however, the function of one stimulus in the relation is altered in some way, changing the relationship between the other two stimuli. For example, if A, B, and C are related to each other but one of them is modified in some way, the others may be affected as well, altering the initial relationship. Through transformation of stimulus function, information that is directly learned or derived can lead to important changes in behavior for the learner. Within educational settings, the ability to derive relations can expedite the learning of new information and can lead to more successful working both in educational settings and in the world more broadly.

Typically developing children can acquire derived relational responses at a very young age (Murphy, 2016). However, this is an area that children with autism can be lacking, which then leads to a deficit in language skills. Therefore, it is important to use effective technologies that focus on derived learning (Törneke et al., 2010) as well as verbal behavior. When a child can make connections between different relations and are able to establish a variety of verbal operants, such as echoics, tacts, mands, and intraverbals, they have the potential to increase their language, as well as learn more than they would be able to if every skill had to be directly taught (Dixon et al., 2017).

The PEAK Relational Training System

Historically, there have been many different language interventions that have been created to address the deficits associated with ASD. Applied Behavior Analysis interventions are endorsed in the medical field for addressing language deficits. The best approach to addressing language and cognitive deficits is to do verbal operant training, derived relational training, or a combination of the two (Dixon et al., 2017). The assessment and curriculum that addresses those two topics are the Promoting the Emergence of Advanced Knowledge (PEAK) assessment and curriculum (Sidman, 1971) and Relational Frame Theory (Hayes et al., 2001).

The Promoting the Emergence of Advanced Knowledge curriculum is an intervention that addresses skills needed to increase language and cognitive deficits. The PEAK curriculum consists of an assessment, curriculum, and data tracking. The curriculum begins with the PEAK Comprehensive Assessment (PCA), which is an all-encompassing assessment that addresses all types of skills a learner needs. Each module has its own assessment (May & Flake, 2019). It also has indirect assessments for the direct training modules and generalization modules that are given to caregivers to complete (Belisle et al., 2021b). The results from the PEAK comprehensive assessment along with the indirect assessment are analyzed and the results then lead to specific interventions.

The PEAK curriculum consists of four different modules, each addressing different skills. Each module is broken up into 184 different programs that target many different skills and learning modes. Each program consists of a target goal, instructions on how to run each program and example stimuli that can be used if appropriate for the students. The programs get more difficult as the student progresses through them (May & Flake, 2019). The first two modules, Direct Training (PEAK-DT), and Generalization (PEAK-G), both focus on beginning language

skills (Dixon et al., 2017). They are very similar to those of Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP) and Assessment of Basic Language and Learning Skills - Revised (ABLLS-R); however, these two modules reach a much higher age range of skills as well as more complex topographies. The other two modules are Equivalence (PEAK-E) and Transformation (PEAK-T). These two modules have skills that focus on stimulus equivalence (Sidman, 1971) and Relational Frame Theory (Hayes et al., 2001). The modules are intended to be run at the exact same time so all modalities can be addressed.

PEAK programming may be successfully used in both clinical and school settings. Dixon et al. (2016), evaluated the effectiveness of equivalence-based instruction when teaching geometry to students with autism the PEAK-E curriculum. This study showed that students could be taught the name of a shape, followed by matching it to a shape property, which would then lead to other derived geometry skills (Dixon et al., 2016).

PEAK programs are usually run while seated with the child in a 1:1 setting. Dosage amount has been shown to vary greatly across different sites based on individual needs and instructional time available for PEAK programming (Belisle et al., 2021b). In this study, the clients were exposed to an average of 1.5 hours a day of PEAK programming. Data is the foundation of ABA and is also a central part of PEAK. Data shows staff whether or not clients are making progress and guides all decision-making (Gilmore, 2017).

Because Applied Behavior Analysis is based on data, taking the data in an organized way is of utmost importance. In the past, many clinics have used paper and pencil to take data and then input the data into a graph either the same day or within the next week (Duarte, 2021). This type of data tracking requires a lot of time and leaves room for human error. Over the years, computer programs have been developed to alleviate the paper and pencil data tracking.

Catalyst by Datafinch is a computer program that allows staff members to have the ability to track data as the session is occurring. This program can track skill progress as well as behavior reduction data (Catalyst, 2022). Catalyst can take live data and graph it, as well as create progress reports for parents (Duarte, 2021). It also allows for sessions to be video, and audio recorded for future use (Catalyst, 2022). In the present case study, we utilized Catalyst to allow for on-going data collection prior-to and during the COVID-19 shutdowns that were adapted to a telehealth model. In addition to adapting technology, we attempted to overcome a number of challenges within special educational programming during this time.

Challenges in Special Education During COVID-19

In the spring of 2020, the Coronavirus-19 (COVID 19) hit the United States. Due to this pandemic, many schools in the United States were mandated to shut down and online learning was adopted during this time for educational instruction. This affected over 90% of the total student population, including students with specialized support needs. The infection rates in each region were the leading decision factor on whether schools would reopen or remain closed for many months (Thorsteinsen et al., 2021). Staff began developing systems that would allow them to continue teaching students, without being in the same room (Belisle et al., 2021a).

The education system was unsure how COVID 19 would affect students' learning while receiving instruction at home. One study suggested that educators be ready for a substantial difference in the educational levels of returning students (Kuhfeld et al., 2020). Not only were educators dealing with little to no direct instruction, but they were also trying to figure out how to address the emotional needs of their students.

Rural schools in Nebraska officially closed their doors on March 18th of 2020 and continued closure until summer vacation was set to begin. This closure would affect all students; however, the students who would experience the biggest obstacles in their education and routines were students in special education (Smith, 2021). Telehealth models were adopted as quickly as possible, and many people were changing instruction to PowerPoints or other computerized systems.

Ferguson et al. (2019) conducted research on different reviews of telehealth models using behavior-analytic interventions. In his study, results suggested that interventions using telehealth were successful when targeting one or more behaviors. Online learning for special education students consisted of zoom meetings, assignments on different applications, and reviewing skills the students had learned throughout the year up to this point (Ballinger, 2020). Parents and siblings of special education students were expected to help make sure that the student was attending zoom meetings and completing review activities.

Another obstacle that families and districts had to overcome was working with very limited internet access in rural Nebraska. Many schools supplied hotspots which would allow families to have internet access in their homes; however, hotspots were limited and did not allow for multiple siblings to be connected at the same time.

Not only were the parents and students dealing with obstacles in their homes, but the schools were also dealing with their own set of difficulties. When the shutdown was enforced, the government decided there would be no waivers for special education services allowed. This meant that all schools would need to continue to follow the IDEA guidelines of a free and appropriate public education (Nelson, 2020). If a student's individual education plan (IEP) stated

that the student was to receive a service, the district would need to ensure that that service was still being delivered.

Following the summer vacation of 2020, schools were faced with a monumental decision. They needed to decide whether learning could be returned to a face to face setting, whether students should remain at home, or whether a hybrid setup could be used (Ballinger, 2020). In the school where this case study was completed, the administration decided students would return to learning in a face-to-face setting with safety measures in place. For example, staff were expected to screen students two times a day. All staff and students were required to wear a mask whenever in the school building, and desks were to be placed a minimum of six feet apart in the classrooms (Dolliver, 2020). Students were expected to stay in their assigned classrooms and the teachers would rotate between the classrooms as needed.

The current case study is a follow up to the previous technical study by Belisle et al. (2021a), in which the authors described the procedures used to create DTT programs using software that is available and commonly used by staff delivering services. This case study takes the steps Belisle et al. (2021a) used to create programming using computerized discrete trial training programs on commonly used software. This programming was then applied to a public-school setting to assess transportability and generality. Results from the PEAK Comprehensive Assessment from before COVID 19 closures to those after the closure were analyzed to determine if students could continue to learn and improve in areas of language and academics. During the shutdown, the students received a drastic decrease in instructional time as well as changes in the implementation of programs. Additionally, only mastered programs were run with the students instead of introducing new concepts during this time to promote maintenance of learning outcomes and given uncertainty as to the duration of school closures.

METHODS

Participants

The participants in this case study were four, Caucasian males that ranged in age from 7 to 15, all had the diagnosis of autism. This case study used deidentified data sets, so IRB compliance was not required. Mac was a 14-year-old eighth grader that received 300 minutes of special instruction throughout his day. He qualified for special education at the age of two when his parents referred him for testing due to a lack of language. He qualified under the verification of developmental delay. He began exhibiting physical aggression toward others due to not being able to communicate and when he wanted to escape tasks. Mac began receiving ABA services in 2017 and has shown a drastic decrease in physical aggression averaging over 100 aggressions a day, down to under 10 aggressions a day. He required a staff member to be with him during each part of his day. Mac previously used VB-MAPP for his programming needs but in 2018, PEAK was adopted by the program and became his main programming along with other behavior analytic programs.

Thomas was an eight-year-old second grader. He was tested and qualified for special education at the age of two under the verification of developmental delay emphasis on language, social and cognitive skills. He was then retested in 2016 and was verified for special education under the diagnosis of autism. Throughout his childhood, he has had aggressive behaviors toward himself and others when his communication needs are not being met. He has also exhibited pica and has required aba programming to address these needs. Along with the other students in the program, Thomas previously used VB-MAPP for his programming needs but in 2018, PEAK was adopted by the program and became his main programming along with other

behavior analytic programs. Thomas received 210 minutes of special instruction throughout his day. Due to limited language skills and unsafe behaviors he exhibited in school, Thomas required a staff member with him for most of his day.

Lincoln was a seven-year-old in first grade. He qualified for special education at the age of two under the verification of speech, language impairment. At age seven, Lincoln was retested and qualified under the verification of autism. He exhibited repetitive activities and stereotyped movements, resistance to environmental change or change in daily routine, and unusual responses to sensory experiences. He currently receives 200 minutes of special instruction throughout his day for three days a week. He attends an outside ABA agency the other two days of the week. At this agency, they focused on food aversions and potty training. VB MAPP was used for Lincoln's curriculum in the school setting until 2018 and then PEAK was introduced. Lincoln required a staff member to be with him throughout most of his day due to a lack of language and academic skills as well as physical aggression. He did have occasional accidents throughout his day.

Chucky was a six-year-old first-grader who received 180 minutes of special instruction throughout his day for five days a week as well as staff support throughout his day. Chucky was first referred for special education because his parents were concerned about his language development and would like him to communicate his wants and needs. Chucky qualified for special education at the age of two with a developmental delay verification. At the age of five, Chucky was referred to an outside school district that offered ABA five days a week. He exhibited disruptive behaviors that inhibited his learning in the classroom and required more extensive programming. He would also elope from any type of academic task and would leave the classroom without permission.

Setting

Each PEAK Comprehensive Assessment was given in a self-contained classroom in the public school setting where the students received ABA programming every day. Each assessment was completed by the program's head teacher. The testing was done at the head teacher's kidney table with dividers around the students to remove distractions. The head teacher had been previously trained by the onsite BCBA to conduct the PCA with the students. Two other staff members were working with different students in the room at that time and kept talking to a minimum during testing sessions. The testing sessions were broken into 30-minute sessions for each of the students and were completed in 3 days. During those 30 minutes, the student was asked 10-16 questions and then given a 1–2-minute reinforcement break.

During the COVID shutdown, each of the maintenance sessions took place in the participants' homes. Two of the students lived in a rural country home. The other two students lived in small rural towns. The students each had iPads that were used for the sessions. Each parent was trained using a video made by staff and sent out at the beginning of the shutdown with directions on how to get their child logged on to the zoom sessions. The PEAK programs were delivered via zoom from the paraprofessionals in the classroom at their desk area.

Additionally, the programs were created on Microsoft PowerPoint and Boom Cards by trained staff and were checked over by the BCBA who oversaw the program.

In an attempt to keep the sessions as distraction free and routine as possible, it was requested that the students were either seated at an office desk in a bedroom or at the kitchen table. The parents or siblings were not to sit near the child during the sessions and all noise was to be kept to a minimum.

PEAK Comprehensive Materials

The needed materials used for the PEAK Comprehensive Assessment were the PEAK flipbooks that show the stimuli for the visual questions. There are three different books that assess each of the four modules. Each book consisted of standard stimuli and a script for the assessor to read from. Figure 1 is an example of stimuli that can be seen in the first flipbook. There is only one single set of stimuli on a page that goes with the scripted question. Some questions do not correlate to pictures and require a verbal response or an imitative response. The instructor used the PCA record booklet to track correct and incorrect answers from the student. Half of the results were then calculated using the factor scoring grids. The Direct Training module, as well as the Generalization module, had factor scoring grids that were used to identify which program correlated with each test question. If the student gave the correct answer during the PCA, that corresponding program could be considered mastered, and the next missed question would show which program would be a target. The last two modules were also scored and sent away for trained staff to use an algorithm and then sent back to the school, identifying the next ten targets.

COVID Shutdown Materials

The public school was closed, and all online learning was to begin on the following Monday. Since students were not allowed in the building during this time, each student was sent home with the needed materials for the first few weeks of online learning. This consisted of an iPad, or chromebook depending on their age, an internet hotspot if needed, and any paper materials they would need to complete their academic assignments. Due to the student's needs, it was decided that the students in the self-contained classroom would meet twice a day on zoom

with a trained staff member to complete PEAK programs and other academic programming instead of having them complete their work using other formats such as IXL or google classroom. Table one shows a list of the PEAK programs that were ran with Mac during the shutdown.



Figure 1. Image of PEAK Comprehensive Assessment flip book

For the zoom maintenance sessions, the student was required to be on the iPad that they used at school before the shutdown, during each session. Each student was expected to have wireless internet at their home. If they were not able to get internet, the school would provide hotspots for the families so they could still attend zoom sessions. All programs were set up as PowerPoints or ran on Boom Cards. Once the staff member was on zoom with the student, the staff member would use the sharing screen feature on zoom, with the student, so they could

visually see each program on their screen. These programs had built-in reinforcement sounds and reinforcement was also delivered by the staff member.

Table 1 Mac’s PEAK Maintenance Programs

Direct Training	Generalization	Equivalence	Transformation
DT 4F: Actions	G 2B: Tact animals	E 2A: Ref: Pictures	T 1A: Pic to Pic
DT: 6H- Vocal Imit.	G 4B: ID Clothing	E 2B: Refl: Objects	T 3A: Bigger/Smaller
DT 7H: Sounds	G 5B: Tact color	E 3A: Ref: Money	T 4A: Text Dis.
DT 8C: Label Food	G 6A: Tact: People	E 5D: Tacting Letters	T 4E: DTC: You and I
DT 8I: Information		E 5E: Shape Names	
DT 8N: Tact Clothes		E 5F: Math Symbols	
DT 9K: Tact Shape		E 5G: Emotions	
DT 9L: Tact Colors			
DT 9O: Tact Letters			

The staff member working with the student was on their Mac that was provided by the school. The zoom sessions also required the paraprofessionals to be in separate rooms when conducting each session because their computers would pick each other’s voices up and confuse the student and cause echoing to occur. Table two shows the list of PEAK programs that were ran with Thomas during the shutdown. During the sessions, the students were expected to answer

verbally for the programs that required a verbal answer. They were given access to the mouse if the program required them to select an item.

Table 2 Thomas’s PEAK Maintenance Programs

Direct Training	Generalization	Equivalence	Transformation
DT 2A: Eye Contact	G 2B: Tact animals	E 2A: Ref. Pictures	T 1A: Pic to Pic
DT 6B: Greetings	G 5B: Tact color	E 2B: Ref.: Objects	T 3A: Bigger/ Smaller
DT: 6H- Vocal Imit.	G 5E: Vocal Echoic	E 3A: Ref.: Money	T 3D: Pic. Disc.
DT 7H: Sounds	G 6A: Tact: People	E 4E: Food Sources	T 4A: Text Dis.
DT 8B: Label Items	G11G: ID of Color	E 5C: Number Id.	T 4E: DTC: You & I
DT 8C: Label Food		E 5D: Tacting Letters	T 5B: OPP Big/Small
DT 8E: Label clothes		E 5E: Shape Names	T 5C: Opp. Pic to Pic
DT 8F: Actions		E 5F: Math Symbols	
DT 8I: Information		E 5G: Emotions	
DT 8L: Tact Food		E 5H: Vocal Counting	

Following the COVID shutdown, the administration was careful to keep in mind the needs and rights of special education learners. A decision was made that all instruction was to involve only the review of previously learned and/or mastered skills – no new material would be presented. This decision ensured that the IEPs of the special education students would be followed with fidelity. The use of the PEAK program was an appropriate option because it was previously being implemented with the students in their educational setting, so they were

familiar with the language that was being used. It was also chosen based on the components that PEAK is made up of, using a curriculum that is created using relational frame theory as a main component. This allows for the students to learn in the absence of direct contingencies, making it a successful program to use during a COVID shutdown when staff can rely exclusively on direct reinforcement learning. Table three show which programs were run with Lincoln during the COVID shutdown from each of the four modules.

Table 3 Lincoln’s PEAK Maintenance Programs

Direct Training	Generalization	Equivalence	Transformation
DT 7H: Sounds	G 2B: Tact animals	E 2A: Ref. Picture	T 3A: Bigger/ Smaller
DT 8B: Label Items	G 5B: Tact colors	E 3A: Ref. Money	T 4A: Text Dis.
DT 8C: Label Food	G 6A: Tact: People	E 4E: Food Sources	T 4E: DTC You & I
DT 8I: Information		E 5D: Tacting Letters	
DT 9J: Body Parts		E 5E: Shape Names	
DT 9L: Tact Colors		E 5F: Math Symbols	
		E 5G: Emotions	

Each PEAK program that was selected to be run with the students over zoom were the programs that had been mastered by each student from the beginning of the implementation of PEAK. The headteacher and BCBA created a list for the paraprofessionals to assist in creating each program using PowerPoint or boom cards. Table four shows the PEAK programs that were ran with Chucky during the shutdown.

Procedure

Each student was given the PCA in a one-on-one setting, in February, to identify the programs that would be targeted over the course of the rest of the semester by the headteacher. The headteacher placed the flipbook on the table in front of the participant with no other materials on the table. The teacher read directly from the PCA script and gave short breaks after each line of questions were completed. During the assessment, no reinforcement was given for correct answers and the teacher did not prompt a correct response. The headteacher took data on a clipboard so the student could not see whether they got it right or wrong.

Due to the shutdown, the administration decided to only allow reviewed skills to be taught. This led to all new programs being put on hold, and programs that were already mastered were reopened and run during the zoom sessions with the target students. The teacher, BCBA and paraprofessionals had one week to transform sessions from a table setting to a telehealth format as well as learn how to create zoom meetings, send invites to each meeting, and run programs through zoom. This included taking the mastered programs that could be done over a zoom session and switching them over to PowerPoint or boom cards. Figure 2 shows an example of a direct training program that was created using the boom cards website and figure 3 is an example of a Direct Training program that was created using PowerPoint.

Program data were tracked on Catalyst throughout the COVID shutdown, which was previously created on Catalyst by the on-site BCBA. Once created, programs were placed on baseline, and depending on if the student passed or failed the baseline, the program was opened to be run or closed to be mastered. Staff members have been using Catalyst since the fall of 2017. All staff had access to an iPad and their catalyst account that the school provides. This

allowed staff members to take data as it is happening. Figure 4 shows an example of a student's catalyst profile.

Table 4 Chucky's PEAK Maintenance Programs

Direct Training	Generalization	Equivalence	Transformation
DT 4F: Actions	G 2B: Tact animals	E 2A: Ref. Picture	T 3A: Bigger/ Smaller
DT: 6H- Vocal Imit.	G 4A: Counting	E 2B: Ref. Objects	T 4A: Text Dis.
DT 7H: Sounds	G5B: Tact Color	E 3A: Ref. Money	T 4E: DTC: You & I
DT 8C: Label Food	G 6A: Tact: People	E 3B: Ref: Words	
DT 8I: Information	G 8B: Tact: Actions	E 4E: Food Sources	
DT 9J: Body Parts		E 5E: Shape Names	
DT 9K: Tact Shapes			
DT 9O Tact Letters:			

The programs are listed on the left side of the screen and the staff can take data on the program and behavior at the same time during each session. Each program consists of teaching instructions that tell the staff member exactly how to run the selected program. The staff member selects the correct score for each trial based on the prompting the student required. As the staff member puts in the data, the red line on the left will turn green as each trial is completed. Once the line is completely green, the staff member knows they have completed the program and can move on to the next program.

What is this?



Figure 2. Direct Training Program on Boom Cards

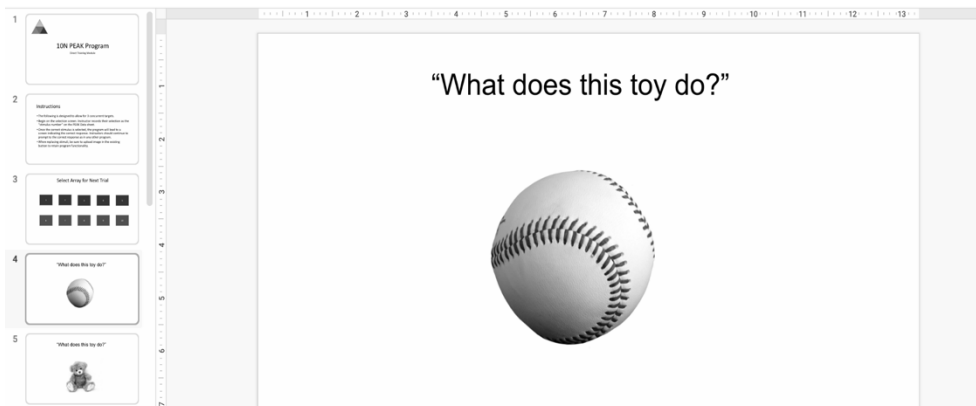


Figure 3. Direct Training Program on PowerPoint

Once the shutdown was over and students were back in the school setting the next fall, the PCA was administered by the headteacher. The room was set up identical to the room set before the shutdown. The testing was done in 30-minute sessions with 1–2-minute reinforcement breaks and was spread out over three days. During the testing sessions, masks were needed to be worn by the student and the teacher administering the assessment. When facial imitations were needed to be completed, the teacher would move back from the table, remove her mask and complete the behavior that needed to be imitated. Once the teacher completed the task, the

student would remove their mask and imitate the teacher, replace their mask and then the staff member would move back to the table to continue the assessment. The data from the assessments were then analyzed by the headteacher and the on-site BCBA to identify areas that needed to be retaught and areas that had been mastered.

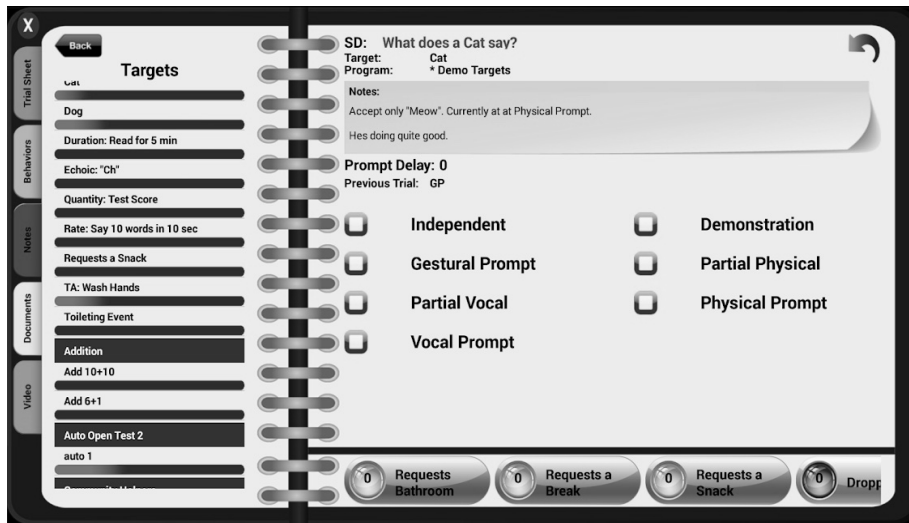


Figure 4. Student's Catalyst Program Profile

RESULTS

During the shutdown, Mac attended 86% of his zoom sessions. He had 56 sessions set up and attended 48 of them. Mac had to rely on his siblings to help him get the zoom sessions going because his mom and dad still had to work most of the weekdays. Mac's house lies in a remote area; consequently, connectivity issues were often a problem, which made it difficult for some of the sessions to be completed. Mac also exhibited problem behavior during sessions, causing them to be stopped before the thirty-minute session was completed.

Before the COVID shutdown Mac was running two programs in each of the four modules and completed each program twice. Mac was completing 16 trial blocks per day prior to the shutdown, compared to 3.8 trial blocks per day during the shutdown, which was a 76% decrease. During the shutdown, Mac completed most of his programs from the direct training module. He ran a total of 91 programs during all of his sessions and 48% of those programs were direct training programs, 13% were generalization programs, 32% were equivalence and 7% of the programs were transformation programs.

Mac's scores are shown in figure 5. His pretest score for the direct training module was 41 and increased four points to 45 in the posttest, a 10% increase. His generalization pretest score was 26 and decreased two points to 24 in the posttest, an 8% decrease. Mac's pretest score for the equivalence module was an 8 as well as his post-test score. His transformation score was 16 for his pretest and stayed at 16 for his posttest. Adding these scores together lead to a 2-point increase from the pretest to the post-test scores.

Thomas attended 93% of his zoom sessions. He had 55 zoom sessions set up for him and he was able to attend 51 of those sessions. During these sessions, staff struggled with getting a good

internet connection due to where Thomas lived outside of the town. Many sessions were cut short or delayed due to lack of internet connection or computer issues. Thomas also attended zoom sessions using his iPad and hotspot that was supplied by the school, while in the vehicle when traveling to Alabama toward the end of the mandatory shutdown.

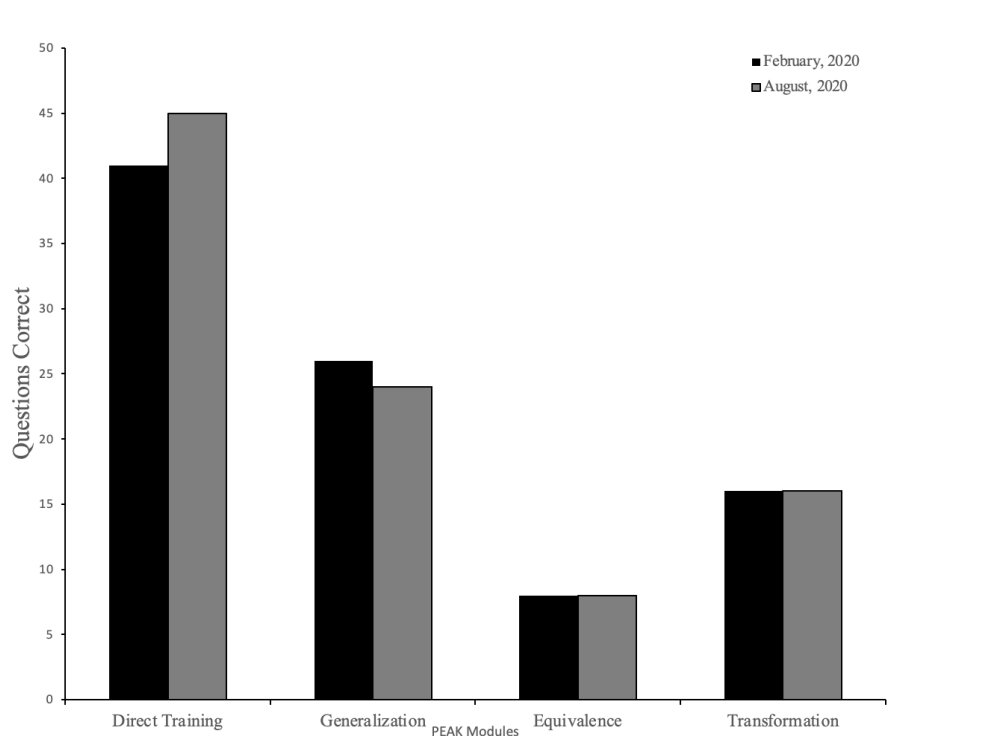


Figure 5. Pre-post PEAK comprehensive assessment (PCA) scores for Mac

During Thomas’s zoom sessions, staff ran most of his programs from the equivalence module. He completed a total of 110 programs during all of his sessions. Thirty four percent of those programs were direct training programs, 20% were generalization programs, 37% were equivalence and 9% of the programs were transformation programs. Before the shutdown

Thomas was completing 16 trial blocks per day prior to the shutdown, during the shutdown he had a 68% decrease and was only running 5.2 trial blocks per day.

Thomas's scores are shown in figure 6. His pretest score for the direct training module was 43 and decreased one point to 42 in the posttest, a 2% decrease. His generalization pretest score was 28 and stayed a 28 in the post-test. Thomas's pretest score for the equivalence module was a 10 and his post-test score was an increase of 8 points to an 18. His transformation score was an 18 for his pretest and decreased one point to 17 for his post-test, a 6% decrease. Overall, he scored a 99 and increased his score to a 105 in the second assessment. Adding these scores together lead to a 6% increase from the pretest to the post-test scores.

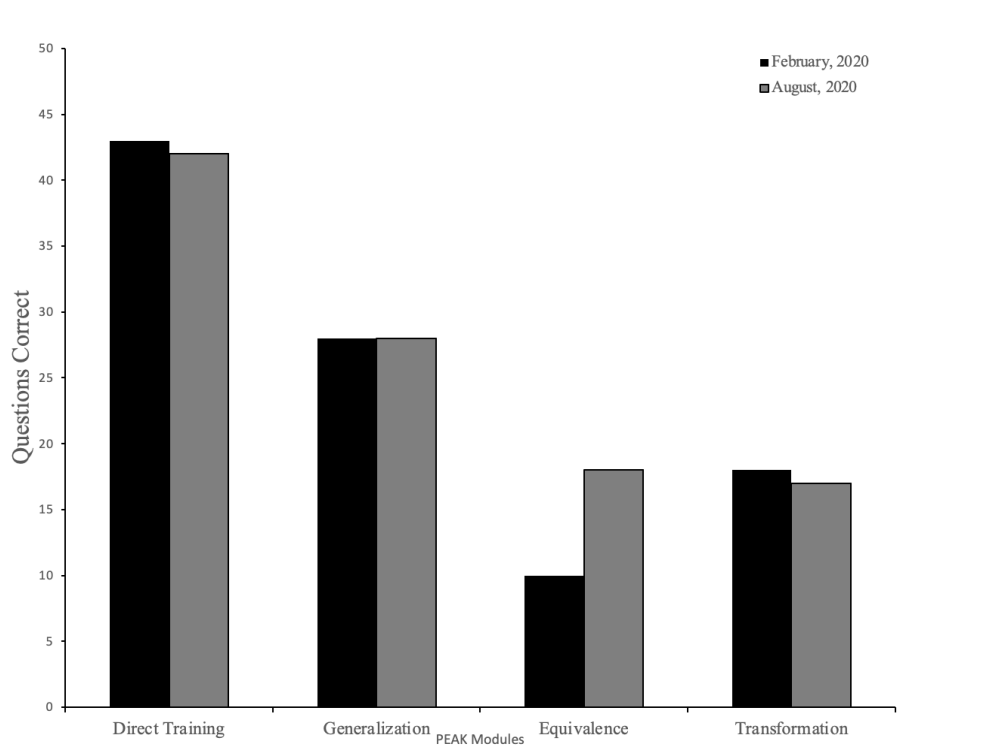


Figure 6. Pre-post PEAK comprehensive assessment (PCA) scores for Thomas

During the shutdown, Lincoln attended 53% of his sessions during the COVID shutdown. He attended 16 out of the 30 thirty-minute sessions. He only attended the public school three days a week, due to attending an outside clinic, so his zoom sessions were set up only on the three days he attended, Monday, Wednesday, and Friday.

During the shutdown, Lincoln received the most programming from the direct training module. He ran a total of 37 programs during all of his sessions. Thirty eight percent of those programs were direct training programs, 16% were generalization programs, 32% were equivalence and 14% of the programs were transformation programs. Before the shutdown Lincoln was completing 16 trial blocks per day prior to the shutdown, during the shutdown he had a 71% decrease and was only running 4.6 trial blocks per day.

Lincoln's scores are shown in figure 7. His pretest score for the direct training module was 42 and increased four points to 46 in the posttest, showing a 10% increase in scores. His generalization pretest score was an 18 and increased twelve points to a 30 in the posttest, a 29% increase. Lincoln's pretest score for the equivalence module was 10 and his post-test score increased by six points to 16, a larger increase with it being a 60% increase. His transformation score was a 30 for his pretest and increased by 2 points to a 32 for his post-test, with a 7% increase. Adding these scores together lead to a 24-point increase from the pretest to the post-test scores, making it a 24% increase in overall scores.

Chucky attended 82% of the zoom sessions between the end of March to the middle of May. With the assistance of his mom, he took part in 41 out of the 50 zoom sessions. Some of the sessions were group sessions which included more than one student from the program and focused mostly on social skills activities.

During the shutdown, Chucky completed most of his programs from the direct training module. He ran a total of 71 programs during all of his sessions with 51% of those programs were direct training programs, 20% were generalization programs, 18% were equivalence and 11% of the programs were transformation programs. Before the shutdown Chucky was completing 16 programs a day and during the shutdown, he had a 78% decrease and was only running an average of 3.6 trial blocks per day.

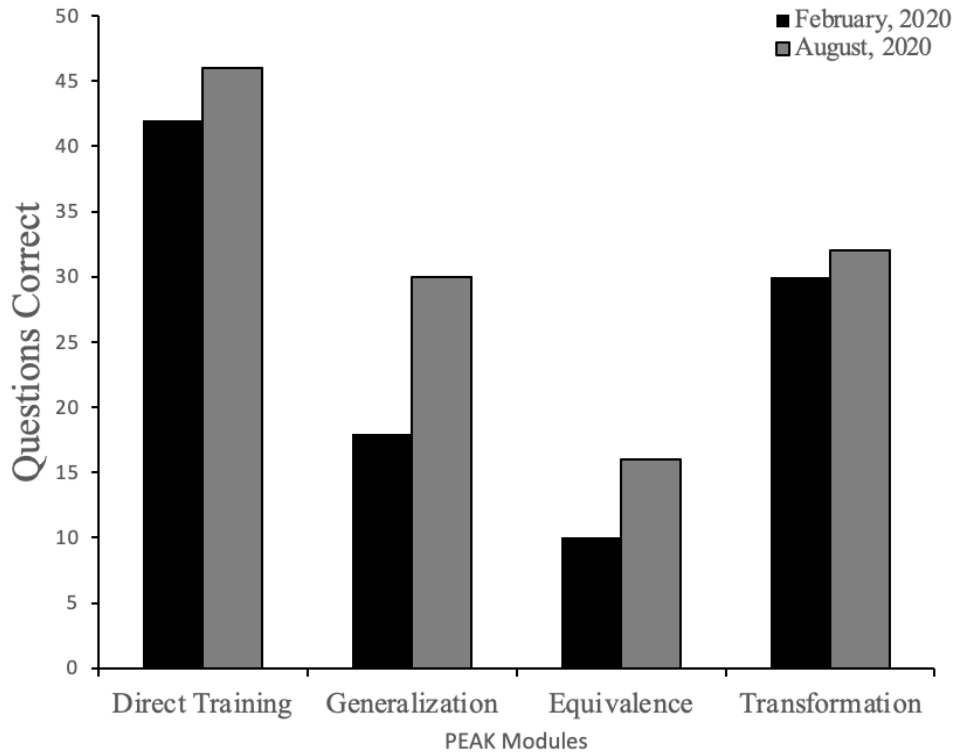


Figure 7. Pre-post PEAK comprehensive assessment (PCA) scores for Lincoln

Chucky’s scores are shown in figure 8. His pretest score for the direct training module was 48 and decreased by 2 points to 46 in the post-test, this is a 4% decrease from his first score.

His generalization pretest score was 29 and decreased by three points to 26 in the post-test, a 10% decrease. Chucky's pretest score for the equivalence module was an 18 and decreased to an 8 for his posttest score, the biggest decrease of 56%. His transformation score was an 18 for his pretest and stayed at 18 for his posttest. Adding these scores together lead to a 13% decrease from the pretest to the post-test scores. Chucky's biggest decrease in scores from February to August can be found in the equivalence module with a 10-point decrease.

During the shutdown, the students had a 73.25% decrease in the amount of trial blocks that were completed. Even with the exponential decrease in the amount of trial blocks completed by each student, the students still collectively exhibited a 4.2% increase in posttest scores.

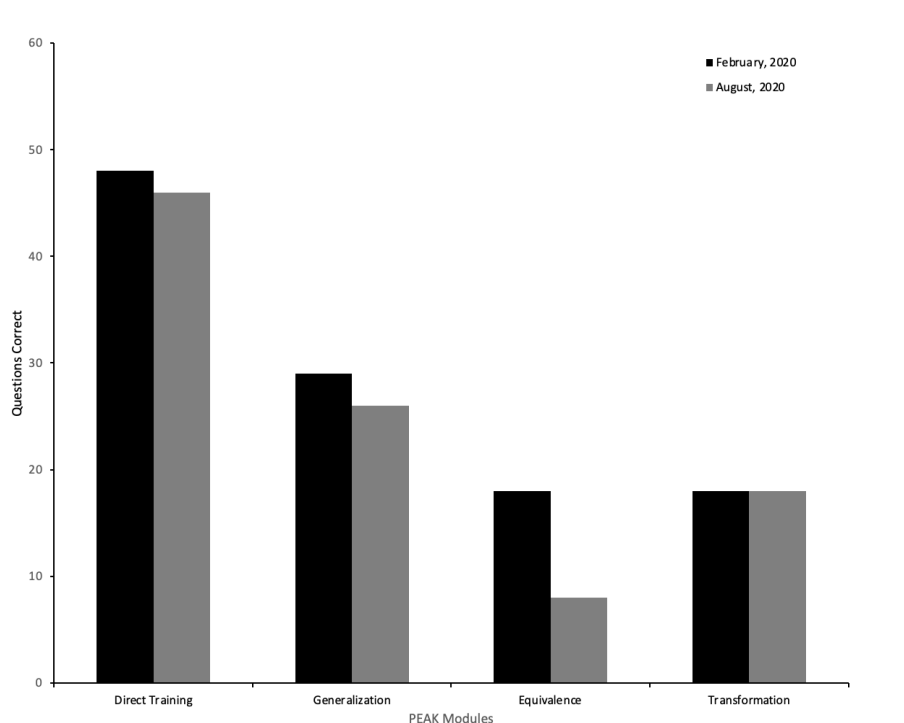


Figure 8. Pre-post PEAK comprehensive assessment (PCA) scores for Chucky

DISCUSSION

The purpose of this case study was to examine the relationship between pre and posttest scores of the PEAK Comprehensive Assessment after a decrease in instructional time during the COVID shutdown. The results from the pretest and posttest scores show that three out of the four participants increased their overall PCA scores after only running maintenance trials throughout the COVID shutdown with a significant decrease in dosage. These results are an indication to the field that dosage time and the setting of interventions can be flexible and still produce positive results. These results also add to prior research done by Ferguson et al. (2019), in which telehealth models using behavior-analytic interventions can lead to gaining new skills. The exact cause for the decrease in scores for the fourth student has not been identified, however, this particular student had previously displayed a regression in skills following longer breaks from school.

Since PEAK incorporates verbal behavior techniques and produces derived relational responding, it allows for the students to learn in the absence of direct contingencies, which made it a successful program to use during a COVID shutdown when staff could not rely exclusively on direct reinforcement learning. Staff are not expected to teach each aspect of language because PEAK uses techniques to promote derived relations. Using programs across all four modules during the shutdown also allowed for the students to practice skills and gain new skills in all aspects of language. The way the programs are set up also allows for the staff to easily make changes to stimuli in order to make it into a PowerPoint or Boom Card program.

Once students returned to the school setting in the fall, COVID was still very prevalent in Nebraska and the surrounding states. Schools had many safety measures in place such as masks,

temperature checks, and screening questions to identify when a student may have symptoms. These actions slowed the spread of the illness but did not completely stop it (Dolliver, 2020). If a student showed symptoms or had a family member they were in close contact with test positive for COVID, that student and their family were expected to quarantine whether they tested positive or not. This rule had many students absent in the fall for two weeks at a time. The safety measures that were put in place by the district could have contributed to the decreasing scores for some of the students. The introduction of wearing masks throughout each of the testing sessions was a new obstacle the teacher and student both worked through when the PEAK comprehensive assessment was being administered. When assessing any facial expressions or imitation questions, in order to maintain the safety distance requirement, the teacher would move away from the table, remove her mask, and complete the question. The student would then pull down their mask, complete the target behavior, and then replace the mask before continuing to the next question.

After the shutdown was complete, many special education programs in the United States were sent to due process as a consequence of not fulfilling IEP requirements during the COVID shutdown. The students in this case study continued to have access to the free and appropriate education required by IDEA (Wright & Wright, 2021). The procedures used during the shutdown allowed this system to be generalized to other classrooms in this public school for summer services and future quarantine situations.

One of the strengths of this case study is that the procedures used during the shutdown were created with generality in mind. The programs that were developed could be used by multiple people across different situations even after the shutdown was completed. The safety measures that were put in place were strict, which led to students and teachers needing to

quarantine for extended times if exposed to COVID once school was back in session. Teachers could easily transition back to this telehealth model and continue to deliver services to the students during their quarantine. Many of the programs that were created during the shutdown used the processes described by Belisle, et al. (2021a) in their technological report and are still used today for maintenance trials and help with the creation of new programs that don't require physical stimuli.

Another aspect that made these procedures successful was the transportability of the programming. During the shutdown, one of the students, Lincoln, stayed at his grandparents' home for multiple days. He was only required to bring his computer to his grandparents for his academic materials and was able to continue to join the zoom sessions while there. Another student, Thomas, went to Alabama towards the end of the shutdown for a retreat with his family. During their drive down to Alabama he was able to successfully join zoom sessions from his vehicle while using his iPad and the hotspot provided by the school. The staff were also able to complete zoom sessions from other places outside of the classroom due to carpet cleaning during the shutdown.

A final strength of this study shows that students can be successful when receiving instruction via telehealth methods with little to no training needed for the staff. In this study, the staff who were implementing programs had very little exposure to telehealth technology previously. The staff completing the telehealth sessions during the shutdown also had a limited amount of training on how to create and use PowerPoints to deliver instructions as well as how to use Boom Cards in program instruction. Even with this insubstantial amount of training prior to the COVID shutdown, all staff were able to deliver instruction effectively via this online platform.

Limitations

During this process, the staff and families came across some limitations as well. One of these limitations was the lack of consistency of sessions. While session times were predetermined, students were not always available to attend sessions due to forgetting to sign into the session and/or internet connectivity issues. Staff tried to solve this issue by having student families set alarms prior to each session so they could check for connectivity issues prior to the session starting.

A second limitation to this case study was addressing the problem behaviors that were exhibited by the student during the sessions. Since these sessions were provided via telehealth, staff were unable to effectively implement behavior plans. Some of the students exhibited behaviors during the sessions which required the staff members to terminate meetings earlier than scheduled to make sure safety was a priority for the student and/or family members who were present during the session. For example, Mac exhibited physical aggression to family members who were near him when he did not want to join the zoom session or participate in programs. If physical aggression was shown, staff was required to terminate the session.

Another limitation to the case study were the distractions which occurred during zoom sessions. These distractions in the students' home would often affect their ability to participate in the zoom sessions. Since the zoom sessions were taking place in their homes, their toys were often within reach and the staff had to find a way to become more reinforcing than their toys. The connectivity issues were also distracting for the students as the video lags made it difficult for students to stay attentive.

Due to staff limitations during COVID, interobserver agreement data was not able to be collected, which would be an additional limitation to this study. The onsite BCBA did attend

zoom sessions throughout the shutdown with a focus on observing and assisting the paraprofessional with any questions or concerns; however, no data was taken during these observations.

A final limitation to this case study was that there was not a control group included. Due to the shutdown being a forced closure, we were not allowed to have students in the building during these two months, so we were unable to compare the students receiving services via telehealth to a group of students who were receiving services in a face to face setting. It was also not possible to compare scores to students who did not receive any instruction because all students were receiving instruction per IDEA guidelines.

Future Research

Future research should attempt to identify whether programming could be delivered successfully across multiple settings. Additionally, more participants should be added to ensure greater reliability. This particular case study only involved four male students in a rural Nebraska setting. The procedures used in this case study should be used with a larger number of students across different areas of the country.

Another area for future research could look at using a changing criterion design to implement new programs using the telehealth model to see if posttest scores would continue to increase. In this case study, the students were only running PEAK programs that had previously been mastered, and using a pretest/posttest design did not allow for as much experimental control. For this future research to be successful, the first step would be to identify the next two programs in each module. Once those two programs were mastered, the study should baseline the next two programs and run them using the boom cards or PowerPoint platform and

conduct sessions via zoom. The mastered programs should continue to be probed throughout the sessions as well as baselining new programs. After running the sessions for a period of two months, students should be retested using the PCA to see if their scores show an increase or loss of skills.

Future research should also attempt to identify the minimum amount of instruction a student would require receiving to continue to make gains in their education. The four students in this case study had a different number of sessions due to many different contributing factors and their sessions were sometimes cut short due to connectivity issues and behaviors. It would be helpful to track the amount of time a student spends in each session working on programming and identify if a certain amount of time was needed to make progress.

In summary, this case study examined the relationship between the pretest scores of the PEAK Comprehensive Assessment scores to the posttest scores after the COVID shutdown. The study investigated the effects of not only a significant decrease in dosage time but also a change in program delivery. During this study, program dosage time decreased from an average of 236 minutes per day to 60 minutes per day. Additionally, programs were delivered using the telehealth model instead of direct instruction in a school setting. Three out of the four students were able to increase their posttest scores and maintain mastered skills while acquiring new skills. Due to the success shown following the procedures discussed in this case study, the district continues to use this process to ensure student success during times when students are absent from school for longer periods of time.

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